Implementation of Microtransactions in Videogames and its Effects on Videogame Demand.

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Abstract

The purpose of this study was to identify how the implementation of microtransactions affected the demand for video games as a consumer product using regression analysis and duration analysis. Microtransactions are a new monetization strategy that is being adopted by the videogame industry at large. Using regression analysis on two study groups, one composed of video games with implemented microtransactions and another without microtransactions, demonstrates the immediate impact of said implementation, while duration analysis demonstrates the impact on a longer period. The results demonstrated that the implementation of this monetization strategy has no effect whatsoever on demand when comparing the two study groups. However, when comparing two groups of videogames, both with microtransactions but divided by the way said microtransactions were implemented, there was a marked difference in the demand of these two groups. Negatively implemented microtransactions called predatory microtransactions had a faster decrease in demand than those with non-predatory microtransactions.

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Dedication

To my mother, my father, my sisters, and my grandparents, for giving me their unwavering love and support throughout my whole life.

Acknowledgement

I would like to thank my family for always supporting me in this academic journey I decided to take almost a decade ago; without them none of this would have ever been possible. My parents, my siblings and my grandparents were for all intents and purposes my safety net when the stresses of college life became overwhelming. They are the reason why I am here as the person I am and for that I can't thank them enough. I would also like to thank all the teachers and professors who have left a mark on me throughout the years, from elementary school to graduate school. Most of all I would like to thank my advisor Prof. Eileen Segarra for the instrumental guidance she gave me through the whole process of writing this paper. Lastly, I would like to thank all my close friends made in college whose presence made the whole experience all the better.

I. Introduction

The study of the videogame industry has been a relatively new area of interest in various disciplines. The peaked interest stems partly from its young lifespan as an established entertainment industry compared to other media already in our culture, such as television. However, equally important is the impact that rapid technological advancements have had on the industry, making it a constantly changing environment with data that can quickly become obsolete for studies that require data sets of an extensive period. The growth experienced by the industry has never stopped, but in recent years, it is slowly coming to a halt; no longer are technological advances the sole driver of larger quantities of revenue. In the era of the attention economy, there is a lot more competition between different types of businesses, and with it, the need to find new approaches to monetization also raises its head.

One of these new approaches is called microtransactions, a business model that spawns from the information age, specifically in the early years of the smartphone era. This model consists in using small in-app purchases of items related to the game in use. First used in mobile games sold in the app stores of smartphones, the microtransactions model has been adopted by all parts of the industry and used in a variety of videogame products. The study of this model has primarily focused on two areas: Marketing and Psychology. In Marketing, microtransactions are viewed solely as new business models, focusing on the best implementation process. In the area of Psychology, studies like the one from King & Delfabbro (2018) have been mainly focusing on the effects this new business model has on the consumers. In these studies, concern started to appear with regards to the implementation of microtransactions in video games. These studies

demonstrate that the general business decisions revolving around microtransactions made by companies that publish video games have generated a negative response in the consumer base, giving the prevalent business model a bad reputation.

Most of these studies have had in common the lack of quantifiable results on the effects of microtransactions. This is expected since the fields of study that have shown an interest in the subject are considered more qualitative than quantitative. For example, based on the literature reviewed, it becomes apparent that over implementation or simply wrong implementation of microtransactions create a negative experience for the consumer. Still, the effect that negative experience has on economic variables is unknown. A look at the impact that microtransactions can have on the units sold of a product can shed light on the direct effects of these business practices on firms' revenues in the video game industry.

The questions addressed in this study stems from the microtransactions model; has this model generated a positive or a negative impact on videogame sales when implemented into the product? For over two years, this debate has been ongoing in the video game community, and both sides of the argument have relevant points. However, these arguments tend to make the business model the focal point of the criticism (Tassi 2013), and maybe that is not the most optimal approach. The reality is that microtransactions are just by themselves, a business model. Like any business model, how development studios implement them makes the difference between its failure and success. Even though most products with microtransactions implemented in them have received backlash, there are various cases where the model worked well with the product, receiving a warm reception from consumers (Tassi 2018).

Given these exceptions from the norm, it is possible to argue that there is more to research on this topic to pinpoint how to make microtransactions a less divisive issue in the industry. This study means to pursue this goal by finding a more concrete answer to the tangible effects this business model has on the demand for products that have had the model implemented. This study aims to establish how video games demand reacts to the different forms of implementations of the microtransaction business model.

General Objective:

- Determine the effect the microtransaction business model has on the demand of video games when implemented.

