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# Management Summary

# Preface

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# 1. Introduction

The video game industry has experienced meteoric growth. The initial forecast for the video game market revenue in 2020 was $159.3 billion (Newzoo, 2020). However, due to the increase in time spent at home amidst the COVID-19 pandemic the global video game market generated a baffling $177.8 billion in 2020 (Newzoo, 2021). In addition to a spike in revenues, the market has also seen an increase in time spent playing video games. A survey conducted in the US reported that gamers spent 45% more time playing video games amid the quarantine (Bloomberg, 2020). Moreover, one of the leading online video game retailers, Steam, hit a peak of 20.3 million concurrent players which is 11% above their previous high (The Economist, 2020). In addition to an increase in playing time, the amount of people playing video games, also known as gamers, has increased. According to the Global Games Market Report by Newzoo, the amount of gamers has already grown by 5.4% from 2020 to 2021. Of the total 3 billion gamers worldwide, 1.4 billion are active on a personal computer (PC) and 0.9 billion on a console (e.g. ps4, Wii, Xbox) (Newzoo, 2021). According to McKinsey & Company, another notable change is the surge in volume of online ratings and reviews which were 87% higher in December 2020 than in December 2019 (McKinsey, 2021). Also, a survey conducted by brightlocal found that 83% of consumers in the entertainment industry look at online reviews before making a decision (brightlocal, 2020). The growth of the video game industry, the surge of online reviews and the importance of online reviews in consumer decision making emphasizes the significance of understanding the influence that online reviews have on video games. Against this background, this study sets out to assess the effect of online review rating on the number of PC game downloads on Steam, and to what extent video game characteristics influence this effect.

A body of prior literature that is related to the effect of online reviews on sales has been identified, and is presented in Table 1. There are three streams of literature that relate to this study. The first stream of literature investigates the effect of expert reviews on sales related outcomes in different contexts. For instance, Basuroy et al. (2003) conducted research in the movie industry and found that positive and negative expert reviews influence box office performance. A research conducted by Cox (2014) in the video game industry had similar results, whose findings show that video games with higher expert ratings are more likely to sell a larger number of units.

The second stream of literature examines the effect of user reviews on sales related

**Table 1: Prior research related to Expert- and User Reviews and their respective effect on sales related outcomes in different contexts**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Article** | **Context** | **Expert** | **User** | **Expert vs. User** | **Dependent variable** | **Key findings** | **Method** |
| (Chevalier & Mayzlin, 2006) | Books | – | ✓ | – | Book sales | Improvement in reviews leads to increase in relative sales | Differences-in-Differences |
| (Ho-Dac et al., 2013) | Blu-ray & DVD | – | ✓ | – | Blu-ray & DVD sales | Positive reviews increase sales of weak brands, no significant impact on strong brands | Multiple linear regression |
| (Zhang et al., 2013) | Cameras | – | ✓ | – | Sales of search goods | Valence\*, volume and product characteristics have a significant impact on sales | Multiple linear regression |
| (Öǧüt & Onur Taş, 2012) | Hotels | – | – | ✓ | Hotel room sales | A higher user rating significantly increases online sales, no significant impact of expert (star) rating | Log-linear regression |
| (Ye et al., 2009) | Hotels | – | ✓ | – | Hotel rooms bookings | Significant relationship between online reviews and hotel room sales | Fixed log-linear regression |
| (Chintagunta et al., 2010) | Movies | – | ✓ | – | Box office earnings | Valence\* has a significant and positive impact on box office earnings | OLS regression |
| (Basuroy et al., 2003) | Movies | ✓ | – | – | Box office performance | Positive and negative expert reviews predict and influence box office performance. Furthermore, there is evidence of negativity bias | Time-series cross-section regression |
| (Tsao, 2014) | Movies | – | – | ✓ | Movie evaluations | Greater importance is attached to user reviews than expert reviews | Between-subject factorial design |
| (Zhu & Zhang, 2010) | Video Games | ✓ | – | – | Video game sales on console | Online reviews are more influential for less popular games, and if gamers have greater internet experience | Differences-in-Differences |
| (Zhu & Zhang, 2006) | Video Games | – | ✓ | – | Video game sales on console | Online consumer reviews have a significant influence on the sale of video games | Differences-in-Differences |
| (Cox, 2014) | Video Games | ✓ | – | – | Video game sales on console | Games with higher expert ratings are significantly more likely to sell a greater number of units | OLS regression |

*\*Valence: Mean user rating*

outcomes in an array of different contexts, such as the hotel (Ye et al., 2009), movie (Chintagunta et al., 2010), and video game industry (Zhu & Zhang, 2006). In addition, research has been conducted on the sale of books, DVDs, and cameras. For instance, Chevalier & Mayzlin (2006) found that the improvement of online book reviews leads to an increase in sales. Furthermore, research by Zhang et al. (2014) on the sale of cameras found that a high mean user rating has a significant impact on sales.

