Quantifying the effects of video live streaming on the video game industry - Substitute or complement?

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Abstract

In terms of revenue, the video game industry is the largest entertainment industry in the world. During the last few years, it benefited particularly from technological advances, growing online communities, and digital distribution possibilities. A relatively new and noteworthy development in the market is video live streaming, where players film themselves while playing video games and often interacting with their viewers.

Product managers and developers quickly adapted live streaming into their strategies to increase revenues. Researchers however, have so far studied the topic primarily from a communication perspective and mostly qualitatively (Hamilton et al. 2014, Johnson and Woodcock 2019) while in the more empirical word-of-mouth (WOM) literature, live streaming is still completely missing (Rosario et al. 2016). Additionally, all WOM studies that focus on the video game industry use data from a time where live streaming was not existent, physical instead of digital distribution dominated the market and entry barriers for developers were substantially higher than now (e.g. Marchand et al. 2017).

As the popularity of live streaming increased, many popular streamers have become micro-celebrities (Khamis et al. 2017, Woodcock and Johnson 2019), which begs the question whether the consumption of such popular streams can substitute the consumption of the broadcasted games therein or if it complements a game’s market prospects through increased awareness. This paper is the first to provide empirical results on how live streaming affects game unit sales. In addition, it gives an update on WOM effects in a market that has changed drastically during recent years and proposes an overview of the intertwined relationships between developers, streamers and consumers in the video game industry.

For this purpose, web scraping techniques were used and a unique sample was created containing data on 102 video games, released between 2018 and 2019 as well as over 1.4 million related posts from the social media platform Twitter. To prevent potential biases through the popularity of famous intellectual properties and large-scale marketing campaigns, the sample is built from small, independently developed games. The dataset is complemented by a survey of 27 independent game developers on their perspective towards live streaming and product success.

Building on Rui et al. (2013), a generalized method of moments (GMM) model is applied to account for the dynamic and endogenous nature of the data. The number of user reviews and streams are used as
endogenous GMM instruments as they are likely to influence each other and themselves over time.
Besides, an OLS regression is applied to show how streams and WOM prior to game releases affect unit sales in the first week of their release.
A significant positive relationship between product success and the number of channels broadcasting a game is found. The amount of viewers however, shows no significant correlation, supporting the hypotheses that popular streams can, in fact, be consumed because of the streamer and not the game. Furthermore, this suggests that live streaming is not just a simple form of visual WOM and that developers have to be careful in the way they include live streaming into their marketing strategies. The results are supported by the survey respondents who believe smaller channels to be more beneficial for product success. In line with the WOM literature (Rosario et al. 2016), a significant and positive correlation between the amount of social media posts and product success is found, especially prior to release. However, quality measures like a game’s professional or user rating show no significant correlations.

Sources:
Quantifying the effects of video live streaming on the video game industry – Substitute or complement?

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Abstract

This paper explores how the introduction of online video live streaming affects the video game industry. In a highly competitive market with low entry barriers, especially smaller developers have to rely on word-of-mouth and user-generated content to even be noticed. Building on the different unique functions of online video live streaming for its users, I show that live streaming is more than just visual word-of-mouth. I use data scraping techniques to establish a unique dataset and apply a dynamic panel estimation on a sample of 102 video games, released between 2018 and 2019, that provides first results to quantify the effect live streaming has on game units sold. Some implications for the optimization of product development and marketing strategies for both developers and managers are given.

Keywords
Video game industry; word-of-mouth; user-generated content; dynamic panel regression; generalized method of moments; video live streaming; social media platforms
1. Introduction

In terms of revenue, the video game industry is the largest entertainment industry in the U.S. (Richter 2019a). The worldwide ongoing digitalization process benefitted the industry particularly as it profits from technological advances, growing online communities and digital distribution platforms. A relatively new and noteworthy development in the market is the introduction of (live) streaming. For a long time, the most subscribed channel on YouTube was PewDiePie (Socialblade 2019), a channel that became famous for its videos featuring channel owner Felix Kjellberg playing video games. In 2014, another video platform, Twitch, gained publicity when it was acquired by Amazon for 970 million US-Dollars. While YouTube’s focus lies mostly on on-demand streaming, Twitch is the largest platform for live streaming in the games market and consistently ranks in the top 30 of most visited websites worldwide in 2019. In their global entertainment and media outlook, PwC notes that people move away from linear television to video streaming platforms like Twitch or YouTube as revenue for online video and digital advertising rises (PwC 2018). In 2018, for example, the World Championship finals of the game League of Legends had around 100 million unique viewers worldwide, which is around the same size as the whole U.S. viewership of the Super Bowl.

Both product managers and researchers have quickly discovered the potential of live streaming (Johnson and Woodcock 2018). While, researchers have focused particularly on communication topics managers are interested in revenue increasing strategies. Still missing from the literature is an assessment of the effect live streaming has on video game sales. After all, the word-of-mouth (WOM) literature showed in many studies the positive influence of WOM on sales (King, Racherla, and Bush 2014; Rosario et al. 2016) and seeing people having fun while playing a game is most certainly something that can be described as some form of visual WOM. Additionally, live streaming marks a chance for smaller developers to get the attention that, without the large marketing budgets of the industry’s biggest players, they most likely could not achieve. Furthermore, market entry barriers have become relatively small. Through digital distribution platforms, any private person with a computer can bring a game to the market. Hence, during the last years, the market for video games grew rapidly. For example, in 2018 the number of games released on Steam, the leading market platform for computer games, increased by almost 50% (Steam Spy 2019). Thus, the pressure not to get lost in the mass of releases increased significantly.