Specific Objectives:

- Identify the determinants of the demand for video games.
- Compare the effects of non-predatory microtransactions and predatory microtransactions on videogame demand.

As established previously, this study will focus more on how the microtransaction model is implemented than on the model itself. Two implementation methods are observed out of the dozens of video games currently being sold with implemented microtransactions. The first is driven by maximizing profit from consumers of the product as fast and as much as possible, risking dissatisfaction with the consumer base. Videogame journalists coined these as predatory microtransactions. The other is a more controlled implementation, in which the profits earned from microtransactions do not come at the cost of reducing the enjoyment of the videogame.

Predatory microtransactions have been on the receiving end of attacks from journalists and sectors of the consumer base. They are generally implemented in a rushed manner, the video game title being in the late stages of development, resulting in un-cohesive gameplay. Non-predatory microtransactions have become more prevalent in recent years in projects that from the very beginning are built with a plan on developing a microtransactions marketplace that is part of the experience, not an apparent last-second addition. Microtransactions, however, are not the only determinant of the success of a videogame title. For this reason, we must first find out the independent variables that determine how the demand for video games behaves. Without this information, the impact of implementing microtransactions cannot be adequately measured since there would be too much-omitted information from other factors that could contribute to demand change when we introduce our new variable and its data. After the first specific objective is complete, the next step is to measure the differences in impact between non-predatory and predatory implementations. These two types of microtransaction implementation will have different implications for the demand. With this piece of information in mind, the following hypothesis is formulated:

"The effect microtransactions have on the demand of videogames will depend on how the model is implemented. If the implemented model tarnishes the usability or the playability of the product, demand will decrease at a faster rate."

The hypothesis relies heavily on d Aleem, S., Capretz, L. F., & Ahmed, F., (2018) definitions of usability and playability. Following the theory established, a videogame with a microtransaction model implemented will only see an accelerated decrease in demand created by said model if this implementation hampers the usability and playability aspects of the game. The terms usability and playability are discussed in later

pages. Still, it's sufficient to say that how the business model affects these two critical aspects of game development holds a lot of weight on the overall effect microtransactions have on the demand of video games.

II. Literature Review

The video game industry is a multi-billion-dollar entertainment industry with an ever-growing pool of consumers of all ages. In academia, this industry has received little attention even though it is one of the most rapid-growing entertainment sectors ever since the arrival of the digital age. This lack of research stems from two key factors; the novelty of the whole industry, reaching 50 years of economic activity during this decade, and the lack of foresight from the people who first started in the industry to document and archive the data and art that was generated. Since the industry's pioneers had a background in computer science, they did not care much for storing essential data, such as product sales. Computer technology was primarily intended for calculations, be it scientific experiments or military advancements. As the potential for computers started to become more prevalent and their uses more versatile, it eventually became an essential tool for the videogame industry (Haddon 1999). But in the end, a computer scientist is not a businessman; few people during this timeframe in the industry thought the financial data from video game companies held any importance.

In the Massachusetts Institute of Technology, computer science students first started developing the hardware and software that would become the foundation of the videogame. This same group of students during the '70s would be the founders of the first videogame-focused company, Atari (Haddon 1999). Since the beginning, video games have had a fundamental relationship with technology. Haddon (1999) writes that the progress of technology is intertwined with the progress of video games, specifically the advancements in the semiconductor industry. This has caused the console cycles to become a part of the industry and a moment of high revenue for the producers; the launch

of new consoles marks the beginning of a new console cycle. Therefore, these new consoles tend to showcase the advancements in technology and use said advancements as selling points for their new product.

The arrival of the digital age, social media, and increased globalization brought to the industry drastic changes in a wide array of areas; from software production to monetization, everything has been affected, for better or worse. Marchand & Hennig-Thurau (2013) took it upon themselves to create a record of the industry today, highlighting all the significant aspects that encompass the business and creative sides. Their objective is to create a conceptual framework of the industry that reflects all the big players in the industry, their roles, and how they interact with each other. This framework is divided into the following categories: game platforms, the economics of games, communication and distribution strategies of games, other game-related aspects. From this framework, one event stands out: the arrival of the internet. It is the technological breakthrough with the most significant impact in the videogame industry. Johns (2005) agrees with this statement, specifying that implementing the internet into the hardware and software provides an additional retailing avenue, as console manufacturers, publishers, and online gaming sites offer physical games for sale. Two years after Johns study, the arrival of the iPhone and an efficiently integrated marketplace in the videogame hardware would change the success of the internet as a retailing avenue. New monetization strategies started to emerge with the advent of the App Store, creating what is now known as microtransactions or freemium models. These new business models would shape the industry in the following console generations that have been in the market during this decade.