The third stream of literature is concerned with the difference between effect of expert- and user ratings on sales related outcomes in different contexts. For example, Tsao (2014) found that greater importance is attached to user reviews than expert reviews in the movie industry. Furthermore, research conducted in the hotel industry by Ögüt & Onur Tas (2012) found that a higher user rating significantly increases online sales, whilst expert rating has no significant influence.

The main focus of this study is positioned in the third stream of literature. In addition, the distinct effects of expert- and user reviews, which are the first and second stream of literature, are included. In order to discuss the contribution of this study to the existing streams of literature, it is necessary to clarify the difference between PC and console gamers. First, the differences in hardware (PC vs. console) will be discussed. Second, the different types of gamers will be described.

PC is notorious for its superiority in terms of computing power, which improves the graphics and speed of video gameplay. The Graphics Processing Unit (GPU), Readily Available Memory (RAM), and Solid-State Drive (SSD) can all continually be upgraded by the owner of a PC in order to keep the hardware up-to-date. However, installing hardware upgrades require additional investment and knowledge of the PC. Also, the initial investment for a new PC is significantly higher than a new console. Although the initial investment for a console is relatively low, games have been found to be more expensive. Furthermore, consoles are built for usability, ease-of-use and no prior knowledge of the system is necessary due to the fact that hardware upgrades are not an option. An upgrade of console hardware only happens when a new console is released (Pakhrani et al., 2020; Johnson, 2021).

According to market research conducted by Clairfield International, gamers can be categorized into three different groups; hardcore gamers, casual gamers, and mass market gamers. Hardcore gamers are mainly categorized by their hefty investments in state-of-the-art gaming equipment, and the large amount of time they spend playing video games. Casual gamers play games regularly, but not as much as hardcore gamers. Moreover, casual gamers have been known to be far more price-sensitive than hardcore gamers. Mass market gamers do not spend a lot of time playing video games (Clairfield International, 2018). Although all three categories can be spread across PC and console, the amount of hardcore gamers is still skewed towards PC. According to the CEO of anzu.io (A sophisticated in-game advertising company), PC games are a form of video game that usually attracts gamers with a hardcore streak. Furthermore, Newzoo states that the PC gamers segment is slowly splitting from the traditional hardcore PC gamer, to a new type of “core” gamer that is interested in other less visually intensive and more competitive games. However, these types of PC gamers are parallels and are both still actively investing many hours in playing video games (Newzoo, 2017). Based on this information, it intuitively seems that PC gamers would most likely be part of the hardcore gamers category. In addition, if you take the price-sensitivity and required knowledge of hardware of casual gamers into consideration, it can be said that they would most likely prefer a console. This indicates a difference in the consumer segment for PC and console gamers, and thus an interesting basis to investigate the differences between these segments.

This study has multiple contributions to existing literature. Firstly, the main aim of is to research the difference of effect, and thus the relative importance, of expert- and user reviews on sales related outcomes in the video game industry. Prior research has investigated the difference in importance between expert- and user reviews, however, this was focused on the movie- and hotel industry (Öǧüt & Onur Taş, 2012; Tsao, 2014). This entails that this study will present new insights into the relative importance of expert- and user reviews in the video game industry.

Secondly, this study examines the effect of expert reviews on sales related outcomes for PC games. As described before, there is an evident difference between PC and console gamers. Prior studies on the influence of expert reviews in the video game industry were explicitly focused on console games (Cox, 2014; Zhu & Zhang, 2010). Therefore, this study contributes to the existing literature on the effect of expert reviews in the video game industry by adding a new dimension, namely PC games.