This study aims to contribute to the literature in two ways: firstly, it provides an overview of the different functions live streaming can have for its users and thus where it can be placed in the word-of-mouth literature and secondly, it is a first attempt at quantifying the effects of live streaming on the unit sales of video games to give developers and managers some implication on optimizing their product development and marketing strategies.
2. The influence of online live video streaming on the video games industry

Figure 1 shows the relationships between the central actors in the video game industry. Developers (including publishers) create entertainment in the form of video games and make those available to consumers. Before live streaming was introduced, consumers either consumed games for their own entertainment and consumed and created (electronic) word-of-mouth (eWOM/WOM)\(^1\) in the form of reviews and comments on social media. With the introduction of live streaming the dynamics changed as streams inhabit a special role in the market as now they incorporate both – WOM and entertainment – or as the market research firm Newzoo argues:

"The capacity to not only stream video, but also comment and share opinions on social media platforms, means the pressure is now on to work with gamers in brand creation instead of solely advertising to them. The relationship has shifted from one of consumer and creator to mutual collaboration, with a growing emphasis on creating entertainment value together with the gamers. Publishers and brands are becoming facilitators of the consumer desire to create and produce." (Newzoo 2015)

To evaluate the different effects that watching a live stream can have on consumers it is important to establish what motivates consumers to start watching a live stream in the beginning. The reason to watch games can come from different intentions: Gandolfi (2016) differentiates between entertainment based on owned games, entertainment based on non-owned games and evaluation for future purchases. Reasons attributable to entertainment

\[^1\] Meaning the communication of information from one person to another.
Based on owned games can come from the intention to learn about a certain game, e.g. improving one’s playing style or finding hidden features (Hamilton, Garretson, and Kerne 2014). While the motivation to watch live streams for evaluation purposes is self-explanatory, the motivation behind entertainment based on non-owned games is more ambiguous. For once it can lie in limitations that prevent the viewer to play the game herself (e.g. due to lacking of the required hardware or money) or a general interest in the topic of games without any specific purchasing intention. Another aspect that has to be named is the motivation to watch esports. As the name already indicates, esports is a specific way to play games – namely in a competitive and therefore sportlike way. Similar to conventional sports, there are leagues, tournaments, world cups and even live events with prize money of up to several million US-Dollars. For viewers who are interested in esports, it can be assumed that they not only are already aware of the watched game but also have a deeper understanding of and most likely also own the respective game. Additionally, as such structures need time to develop, games with such large esports scenes are usually long established in the market. Thus, even though esports makes up a large proportion of live video streams, it is of lesser importance for the purpose of this study.

Lastly, a main feature of live streams is their highly communicative design through a chat with the audience. This highly benefits the chance to form a community with the streamer in its center resulting in the fact that many streamers already have become micro or digital celebrities (Khamis, Ang, and Welling 2017; Woodcock and Johnson 2019). Fans of such streamers may follow the streams out of the (primary) intention to view the personality and not the provided gaming content. An indicator for this is the large proportion of views of streams with non-gaming tags like IRL (short for in real life\(^2\)) and Just Chatting as well as Hamilton, Garretson, and Kerne (2014) who, in their questionnaire, also received answers in support of that claim. Certainly, those three categories are not mutually exclusive and any combination of them is thinkable. In their identification of eight gaming consumer prototypes Newzoo (2019b) distinguishes those mainly by their varying interest to play and view video games as well as to own the respective hardware. Thus, such a categorization helps to clarify that the viewership of live streams consists of heterogeneous individuals that differ in the central aspect of this study, their probability to become (prospective) purchasers. Considering, that every viewer only has limited leisure time per day it seems equally plausible that, depending on the nature of the game, watching live streams could also lower potential sales. Especially with story focused games, viewers could be more interested in solely experiencing the story instead of playing (and thus buying) the game themselves. Some streamers also let their community make specific gameplay choices, creating a feeling of togetherness. It is unclear whether such an approach could lower the audience’s desire to play the game themselves or rather encourage them to make different choices in their own attempt. Additionally, with a growing required playtime of a game, opportunity costs could become an issue for consumers, which may lead to a shift from playing to watching.

\(^2\) as opposed to the “digital world”.
It follows that a consumer’s primary motivation to watch a game-associated live stream can be classified as such:

1. to watch games
   1.1 conventional game footage
   2.1 esports
2. to watch a specific streamer.

For the purpose of this study – establishing the relevance of live streaming for product success – category 1.1 is the most important.

Building upon this chapter, live streaming can serve the following functions for consumers and developers in the video games market:

**Streaming as entertainment**

The large popularity of live streaming both online in conventional streams and special events like esports tournaments or offline in the invitation of streamers to conventions and community meetings makes obvious that live streaming has a strong entertainment function for consumers. In the questionnaire from Gandolfi (2016), 53% answered that they watch Twitch for entertainment reasons and nearly 46% to follow specific streamers.

**Streaming as advertising**

In the video game industry there is strong competition between developers. Even in the AAA sector, publishers sometimes postpone releases to avoid direct competition (Alexander 2018). For smaller developers without large marketing budgets, competition has become even fiercer in recent years as game releases on Steam grew exponentially with over 9,000 of nearly 27,000 games having been released in 2018 alone (Steam Spy 2019). To get noticed in such a crowded market, developers often rely on streamers to make their game known to a larger public. There are websites specifically designed for the distribution of games to streamers and recently, Twitch introduced a tool to enable developers to find suitable streamers and even pay them depending on the amount of time streamers play their respective games.³ From an advertising perspective, streaming thus can be divided into streaming as product placement (indirect advertising) and streaming as direct promotion, depending on whether streamers are simply playing the game or are required to show specific elements or even paid to only talk positively about a game.