Fielt (2013) gives the best definition of a business model and what it is trying to achieve. He writes that a business model describes "the value logic of an organization in terms of how it creates and captures customer value and can be concisely represented by an interrelated set of elements that address the customer, value proposition, organizational architecture and economics dimensions." (Fielt, 2013, p.99) The importance of this definition lies in emphasizing the customer or, better yet, the consumer. At the end of the day, the objective is to retain that consumer; the consumers keep utilizing your product, the producer keeps on generating revenue. In the realm of video games, there have been various business models since the '80s. These business models can be classified and divided into two groups: the hardware and the software sides of the industry. (Gomagias, N., Cabras, I., Fernandes, K. J., Li, F., Nucciareli, A., Cowling, P., Kudenko, D., 2014). The division occurs because the videogame industry works in a two-sided market economy. Out of all the classifications created, attention will be given to the dominating models that are currently in use, the publishing model and the freemium model. One of the primary features of the publishing model is its focus on revenue and profit maximization through videogame sales (physical or digital), following a risk-averse strategy that skews the publishing decision heavily towards hit-driven titles (Gomagias, N. et al., 2014). In contrast, the freemium business model provides free products with essential functions and attracts users with free services. After acquiring a substantial number of users, it offers advanced functions or value-added services with a fee, thus generating profit (Hao-Chen Huang, 2016). These revenue models are the primary source of funding for the Video Game Development business model (the creation

of the videogame); the revenue model that publishers choose to implement impacts directly the development and design of the product.

Ho-Chen Huang (2016) classified five key characteristics that set apart the freemium model from the others. These include a free basic tier, two-sided networks, revenue sharing, service convenience, and network effect. The free basic level is to provide a free version of the product to the consumer. Most of the consumer base will use this product version, with another tier with extra features requiring a purchase. Two-sided networks, common to the industry, is the interaction between two participants in the industry. In the case of freemium business models, one side is composed of users enticed by the free services while the other is a collection of advertisers, firms, and buyers who are also users of the service. The interactions of these two networks create value that leads to the third characteristic, revenue sharing. This characteristic of the model focuses on the creation of revenue, primarily employing advertisements. The bigger the user base, the more advertisers are willing to pay to advertise their products. There are cases where even the consumers can generate revenue, but this is not the norm in the videogame industry. Service convenience has to do with the fact that this model can only be used on a digital platform. Thanks to the internet and technological advancements in smartphones, the ease of access to these types of business models creates ease of entry for consumers, potentially increasing the number of users willing to buy the virtual goods being offered in the digital marketplace. The last one is the network effect; this one ties neatly with the previous characteristic. A network effect occurs when there are more consumers of a particular product, making the individual consumer's effectiveness of

product use more significant. With the ease of access model, the chances of generating a more considerable network effect can increase exponentially.

This business model has seen a popularity boost in recent years, being implemented into all types of games. The problems arise when the implementation occurs in a way that has negative consequences for the product. Because of generating even more revenue, publishers can shoot themselves in the foot by implementing microtransactions without adequately analyzing their effect on the entertainment experience. Aleem, S., Capretz, L. F., & Ahmed, F. (2018) look at the factors that can make or break a video game from the consumer's perspective, differentiating it from other studies that use the producers' viewpoint exclusively. The factors that are highlighted are quality factors, these being usability and playability. Usability encompasses everything that deals with how easy it is for the player to navigate the experience. Aspects like the interface, tools for the construction of challenges, and communication of critical information are cataloged in this factor.

On the other hand, playability deals with aspects of video games that the player is much more aware of. Things like gameplay, game mechanics, and game narrative are part of a video game's playability; they are the entertainment part of the product. Since they encompass what could be called the game experience, the playability factor must be accounted for in the same way as usability to assess the quality of the product honestly. Suppose the freemium business model affects in any way the playability or usability components of the game. In that case, the implementation of the said model will have negative consequences for the consumer who is trying to enjoy the game.