Finally, this study focuses on the effect of user reviews on sales related outcomes for PC games. Prior research has been conducted for this effect on the sale of books (Chevalier & Mayzlin, 2006), DVDs (Ho-Dac et al., 2013), cameras (Zhang et al., 2013), and movies (Basuroy et al., 2003; Chintagunta et al., 2010). In terms of video games, only Zhu & Zhang (2006) researched the effect of user reviews on console game sales. Therefore, this research contributes to the existing literature by adding PC games as a new dimension.

In summary, this study investigates what the effect of expert- and user review ratings is on sales related outcomes for PC games in the video game industry. To be more specific, the sales related outcome that will be used in the analysis is the number of downloads a game has on the Steam platform. In addition to the distinctive effects, the relative importance of expert- and user reviews will be examined. Furthermore, video game characteristics will be included as moderators. The video game characteristics that will be included are publisher (i.e. major- or minor publisher) and game mode (i.e. single- or multiplayer).

The findings of this research provide managers and marketers of minor- or major publishers with information regarding the relative importance of different review types (i.e. expert- and user reviews) on video games, and in specific the effect on PC games. This can lead to strategic adjustments to influence review ratings of a video game in order to improve its sales performance.

# 2. Theoretical framework

## 2.1 Conceptual Framework

The conceptual framework for this research is presented in Figure 1. The framework consists of the main effect of expert- and user reviews on number of downloads on Steam. In addition, the main effect is moderated by video game characteristics (i.e. game mode and publisher).

**Figure 1 - Conceptual Framework**

Diagram

Description automatically generated

## 2.2 Hypotheses

### 2.2.1 The main effect of expert reviews on Nr. of downloads on Steam

In order to understand the conceptual model, it is necessary to define the variables included. Review rating is separated in two distinct variables, namely Expert rating (i.e. ratings by experts, critics or professionals in a respective industry; Cox, 2014; Chen et al., 2011) and User rating (i.e. rating by a user or consumer assessing quality of product or service; Ho-Dac et al., 2013). Furthermore, number of downloads on Steam (written as: # of downloads on Steam) represents the number of downloads for a particular game on the Steam platform.

As mentioned before, a basis of extant literature exists on the effect of expert reviews on sales related outcomes. In the movie industry, Basuroy et al. (2003) found that positive (and negative) critic reviews influence and predict box office revenue. A study conducted in the movie industry presents similar results, indicating that higher expert ratings significantly impact returns (Chen et al., 2011). In terms of the video game industry, studies by both Cox (2014) and Zhu & Zhang (2010) support these findings, offering evidence that suggest that the purchasing decision of consumers in the video games market is significantly influenced by expert review scores. However, Zhu & Zhang (2010) also propose that expert reviews are more influential for less popular games. The findings of the beforementioned studies indicate a clear direction regarding the influence of expert reviews on sales related outcomes. This study argues that this holds for PC games, the reasoning behind this is twofold. Firstly, the movie- and video game industry are both entertainment based industries and so may yield similar results. Secondly, despite the dissimilarities between PC and console gamers the general effect of expert reviews will be the similar as it is still centred around video games. This leads to the following hypothesis:

H1: Expert reviews positively influence the number of downloads on Steam.

### 2.2.2 The main effect of user reviews on Nr. of downloads on Steam

There is an extensive basis of literature available on the effect of user reviews on sales related outcomes. A multitude of studies in different contexts have presented similar results. For instance, studies concerning the sale of books (Chevalier & Mayzlin, 2006), cameras (Zhang et al., 2013), new products (Cui et al., 2012), mobile phones (Decker & Trusov, 2010), and rooms in hotels (Jenq, 2019; Ye et al., 2009) all found significant relationships with user reviews. More importantly, studies conducted in entertainment based industries such as the movie industry suggest similar results. For example, Chintagunta et al. (2010) found that the mean user rating is one of the main drivers of box office performance. However, a study by Lui (2006) contradicts this stating that instead of the mean user rating the volume of user reviews offers explanatory power for box office performance. Although volume might carry more explanatory power, Duan et al. (2014) suggests that the mean user rating significantly influences the volume of user reviews, which subsequently influences box office performance. In addition to the movie industry, findings from a study by Zhu & Zhang (2006) suggest that user reviews have a significant influence on the sale of video games. The findings of the video game- and movie industry, which are both entertainment based industries, combined with the general consensus of other contexts that user reviews influence sales related outcomes leads to the following hypothesis:

H2: User reviews positively influence the number of downloads on Steam

### 2.2.3 The difference in effect of user- and expert reviews on Nr. of downloads on Steam

Although there is a scarce amount of extant literature regarding the difference in effect of expert- and user reviews on sales related outcomes in the video game industry, there is an array of literature from other industries available. Prior research from the hotel industry found that consumers relate more to opinions of peers, rather than those of professionals who are paid to write reviews (De Langhe et al., 2016). Ögüt & Tas (2012) had similar findings, suggesting that a higher user rating for hotels significantly increases online sales whilst an expert defined star rating does not. A study from the movie industry supports these findings, stating that potential moviegoers attach greater importance to consumer reviews than to critic reviews (Tsao, 2014). However, this is contradicted by two recent studies, which suggest that expert ratings are more influential for moviegoing decisions than user ratings as experts are critical and more consistent, and that expert reviews have a larger influence on the movie industry as a whole (Basuroy et al., 2020; Souza et al., 2019). Research on the video game industry builds upon these findings, proposing that user reviews are often highly polarized, whilst expert reviews are more balanced over time (Santos et al., 2019). The beforementioned literature leads to the impression that expert reviews are valued more, relative to user reviews in an entertainment oriented industry due to their consistency and reliability. Furthermore, Research in the movie industry suggests that infrequent moviegoers are influenced to a greater extent by user reviews, whilst frequent moviegoers are influenced to a greater extent by expert reviews (Chakravarty & Mazumdar, 2016). As mentioned in the introduction, PC gamers are often more invested in the act of playing video games relative to console gamers. Therefore, this study that PC gamers may be similarly classified as frequent moviegoers, thus placing more emphasis on the importance of expert reviews. This leads to the following hypothesis:

H3: Expert reviews positively influence number of downloads on Steam more than user reviews.

### 2.2.4 The moderating effect of game mode

The first moderator is game mode. Game mode is the manner in which a video game can be played. This can be multi-player, which means the video game can be played (online) by more than one player. Conversely, single-player means the video game can be played by one player (Situmeang et al., 2014; Cole & Griffiths, 2007).There is a limited amount of extant literature on the influence of game mode on the relationship between expert- and user reviews and sales related outcomes. Cox (2014) found a significant effect concerning the number of players that were able to play a video game. The more players were able to play, the more games were sold (Cox, 2014). Moreover, prior research about video games has found that mode of play predicts the time spent playing, and that there is a positive relationship between the social aspects of playing video games and time spent playing (Cole & Griffiths, 2007; Johnson et al., 2016). Furthermore, Zhu & Zhang (2010) suggest that user reviews are more important for games that are played online. Although time, as mentioned by Cole & Griffiths (2007) and Johnson et al. (2016), is not a perfect indication of preference in terms of game mode, it does give an idea towards the social aspects of gaming. When taking the social aspects and the findings of Cox (2014) into consideration, it can be said that the single-player (and thus less social) games are more focused on the quality of the game (expert opinions) than the opinion of other players. Therefore, this study formulates the following hypothesis:

H4: The positive effect of expert reviews on the number of downloads on Steam is stronger (weaker) when game mode is single-player (multi-player)

Furthermore, based on the literature this study argues that multi-player (online) games are more likely to have a stronger influence on the relationship between user reviews and the number of downloads on Steam than single-player games. The reasoning behind this is twofold. Firstly, multi-player games are played by a large community of gamers and thus user (gamer) opinions are regarded highly. Secondly, user reviews have been found to have a significant impact on the performance of games that are played online (Zhu & Zhang, 2010). This leads to the following hypotheses:

H5: The positive effect of user reviews on the number of downloads on Steam is stronger (weaker) when game mode is multi-player (single-player)

### 2.2.5 The moderating effect of publisher

The second and final moderator is publisher. Publisher is the company that publishes the video game to the market for sale to the general public (Cox, 2014). In context of this study, a major publisher is a company with an annual revenue above $50 million and a minor publisher is a company with an annual revenue below $50 million. Once again, a limited amount of extant research on the video game industry is available. Prior research conducted on the movie industry found that movie stars and budgets moderated the impact of expert reviews on movies (Basuroy et al., 2003). Moreover, Souza et al. (2019) found that the influence of expert reviews on blockbusters is null, whilst the influence on small release films is large. The findings in these academic sources lead to the following hypothesis:

H6: The positive effect of expert reviews on the number of downloads on Steam is stronger (weaker) when the game is released by a minor publisher (major publisher).