“At the end of the day, Twitch is free advertising. Every single stream, we are advertising that game.” (An interviewee in Woodcock and Johnson 2019)

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³ See for example www.keymailer.co/ or Twitch Bounty Board.
Streaming as information

When asked for their reasons to watch Twitch nearly 23% answered evaluation for future purchases (Gandolfi (2016)). Live streaming can provide an unfiltered and uncut view into the nature of a game. While review videos from magazines are usually edited to show many different aspects, live streams do the exact opposite. Depending on how long they watch viewers will only see a limited part of the game but this part can be as close to a hands-on impression as possible while additionally showing the amount of joy the streamer actually has while playing. Additionally, games are often streamed by multiple streamers at the same time and viewers could skip through different channels to get a broader impression.

“Twitch provides the most authentic preview of a game you’ll find on the internet. That’s because it replicates the experience of watching your friend play from their couch.” (Hernandez 2016)

Though the view expressed in this quote is probably a little biased as it comes from an employee of Twitch, it still captures the essence of many viewers’ experiences with live streaming.

3. The characteristics of word-of-mouth and user-generated content

Word-of-mouth

Word-of-mouth, has a long history in communication and marketing research. It is considered as one of the key dynamics for product success. The introduction of the internet and the rise of social media platforms further increased the importance of WOM. Hence, there exists a large body of literature on the effects of online reviews and microblogs on product sales, especially on experience products such as books, movies or video games (see King, Racherla, and Bush (2014) for a comprehensive literature review and Rosario et al. (2016) for a meta analysis). It is commonly agreed upon that consumers seek or listen to WOM to gain information to reduce search costs or uncertainty. Furthermore, WOM does not necessarily need to be actively searched for. It can get a potential consumer’s attention during a conversation or on social media platforms by chance and thus, spark a purchase intention (King, Racherla, and Bush 2014). Additionally, the volume of electronic WOM (eWOM) is argued to be an important driver of buzz or hype. However, there are contrasting results regarding the importance of eWOM valence (Liu 2006; Duan, Gu, and Whinston 2008; Rui, Liu, and Whinston 2013 and Marchand, Hennig-Thurau, and Wiertz 2017). While volume is usually positively correlated with sales, the effect of valence seems to depend on the overall perception of the product. However, in their meta-analysis Rosario et al. (2016) dive deeper in the definition of the valence variable and argue that some studies actually use a mixture of volume and valence as variables. If only a non-confounded metric of valence is used, valence has a positive effect, though lower than volume, the authors state.

However, what the existing studies all seem to have in common is that they focus primarily on physical products (or require some sort of physical interaction by the consumer, e.g. visiting a movie theater). In recent years, digital distribution saw a steady and significant increase in market share compared with physical distribution. One of the reasons for that
trend is that digital distribution allowed for the supply of innovative and for consumers highly practical business models like streaming, often combined with subscription models making digital goods instantly available to the consumer. Nowadays, movie streaming platforms generate higher revenues than Blu-ray and DVD sales (Richter 2019) and can even be an attractive alternative to a cinematic release for studios. In the video games market, digital products now dominate as well with 83% of all U.S. video game sales in 2018 being digital as well as 80% in the United Kingdom while 2009 only 20% were digital in the U.S. (ERA 2019; ESA 2019a, 2019b). The possibility of instantly having a purchased product available could result in an even greater role of WOM effects due to a higher potential for impulse purchases. Additionally, next to an increasing use of social media platforms, a new potentially important influence has seen a significant rise in the last years and has not yet been measured quantitatively: online (live) video streaming. According to King, Racherla, and Bush (2014), an open question in the WOM literature is the potential of visual eWOM. With visual content, product reviews can provide consumers with information that does not necessarily need to be explicitly communicated otherwise. Many magazines supplement their reviews with pictures or videos and platforms like YouTube feature channels that are exclusively specialized on video reviews or unboxing videos. Through such videos, consumers are enabled to decide for themselves whether the evaluation of the reviewer is in line with their own perception of the product. This likely results in a more informed purchase decision. However, with YouTube channels existing solely for the creation of such videos and entire communities evolving around such channels and the line between the use of these channels for information and for entertainment purposes begins to blur.

**User-generated content**

A common self-designation of online influencers is that of being a *content creator*. Whether it is a YouTube video, a picture or video log on Instagram or a gameplay video on Twitch - there is content being created for other users to consume on the respective platform. The motivation behind the content creation, meaning if the content was paid for by a sponsor, primarily motivated by economic gain or a pure wish to entertain is secondary in this case as all cases result in a new product being created to be consumed. This marks a critical difference to eWOM as in reviews or simple chatter about a product the informational aspect is always dominant and the amount of eWOM thus generally provides a good idea about the public’s interest in a product. With the broader term *user-generated content (UGC)* this relationship is not that clear. If for example, PewDiePie uploads a new video of him playing a video game a high viewer number does not mean that people were interested in the game as most likely the primary interest of the audience lies in the video itself, PewDiePie’s *own* product. Still, such a video could resonate with some viewers in a way that sparks an interest

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4 Outside of the U.S., the movie *Annihilation* was released directly on Netflix without starting in cinemas first. Additionally, Netflix released the Oscar-nominated movies *Beasts of no Nation* (simultaneously with cinematic release), *Roma, Mudbound* and *The Ballad of Buster Scruggs* (only streaming release, own productions by Netflix).
in the game (attention effect) or even lets them decide for or against a purchase (persuasion effect).