Prax (n.d.) has studied the effects of inadequate implementation of a freemium model in the videogame Diablo 3. He developed a theoretical framework consisting of three factors; if these three factors are seen in the product, it can be said that the business model negatively influenced the game's design. The first two factors detail how influence from the business model can change aspects of game design to ensure the product's capability to generate sufficient revenue. The influence of the business model is seen in most video games in some shape or form; therefore, these factors do not indicate if the effect was negative. For this reason, the focus will be given to the third factor, called Problematic Game Design. In this factor, Prax (n.d.) states that to establish a negative influence in game design caused by the business model of the videogame, the game design feature that is being implemented must be considered "Problematic." He states that a game design feature is deemed problematic if it has elements considered harmful in game design literature, has negative consequences for players, or limits the game's potential to be persuasive.

Examples of these problematic features are the need to start at the beginning of a level after death, no possibility for saving the game, and high difficulty to keep people from playing too long or beating the game. Limiting the game's persuasiveness means that the feature limits the game's capacity as an artistic expression and its ability to take comments on social and cultural positions; in other words, it limits how the videogame defines itself as a cultural product. Hamari & Lehdonvirta (2010) argue that these adverse effects can be diminished if the game design and the marketing (business model) were integrated from the very beginning. However, they also establish that the integration still

seems far away; a harmonization between game design and the business mindset means that the creative and business sides would have to be on the same page.

Other studies tend to take a more specific approach to microtransactions and the various fields of study generated by this business model. Hamari, Alha, . . ., Paavilainen (2017) studied the reasons why people would end up purchasing the virtual goods offered in microtransactions. They identified nineteen possible reasons a person would spend money in in-game purchases and grouped them up into six major categories. These categories are unobstructed play, social interactions, competition, economic rationale, indulging the children, and unlocking content. For example, economic rationale represents the possible motivations of reasonable pricing, a special offer, and investing in a hobby. Using a survey, they gathered data on why people spend their money in-game and cataloged the results utilizing these last six categories. The results demonstrate that the only categories that showed positive associations with how much money a person spent were economic rationale, social interaction, and unobstructed play. Two out of the three types deal with game design, highlighting the relationship between said design and the implemented business model.

Evers, Van de Ven & Weeda, D. (2015) focuses on the negative aspect of this freemium business model. Their objective was to find evidence that the implementation of microtransactions, giving the option to buy functional items that help the player in-game, was detrimental to their status in the social space of the video game. In other words, other players negatively perceive you for gaining these items by buying them instead of earning them through gameplay, earning you a lower status in the community. At the end of this study, the five postulated hypotheses were proven true, agreeing with

the previous research of Aleem, Capretz, & Ahmed (2018). Their results demonstrate the importance of not tampering with the game design too much just for an enormous profit; the adverse effects on the consumer are not only relegated to his economic wellbeing. The social status of these individuals in the digital community they take part in can also be impacted, and in some extreme cases, addictions can be formed. In an editorial, King & Delfabbro (2018) state that predatory monetization schemes in video games, of which most lie under the banner of freemium, are purchasing systems that disguise the long-term cost of the activity until players are already financially and psychologically committed. These types of practices generate disturbing similarities between video games and gambling. Close & Lloyd, J. (2021) reach similar conclusions.

Now that the impact of microtransactions has been established, how can said impact be measured? The primary goal is to determine the effect that the implementation of freemium business models (microtransactions) can have on the demand of video games; to that end, two methodologies can be used, studying this effect from two different points of view. The first method will study the immediate impact of the freemium model's implementation on demand. It is feasible to estimate the effects independent variables have on the dependent variable chosen to be studied using linear regression analysis. This model for the demand for video games was used by Sacranie (2010) to determine what determinants of video game demand are significant and not. Sales were selected as the dependent variable and used to measure the demand for the product, in this case, a video game. The first independent variable is the aggregate reviews of said video games; reviews are how we can measure the quality of games. The opinions of established critics are made into an aggregate review published on the

Metacritic website; this is the data utilized for this variable. These will be the only numerical variables; the rest are dummy variables that will reflect the characteristic they measure on each of the video game titles being studied if they demonstrate said feature. The first set of dummy variables focuses on the different consoles (hardware) in which the video game title can be played. Since this regression was made in 2010, the consoles used here are from the previous console generation; if this exact model were to be estimated in 2018, the hardware would be replaced by the newer versions of these hardware consoles.