Furthermore, a study conducted by Zhu & Zhang (2010) found that online user reviews were more influential for less popular games. In addition, Ho-Dac et al. (2013) supports this stating that online user reviews increases the sale of brands with low brand equity. The beforementioned findings lead to the following hypothesis:

H7: The positive effect of user reviews on the number of downloads on Steam is stronger (weaker) when the game is released by a minor publisher (major publisher).

# 3. Method

## 3.1 Data Collection

To test the conceptual framework, data for all variables in question has to be collected. There are three sources from which the data is collected, each will be discussed in the following paragraphs. A detailed description of all variables is provided in Table 2.

Firstly, data is collected from Kaggle.com, which is a website that offers its users the ability to share and collaborate on datasets. From this website a rich Steam store dataset is downloaded. The dataset is named *Steam Store Games (Clean dataset)*, and has been shared by Nik Davis. The dataset contains data from 27,033 game titles released between 1998 and 2019. Data on user reviews (x2), game mode (m1), publisher (m2), release date (c1), and price (c2) is available in this dataset. The dataset is saved in the data file of this study’s respective GitHub repository (See Appendix A).

Secondly, expert review (x1) data is collected from steamspy.com, which is a Steam stats service which automatically gathers data from Steam user profiles using a Web API. In order to collect data from steamspy a web scraper is developed. This web scraper uses the game IDs provided in the Kaggle dataset to create a list of unique URLs which are used to scrape all necessary web pages. The web scraper can be found in the collect file, and the data collected is saved in the data file of the GitHub repository (See Appendix A).

Finally, the number of downloads per game on Steam (y) is collected from SteamDB, which is a third-party website that gives insight into the Steam platform and its database. The data collection method for this website is also by web scraper. In order to correctly scrape this website, the web scraper uses game IDs to create a unique URL. Furthermore, the web scraper detects a temporary ban and waits until it is able to scrape again. The web scraper can be found in the collect file, and the data collected is saved in the data file of the GitHub repository (See Appendix A).

|  |  |  |  |
| --- | --- | --- | --- |
| **Variable** | **Measurement scale** | **Description** | **Data source** |
| # Downloads on Steam (y) | Ratio | Number of game owners on Steam | SteamDB |
| Expert review (x1) | Ratio | Average expert review rating per game | steamspy |
| User review (x2) | Ratio | Average user review rating per game | Kaggle |
| Game mode (m1) | Nominal | Dummy variable: 0 for multi-player, 1 for single-player | Kaggle |
| Publisher (m2) | Nominal | Dummy variable: 0 for minor publisher, 1 for major publisher | Kaggle |
| Release date (c1) | Interval | Year of release | Kaggle |
| Price (c2) | Ratio | Most recent list price of game | Kaggle |

**Table 2: Detailed description of variables**

## 3.2 Data Processing

To conduct this research, it is necessary to process the data in order to get one final, cleaned dataset consisting of all the variables in the conceptual framework.

## 3.3 Data Description

Tables and elaboration

## 3.4 Model

Regression

# 4.1 Analysis

# 4.2 Findings

# 5.1 Conclusions

# 5.2 Recommendations

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# Appendices

## A. GitHub Repository

Overview of the of the directory structure and files:

├── README.md  
├── makefile  
├──.gitignore  
├── data  
│      └── dataset1  
│             ├── \*.csv  
│             ├── \*.csv  
│             └── \*.csv  
├── gen  
│      ├── analysis  
│      │      └─ output  
│      │          └── regression\_results.R

│      └─── data-preparation  
│            └─ output

│             ├── summary\_output.R  
│                └── df\_clean.csv  
├── src  
│      ├── collect  
│      │      ├── SteamDB.ipynb  
│      │      ├── steam\_kaggle.R  
│      │      └── steamspy.ipynb  
│      ├── preparation  
│      │      ├── summary\_stats.R

│      │      └── clean.R  
│      ├── analysis  
│      │      └── regression.R  
│      └── .DS\_Store  
└── images  
       ├── \*.PNG  
       └── \*.PNG