“This sets Twitch streaming apart from other social media formats, whether video or just image based. Rather than integrating advertising into another activity, for example, a sponsored product review on YouTube, the gameplay is itself already a form of advertising.” (Woodcock and Johnson 2019)

A platform that is very well suited for an analysis of such effects is Twitch. In the second quarter of 2019, 2,706.2 million hours were watched on Twitch and 94.7 million hours were streamed. Twitch’s largest competitor is YouTube Gaming Live which, in comparison, only had 701.8 million hours watched and 13.2 million hours streamed (Streamlabs 2019). The strong focus on a clearly defined product group is a strong practical advantage in comparison to YouTube or Instagram. Every video can be directly attributed to the game it broadcasts which allows for far easier data collection. Additionally, the market for video games and its communities act predominantly online nowadays, thus reducing the risk of missing critical aspects in the data. Lastly, the introduction of live streaming has completely shaken up the gaming industry. A large number of developers have changed product development, marketing strategies and monetization in drastic fashion (Bonilla 2017, Orland 2015). To the best of my knowledge, there are no other studies that try to quantify the effects of live streaming. Therefore, this study aims at providing a first insight by estimating the influence of live streaming on video game sales in contrast to conventional eWOM.

With the digitalization of the market for video games and the special role of live streaming therein in mind, the following questions arise:

1. Is live streaming just a different aspect of eWOM?
2. How exactly does live streaming affect video game sales?
3. Do the old mechanisms of eWOM still hold with the introduction of live streaming?

There seems to be a common ground in the video game industry that streams positively affect sales (Bonilla 2017, Orland 2015). However, depending on the type of the game and due to its entertainment aspects, live streams can act as a substitute to direct consumption of the games that are broadcast, with viewers vicariously consuming the game through the streamer (Newzoo 2019b). Therefore, I hypothesize the following:

• **Hypothesis 1**: Live streaming includes both complementary and substituting aspects for video games.
  - **Hypothesis 1a**: There is a positive relationship between the amount of channels broadcasting a game and product success.
  - **Hypothesis 1b**: There is no significant relationship between the number of viewers and product success.

• **Hypothesis 2**: There is a positive relationship between the amount of eWOM on a game and units sold.

To measure the effects of live streaming and eWOM on games, this study focuses on smaller titles (so-called indie games). The term indie game was originally derived from independent, as indie games are typically developed by small teams or single (private)
developers without any (substantial) connections to large publishers. Therefore, the financial capabilities of such indie developers are significantly lower, seldom leaving room to acquire costly intellectual properties (IPs) or finance (larger) marketing campaigns. Next to differentiating between financial and publishing independence, Garda and Grabarczyk (2016) emphasize indie games’ creative independence. As they are not in direct competition to large blockbuster titles (so-called triple-A or AAA), indie games often serve niche audiences that allow less conventional design choices. It is impossible to draw a clear line that suffices each possible definition of the term indie and especially in the case of team size or financial capabilities there can be large differences between developers. Given the production size and revenues of AAA games (such as Call of Duty or Grand Theft Auto series\(^5\)), AA games are much closer to indie games than to AAA titles. Such AA games are mostly developed by studios that are not owned by a large publisher and thus, do not have the capabilities to spread their risk by developing multiple games simultaneously. The German developer Yager, for example, considers itself a AA studio but had its own booth at GamesCom 2019 (Europe’s largest games convention), in the official indie area of the convention. Therefore, in this study everything below AAA will be considered as indie.

Considering only indie games gives this study an advantage over studies like Marchand, Hennig-Thurau, and Wiertz (2017) as the sample consists of mostly original IPs. A game based on a long established IP or even a sequel on the other hand automatically profits from its connection to its predecessor(s). Having less-known titles in the sample, a more direct relationship to word-of-mouth and viral effects can be assumed. Additionally, the Managing Director of Yager argues that everything below the AAA-level is not only deeply dependent of positive word-of-mouth, but also claims live streaming to be an important factor in a game's success (Graf 2018).

4. Data

The dataset was carefully compiled from several sources. A brief description on these single sources is given and relevant variables are described in further detail.

Data collection

The data were mostly gathered using web scraping techniques. Twitter data was collected via the official Twitter application programming interface (API). Starting on March 17, 2018, a script searched for tweets that included specific search terms for each game on a daily basis. The search terms were created individually by a human coder and, depending on the different possibilities to mention a game, vary from one to six terms per game. For example, while a game like Frostpunk with its newly coined and therefore unique title only requires said title to be searched for, other games with longer or more generic titles required a more

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\(^5\) Grand Theft Auto 5 grossed $1 billion in its first three days after release and production cost are estimated at $265 million (Cherney 2018, Goldfarb 2013).
careful approach to ensure that only relevant tweets were captured. As multiple search terms lead to some tweets being collected multiple times, tweet IDs were controlled for duplicates after collection. When the title of a game proved to be too generic to gather only relevant tweets, the game was excluded from the sample.

The game specific data such as the game’s app ID and release date were retrieved through the Steam store website. The number of user reviews were obtained through calls to the Steamworks Web API. In addition to user reviews on Steam, reviews from professional critics were collected from the website metacritic.com, which is one of the largest review aggregators for video games. The aggregated score (“metacritic score”) of a game even is embedded in their respective Steam store page. The number of owners per game, its price as well as streaming views and channels were retrieved from the third-party websites steamspy.com (Steam Spy) and sullygnome.com (Sullygnome). Steam Spy provides estimates on the amount of owners based on a proprietary algorithm. Steam Spy and Sullygnome’s streaming data is retrieved via the Twitch API and consists of daily values of peak concurrent viewers and peak concurrent channels per game on the streaming platform Twitch.