The following three variables deal with exclusivity, sequels, and licenses, respectively. Exclusivity means that the game can only be played on one specific console; hence it is exclusive to that particular hardware. Sequels and licenses deal with franchises; if the game is a sequel, it is part of a franchise that has been previously established, making it a safe bet for a return in investment. In the same vein, if the game is licensed, it uses an already established IP, making it a safe bet for investment and production. The last group of dummy variables represents different video game genres: action, adventure, first-person shooter, role-playing games, and sports. All the big games from the previous five years can be placed in one of these five genres. Sacranie's study found that review scores and action genre games had the highest positive significant impact on video game sales. An increment of one point in a review score increases sales numbers by 17,800 units sold, whereas being an action video game does the same by a margin of 350,000 additional units. In contrast, the rest of the determinant variables did not affect sale numbers.

III. Methodology

As we stated in the previous section, this study is composed of two methodologies, each tackling the issue differently. The Sacranie (2010) regression model previously mentioned will be our first methodology, adjusted and updated for the purposes of this study. The most significant change must be how the microtransaction variable will be factored in the model. The most efficient way to do this is by estimating the same regression model used by Sacrinie (2010) but with an additional dummy variable representing implemented microtransactions. With this new addition, videogame titles that have microtransactions will be identified with a value of one; if not, the value of the dummy variable will be zero. The updated model will primarily focus on this study's specific objective of finding out what are the determinant variables of videogame demand while simultaneously progressing the general aim of finding out the effect the microtransaction business model has on demand.

Sales and Review data is needed to estimate the multiple regression model. Sales data is compiled using VGChartz, an industrial research firm that publishes weekly sales estimates of hardware and software in the video game industry. Using these weekly sales estimates, the Sales variable for each video game in the study is defined as total sales for the first ten weeks the product was in the market. The Review variable will be composed of the Metacritic score that each video game has received. This score is the aggregate of all review scores published by reputable sources, making it the most accurate measure of the consensus of professional video game reviewers on the selected video game titles. The rest of the model comprises binary variables with either a value of zero or one. These dummy variables values will be based on the characteristics of each videogame in the

study, which consoles they are available in, type of genre, if they are exclusive, licensed, or a sequel, and if they have microtransactions. The sample will have a total of sixty observations, sixty videogames, all sold at 59.99$ on their respective release dates.

$$Sales = \beta0+\beta1(Review)+\beta2(Micro)\ \beta3(PS4) +\beta4(XBONE)+ \beta5(SWITCH)+ \beta6(PC)+ \beta7(Exclusive)+ \beta8(Sequel)+ \beta9(License)+ \beta10(Action)+ \beta11(FPS)+ \beta12(Adventure)+ \beta13(RPG)+ \beta14(Sports)+ \beta15(Other)$$

Another way of factoring in the effect of microtransactions is by using the review variable. The literature, specifically Aleem, S., Capretz, L. F., & Ahmed, F. (2018), states that the quality of a game depends on usability and playability, meaning that both aspects must be at their best. Adding to this, in Prax (n.d.), it is found that if poorly implemented, microtransactions can negatively affect the game's playability, hindering the quality of the product. Zhu & Zhang's (2006) study investigates how online consumer reviews can impact the sales of experience goods; they used videogames sales data from 2006 to determine these effects. The study's findings indicate that reviews significantly influence the demand for video games and that the higher the quality, the higher the review will be. It can be argued that the effect of poorly implemented microtransactions can also be seen in the scores of the reviews. Since reviews are tools that measure the quality of a game, a game with negatively implemented microtransactions is expected to have a lower score than a title with no microtransactions. For this reason, a second regression focusing on the impact microtransactions have on the review variable is valuable to pursue.

Our second methodology is called survival analysis; this statistical model studies the occurrence of an event throughout time. During the study, observations occur at established time intervals; they could be days, weeks, months, etc. The use of survival analysis is common in the medical field, where time until death is an expected question that is asked, but it is applicable to all matters of study. For this study, the model measures a decrease in video game sales figuress during a period of twenty weeks. When compared between two groups of test subjects, video game titles with microtransactions and video games without microtransactions, the obtained results give an overview of how the sales Figures between both groups behaved week by week. Several ratios can be measured from this data that estimate the probability of maintaining good sales Figures. The purpose of this study is to compare the proportions of the two groups mentioned above and see which one leads to better sales Figures in a twenty-week period.

Another example of survival analysis, also called duration analysis, can be found in Guindon (2014), where it was used to view how tobacco prices can affect the onset of smoking in a low-income country, using Vietnam specifically. Here the event that wants to be measured is the moment a person decides to smoke cigarettes for the first time—measuring when this occurred over an established period permitted the researchers to determine if the tobacco prices had an impact on the first time use of cigarettes. Miles (2005) used duration analysis to study the effect that the show "America's Most Wanted" had on the apprehension rate of criminals who were on the run. In this case, the event being studied is the apprehension of the criminal, how long it takes for authorities to catch him and if the suspect's appearance in the tv show makes the arrest happen quicker. In both example studies mentioned, what is being measured is how much time passes

until the event being monitored occurs. The outcome of this model is composed of two parts: Time and Event.