The final dataset consists of 102 games that were released between 2018-03-27 and 2019-03-01. Though far more games were released on Steam during that period, the sample represents a viable selection of games for the purpose of this study. Next to the exclusion of games with too generic titles and AAA games, further challenges had to be considered during the sample selection. The Steam marketplace is not curated and thus, several “games” are released without real market ambitions which is why simply retrieving a list of upcoming releases on Steam was no option. Additionally, due to their independence and small capacities, indie developers often postpone game releases or do not even set release dates at all until close to being finished. Therefore, potential games were evaluated carefully in their ambitions the list of games was regularly expanded during the data collection period through several detailed web searches.

The first 10 weeks after release are considered the most important for product success with the majority of sales commonly being generated during that period. Sales numbers usually start high and diminish drastically with each additional week (Marchand, Hennig-Thurau, and Wiertz 2017, Twitch 2019). As Figure 2 shows, the demand for live streaming – displayed as mean percentage of viewers over all views and games with week 0 being the release week – is comparably focused on the time around release with the difference that some games are already broadcasted shortly before their release to create hype. Thus, using more than 10 weeks would hardly provide any additional information. Furthermore, as the games were all released on different dates, the restriction on the same number of weeks for each game leads to the dataset being balanced panel.

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6 The twitter API proved to be rather helpful for those instances as the use of quotation marks can ensure that words have to stand next to each other while a minus can be used to exclude words (in this study mostly usernames similar to the respective search term).

7 Not to be mixed up with sales, as copies can also be given away for free as part of promotions, for game critics or as reward for crowdfunding participants.
Variable Description

In the following, the main variables that are incorporated in this study’s models are described.

Dependent variable: number of reviews

As the focus of this study lies on the variables’ dynamic changes during the observation period and not on their cumulated numbers the number of user reviews on Steam are used as proxy for game unit sales, which is a common approach in the game industry (Birkett 2015, 2018). While the owner numbers retrieved from Steam Spy are considered to be rather good estimates of the real overall amount of owners (Barrett 2017), the variable turned out to be not usable due to too much variation between the daily estimates. Additionally, Steam Spy can only provide estimates in increments of 1000 which often are too wide to measure weekly differences for the games in this study’s sample. In consequence, the number of user reviews on Steam is the best available data for the purpose of this study as:

1. Every review has a time stamp so the dynamic changes are more nuanced and can accurately be tracked.

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8 Additionally, the correlation coefficients between the total number of owners and reviews over the full sample as well as the first week after release both have a value of 0.89.
2. Only users who possess the game in their Steam account are able to write a review for the respective game, resulting in a low probability of a given review to be fake.

Independent variables

The independent variables used in this model are the peak amount of concurrent viewers and channels, amount of tweets, price and the amount of professional reviews on metacritic.

Streaming variables: peak concurrent viewers and channels

Other platforms like YouTube Gaming or Mixer\(^9\) also allow users to broadcast live footage of themselves playing video games. However, Twitch is by far the largest platform in the market (Newzoo 2019a; Streamlabs 2019). Daily peak values for viewers and channels are used in this model as those data are easily available, while mean values would require regular, high frequency API calls for every game in the dataset. Though one could think of a scenario in which a game with a lower peak viewership reaches a larger audience with a higher mean of concurrent users, using peak values ensures that only unique viewers (and channels) are counted. Furthermore, in terms of raising awareness or getting information on a game, a few minutes watched can already suffice.

Social media variable: amount of tweets

With a daily active user base of 126 million and 321 million monthly active users, Twitter is one of the largest social media platforms worldwide (Twitter 2019). As Twitter’s focus lies on timely microblogging content and a community based on weak ties (especially due to the possibility of one-sided subscriptions), Twitter is particularly suited for the dissemination of eWOM. The weekly amount of tweets per game measures the audience’s general awareness or interest of the respective games in social media platforms. For every tweet, the Twitter API returns a binary variable whether a tweet was a retweet or not. As retweets are posted in a user’s timeline the same ways as original tweets, retweets are treated the same way as original tweets.\(^{10}\)

Price

Prices on Steam can be changed easily and especially smaller developers often seem to adjust their prices quickly or release their game at a discounted price. Additionally, sales events are a long established tradition on the platform, which make them appealing for developers to participate in to raise their game’s level of awareness. Price changes can be introduced at any time, so due to the weekly structure of this panel analysis, weekly prices are calculated as the average price per week. Certainly, a daily structure could show more

\(^{9}\) https://gaming.youtube.com/; https://mixer.com/

\(^{10}\) In their study, Marchand, Hennig-Thurau, and Wiertz (2017) excluded retweets from their sample but did not provide an explanation why.
nuanced effects on this matter. However, the main interest lies on UGC variables where a daily effect seems somewhat questionable.

**Amount of professional reviews**

The amount professional reviews per week listed on metacritic provides information on the general reach of each game. There are two kinds of information that could lie within the variable. For once, the more popular or anticipated a game is, the higher the probability to be reviewed by a professional critic. Especially early after release, if many websites review a certain game, one can expect that the game was anticipated before release. Additionally, unlike tweets or even user reviews, professional reviews take time to create so especially shortly after release it seems unlikely that reviews are the result of increased social media presence around the time of release. Furthermore, just as with twitter, visitors of said websites could become aware of a game because of the website and with increasing amount of such reviews, awareness for the game could increase as well.

**Summary statistics**

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<td>254.2</td>
<td>0</td>
<td>3</td>
<td>49</td>
<td>5,053</td>
</tr>
<tr>
<td>Owner Change</td>
<td>1.020</td>
<td>3,923.1</td>
<td>15,642.5</td>
<td>0</td>
<td>0</td>
<td>2,178.6</td>
<td>254,029</td>
</tr>
<tr>
<td>Professional Reviews</td>
<td>1.020</td>
<td>8.2</td>
<td>11.7</td>
<td>0</td>
<td>0</td>
<td>11.0</td>
<td>62</td>
</tr>
</tbody>
</table>

*Table 1: Summary statistics*

Table 1 shows the descriptive statistics of the key variables in their original format. High correlation coefficients between the number of reviews, viewers and channels hint that multicollinearity may be an issue. However, all variance inflation factors (VIF) are below 4, therefore the concerns of multicollinearity can be refuted (Wooldridge 2012). High correlation of tweets with reviews and the streaming variables supports the idea that in a completely digital environment with instant access to bought products, eWOM can play a large role.

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11 See Table 2 in the appendix for a correlation matrix of the log-transformed variables used in the regressions.
5. Model

Model specification

Model - OLS Estimation for the Release Week

Before its official release, many developers decide to give streamers access to their game or even stream their game on an own channel to generate buzz and interest. In this sample, over 70% of the games were streamed before their official release with the majority of it falling in the week directly preceding the release. To capture the effect of this marketing action, I estimate a simple OLS regression model using the number of viewers, channels and tweets from the preceding week as dependent variables and price, number of professional critics, and the rating measured as percentage of positive reviews in the Steam store as control variables. Squared rating is also added to account for left skewness as game ratings tend to have an upwards bias (Metacritic 2019). In addition to the full sample, the model is estimated with a second sample where games without any streaming before their release are dropped.

\[
\log(Reviews) = \alpha + \log(Viewers)_{t-1} + \log(Channels)_{t-1} + \log(Tweets)_{t-1} \\
+ \log(Price) + \log(ProfessionalReviews) + Rating + Rating^2 + \epsilon
\]

(1)

Endogeneity

To capture the full impact of UGC over a longer timeframe a dynamic generalized method of moments (GMM) model with individual and time fixed effects is applied and accounts for the dynamic and endogenous nature of the data. The GMM model was developed by Arellano and Bond (1991) and Blundell and Bond (1998) and is a popular method to deal with endogeneity in dynamic panel data as the results it provides are considered to be consistent when “unobserved heterogeneity, simultaneity or dynamic endogeneity” (Wintoki, Linck, and Netter 2012, 588) are present (Ullah, Akhtar, and Zafarian 2018). Another advantage of GMM models lies in the method not requiring external instruments. Past values of the variables can be used as internal instruments for their current realizations (Wintoki, Linck, and Netter 2012). Additionally, the use of fixed effects eliminates time-invariant variables through first-differencing. Therefore, possibly important but unobservable variables like talent of the developers or production budget are indirectly controlled for (Rui, Liu, and Whinston 2013). For balanced panels, Arellano and Bover (1995) recommend the use of a two-step GMM model for efficient and consistent estimates.

Game sales and UGC are likely to be influenced by each other. On the one hand, with higher game sales, the chance that consumers will generate content with it rises and on the other hand, more content increases the chance of potential consumers being affected through awareness or persuasion effects that eventually could result in more sales. Therefore, reviews and channels are treated as endogenous GMM instruments while the rest of the variables are
included as standard instruments. The underlying reasoning is that streamers need to own a game to be able to stream it on their channels. Therefore, with a larger user base, the likelihood of channels streaming a certain game rises. Furthermore, games require a time investment in addition to a monetary one in that they take a certain amount of time to finish. Players (and therefore also streamers) are more dedicated to keep playing a game they paid money for and, depending on the extent of the game, can spend time with for more than a week. For viewers and tweets on the other hand, there are no such dependencies as there is no investment that motivates to continue watching or tweeting. Additionally, Twitter is contemporary by design - tweets can therefore be expected to be reactions or opinions on topics of the same week as the one they were posted in. With viewers, it is similar to tweets. If for example, a tweet catches a user’s interest in a game she can immediately look for a live stream. Further, if live streams are used for consumer information it does not require several weeks of time. In fact, within a week a potential consumer could even have become a buyer and play the game herself instead of continuing to watch it. Thus, the regression formula for the GMM model looks as follows:

\[
\log(\text{Reviews})_{it} = \log(\text{Reviews})_{i,t-1} + \log(\text{Viewers})_{i,t} + \log(\text{Channels})_{i,t} \\
+ \log(\text{Tweets})_{i,t} + \log(\text{Price})_{i,t} + \log(\text{Professional Reviews})_{i,t} \\
+ \alpha_i + \mu_t + \epsilon_{it}
\]  

(2)

Results

OLS Estimation - Release Week

As shown in Table 3, the number of viewers is significant at the 10%-level while the number of tweets and price are significant at the 5%-level. The positive coefficient for price can be explained as another proxy for a game’s quality. For indie games, a higher price typically reflects a higher production value. This could also explain why both of the rating variables show no significant effects. The weak positive effect of the number of viewers and the lack thereof for the number of channels is rather surprising as those streams are the typically the first real gameplay footage for most viewers. It might be that without the possibility to instantly buy a game that raises interest the effect diminishes quickly. For tweets as conventional eWOM the effect seems to be different. Without the possibility to play, users can only share their anticipation on social media platforms. Additionally, tweets show up in a user’s timeline chronologically while the majority of live streaming takes place in the release week (see Figure 2). Thus, lesser known games have a hard time to compete with already released games on streaming platforms, probably flying under the radar for many users. On twitter however, a tweet stays visible and does stand in competition with the tweet preceding or following it.

The regression results of the second sample are surprising as the only significant variable is the number of tweets. However, the results support the previous reasoning where social media platforms seem to be the more important channels to generate and spread anticipation.
### Table 3: OLS regression results

<table>
<thead>
<tr>
<th>Dependent variable:</th>
<th>Log(Reviews)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Log(Price)</td>
<td>0.632**</td>
<td>0.204</td>
<td>(0.288)</td>
<td>(0.351)</td>
</tr>
<tr>
<td>Log(Professional Reviews)</td>
<td>0.227</td>
<td>0.124</td>
<td>(0.145)</td>
<td>(0.167)</td>
</tr>
<tr>
<td>Log(Channels(_t-1))</td>
<td>-0.043</td>
<td>0.292</td>
<td>(0.169)</td>
<td>(0.230)</td>
</tr>
<tr>
<td>Log(Viewers(_t-1))</td>
<td>0.109*</td>
<td>0.095</td>
<td>(0.062)</td>
<td>(0.085)</td>
</tr>
<tr>
<td>Log(Tweets(_t-1))</td>
<td>0.189**</td>
<td>0.214**</td>
<td>(0.092)</td>
<td>(0.104)</td>
</tr>
<tr>
<td>Log(Rating)</td>
<td>2.590</td>
<td>5.901</td>
<td>(5.450)</td>
<td>(6.138)</td>
</tr>
<tr>
<td>Log(Rating(^2))</td>
<td>-2.965</td>
<td>-5.366</td>
<td>(3.796)</td>
<td>(4.318)</td>
</tr>
<tr>
<td>Constant</td>
<td>1.294</td>
<td>0.609</td>
<td>(2.060)</td>
<td>(2.371)</td>
</tr>
</tbody>
</table>

| Observations | 104 | 75 |
| R\(^2\)     | 0.398 | 0.420 |
| Adjusted R\(^2\) | 0.355 | 0.360 |
| Residual Std. Error | 1.301 (df = 96) | 1.215 (df = 67) |
| F-Statistic   | 9.085*** (df = 7; 96) | 6.937*** (df = 7; 67) |

*Note:* *p<0.1; **p<0.05; ***p<0.01
Table 4: GMM results

Table 4 shows the regression results of the dynamic model. All coefficients show the expected algebraic sign. While the number of channels has a positive and significant effect, the number of viewers is not significant. Though somewhat surprising at first, the results are in line with the narrative of Twitch itself. Hernandez (2016) argues that smaller streamers are much more likely to convert viewers into buyers. Top streamers often have a celebrity status within their community; therefore, it seems plausible that viewers of top streamers are more focused on the streamer and less on the respective game. Hernandez (2016) further states that watching a smaller streamer is ‘more like your friend’s couch and less like a stadium’. Thus, it might be more important to reach a diverse audience through several channels, than a possibly less heterogeneous audience of only one or a few channels. Following these results, in combination with those from the OLS regression, Hypothesis 1
with its sub-hypotheses can therefore be accepted. To a smaller degree, tweets regarding a
game also have a positive effect on the number of reviews while the price level shows a
negative correlation. Both directions are as expected and in line with what economic theory
and the literature on eWOM suggests (Marchand, Hennig-Thurau, and Wiertz (2017), Rui,
Liu, and Whinston (2013), Duan, Gu, and Whinston (2008)). As in both regression results,
eWOM shows significant positive effect, Hypothesis 2 can be accepted. For robustness checks
Roodman (2009) argues that in finite samples, GMM models can be biased by the inclusion
of too many instruments and recommends testing smaller lag structures to reduce the
instrument count. A reduction of instruments from 84 to 54 only changes the coefficients only
to a small degree while significance and algebraic sign remain unchanged except for the latter
in the case of the number of professional reviews. A second robustness check was performed
with a reduced sample where less popular games with a total number of reviews lower than
200 were dropped. Again, the results hold but the number of tweets now is only significant
at the 10%-level. In both robustness checks the central results however remain
unchallenged.

6. Discussion and Conclusion

The results show that live streaming can be an important driver for product success when
used in the right way. This is also supported by the results of a survey among 28 indie
developers who attended Gamescom 2019 (one of the largest trade fairs for video games
worldwide) as exhibitors. 75% of the respondents think that live streaming is beneficial for
a game’s financial success and 64% believe it to be especially important for indie games.

After release, streaming seems to be far more important than conventional eWOM.
Audience size of a game showed no significant effects but the number of broadcasting
channels did. As already suspected, the different appeals of live streaming are likely the
reason for that. High peak concurrent viewer levels can be reached even when only a single
streamer with a relatively large audience broadcasts a game and even the duration of the
broadcast does not have to be long. Thus it is unclear whether the audience is more dedicated
to the streamer or whether the broadcast/game was even interesting at all. The responses
also support that interpretation as a clear majority of 60.7% believe that reaching smaller
but more specific target audiences is more important than to reach a large viewer base which
was favored by 25% while the rest were indifferent. Additionally, under the assumption of
the same overall sum of viewers, 50% believe many smaller channels to be more effective
whereas 28.6% favor a few large channels and 21.4% believe that it does not matter.
Hernandez (2016) argues that while smaller streamers may be more influential to convert
views into purchases, larger streamers influence their lesser-known peers to pick up certain
games as they try to gain a larger audience.

Another important aspect for managers that can be derived from the relatively large
influence of the number of channels is that targeting multiple smaller channels instead of one
or a few larger ones maximizes the probability to reach a more diverse audience. Due to the

__________________________

12 The complete survey questions can be found in the appendix.
celebrity-like status of many streamers, and thus communities evolving around them, their viewers’ interest lies not only primarily on the streamer instead of the game but also results in self-selection of more homogenous viewers that the streamers resonate with. To reach a wider spectrum of potential consumers can therefore increase the chance to find the perfect target audience. Additionally, conventional eWOM effects are likely to unfold when they originate from different groups as with a single community the chance is likely higher that the eWOM simply stays within the boundaries of the community, thus rendering it ineffective. Furthermore, the supposedly higher conversion rate from views into purchases for smaller streamers is supported by the results. If the conversion rates were similar across the variety of channels, then audience size and number of channels could be expected to provide similar results.

As many streamers are either streaming professionally or semi-professionally, one can assume that they behave rationally to maximize their audience size. A game that does not provide enough entertainment can thus be expected to be dropped quickly. A streamable game however, can quickly be picked up by other streamers. These dynamics are already noticed within the industry. Twitch itself promotes the phrase “Stream First” for game development meaning that developers should always consider the streamability of their games in the development process as they argue it to be crucial for product success (Twitch 2016, 2019; Williams 2016). That a streaming platforms pushes such a narrative does not come as a surprise but the survey results hint at developers also accepting the idea of considering streaming within their product development. 78.6% say they have thought about including features into their game that are specifically designed to benefit live streaming of their games. For more fundamental design choices (that can dictate the whole style of the game) the responses were less explicit. However, while 28.6% say live streaming had no influence on such choices, 25% say it had some influence and 46.4% say it had at least a moderate influence.

Before a game’s release, live streaming seems to be far less effective than after with anticipation seemingly being driven by social media platforms such as Twitter and the survey indicates that social media platforms take a more important part in the respondents’ marketing plans than live streaming. However, the prerelease effects of live streaming could appear smaller than they actually are. It is quite thinkable that consumers can discover a game through live streaming but without being able to instantly play or even stream the game themselves, they turn to social media to communicate their anticipation. Another possibility is that they discover a game directly on twitter through a tweet that has game footage embedded. In such a case, Twitter may have been the medium to spread awareness but the persuasion might have come from the streamed footage. For developers, the interplay between live streaming and social media could be used by developing games that create memorable moments or reactions with their players that afterwards can be converted into short video clips to share on social media and generate buzz. Popular examples of such game designs can be found in indie games like Getting Over It with Bennett Foddy which was purposely designed to be frustrating for players and gained popularity out of the malicious joy to watch other people fail or Untitled Goose Game where the bizarre setting of controlling a goose to create mischief in a small English village struck a nerve with its audience that led to the mass creation of original content in the form of jokes, pictures and videos (memes) being shared on Twitter (Frank 2017; Haynes 2019).
Lastly, there are a few caveats that shall not be left unmentioned. For one, even though Steam is a quasi-monopolist for most games, the number of reviews on Steam is still only a proxy for units sold. Additionally, next to peak concurrent viewers and channels, mean values over the whole day would make an interesting extension to the sample. For tweets, the Twitter API does not give out every single tweet to a search term but rather an extensive sample of them. Furthermore, even though the search terms were carefully chosen, the process could still have resulted in some tweets not being collected at all.

**References**


## Appendix

<table>
<thead>
<tr>
<th></th>
<th>Log(Reviews)</th>
<th>Log(Viewers)</th>
<th>Log Channels</th>
<th>Log(Owners)</th>
<th>Log(Tweets)</th>
<th>Log(Price)</th>
<th>Log(Owner Change)</th>
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<td></td>
<td>0.58***</td>
<td>0.59***</td>
<td>0.49***</td>
<td>0.37***</td>
<td>0.19***</td>
</tr>
<tr>
<td>Log(Professional Reviews)</td>
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<td></td>
<td>0.27***</td>
<td>0.28***</td>
<td>0.43***</td>
<td>0.25***</td>
<td>0.37***</td>
</tr>
</tbody>
</table>

Note: * p<0.1; ** p<0.05; *** p<0.01

### Table 2: Correlation matrix of log-transformed variables

## Survey Questions

1. For how many years is your studio/are you involved in the gaming industry?
2. Do you think live streaming is beneficial for a game’s financial success?
3. Did you now think different about the importance of live streaming for a game’s financial success than you did in the past?
4. Do you think live streaming is more important for indie games than AAA titles?
5. Did live streaming have an influence on the fundamental design of your game(s)? E.g. sandbox instead of linear/narrative
6. Are social media platforms (Twitter, Discord, etc.) an important part of your marketing plans for your game(s)?
7. Is live streaming an important part of your marketing plans for your game(s)?
8. If live streaming is part of your marketing plans: How do you plan to use live streaming?
9. If you collaborated with streamers, how did you approach them?
10. Do you plan to use or have you used live streaming preceding the release of your latest game(s)?
11. Have you thought about including features into your game that are specifically designed to benefit live streaming of your game(s)?
12. What is more important you: Reaching a large viewer base or a (potentially) smaller but more specific target audience?
13. Do you think having your game streamed on a few large channels is better than on many smaller channels (with the same overall sum of viewers)?
14. Do you work with a publisher?
15. Have you used crowdfunding to fund the development of your latest game(s)?

16. Have you considered enrolling your game in a subscription-based system (Xbox Game Pass, EA Origin Access, etc.)?

17. Do you believe subscription-based systems will be good for the industry as a whole?

18. How many people are involved in the development of your latest game(s)?

19. If you have any additional thoughts that you think are relevant to the topic but were not covered in the questions, please feel free to write them down here.