Time measures how long the subject was observed during the study, while the Event variable indicates if the event being measured occurred or not. In a study of three years in which the event is death, if a participant dies in the second year, they would have been observed for two years (T=2) and experienced the event being studied (E=1). A participant that survives the three years was observed for three years (T=3) and did not experience the event (E=0). When the event does not occur (E=0), that variable is called a censored variable, meaning that after observations were complete, the subject was still waiting for the event to occur, in other words, alive.

Variables are often censored before the study is finished because of a lack of data for that variable; once it is no longer possible to observe a variable during the study, the outcome of the said variable cannot be known. Since the outcome of the variable is unknown, the variable is censored and not used to identify survival time. This is an essential aspect of the censored variable; it is noninformative; whether a variable is censored or not has no impact on the probability of the event occurring throughout the study. For this study, the Event variable will measure a fifty percent drop in sales figures from one week to the next, using the duplicate sixty videogame titles used in the regression analysis and the same source, VGChartz. The study will have a duration of twenty weeks; however, not all observations will reach the twenty-week mark; some will inevitably be censored due to a lack of data.

The objective of survival analysis can be summarized with the Survival Function (S_t) demonstrated below: to calculate the probability that the survival time of a test subject (T) is beyond time(t). If t were three years, the function would search for the probability of surviving beyond three years; this probability is called the survival ratio. It is the first of two results given by survival analysis. The survival ratio demonstrates the likelihood that a group of test subjects will survive until the next interval in time, where they will be observed again. The survival function is expected to decrease with time. Since the established time of the study is a total of twenty weeks, t will reach a maximum value of twenty.

$$S_t = P(T > t)$$

$$HAZ = P(T < t + \delta | T > t)$$

$$HR = \frac{HAZ\ x = 1}{HAZ\ x = 0}$$

If the survival ratio demonstrates the probability of survival, then the hazard (HAZ) illustrates what is the likelihood of the event occurring in the next few seconds ($T < t + \delta$) given that the subject is alive right now ($T > t$). Hazard does not say much on its own, but it is a necessary probability for the calculation of the hazard ratio (HR), the second result given by survival analysis. This ratio shows the likelihood of the event occurring to a group that is exposed ($x = 1$) relative to a group that is not exposed ($x = 0$). To better understand this ratio, let x be the exposure to microtransactions; if the subject, in this case, a video game, has implemented microtransactions, its value would equal one; if not, it would equal zero. Calculating each group's hazards and dividing them gives us the HR; for this study, it would show the probability of a video game

experiencing a fifty percent drop in sales from one week to the next if said video game has implemented microtransactions.

The survival and hazard ratios determine the effect a freemium business model can have on big-budget video game demand. They are also beneficial in studying the different methods of implementation seen in microtransactions, as stated in the second specific objective. Using survival analysis exclusively on video games that have microtransactions and categorizing them between non-predatory microtransactions ($x = 0$) and predatory microtransactions ($x = 1$) will determine how different implementations of the freemium business model in big-budget videogames changes the potential sales figures between the two groups. The Literature Review explained that if usability and playability were not affected by implemented monetization models, there would be no damaging effect on the consumer's experience. There are video games titles that successfully create game economies solely on cosmetic items that do not impact gameplay, leading to a virtual economy sustainable by solid gameplay mechanics with thoughtful online marketplace design. These games will be categorized as the non-predatory microtransaction group. Survival analysis is used in this study for two sets of results; one consisting of all sixty videogame titles, organized between those that have and those that do not have microtransactions, and a second study of the thirty microtransaction titles categorized between non-predatory and predatory microtransactions.

Two survival analysis models can be used to estimate the two ratios: the Kaplan Meier survival curve and the Cox proportional hazard model. Kaplan Meir survival curve estimates the survival function and graphs the survival ratio; it is useful when comparing

two groups using a categorical variable. The Y-axis measures the survival ratio, and the X-axis measures the time. As the weeks pass, the survival ratio will decline with every observation of the event occurring. Survival curves are created by graphing the survival ratio for every study interval, in this case, twenty weeks. The observation of the event will be seen as a sudden 90-degree fall in the graph, creating a staircase-like chart where the longer it stays horizontal, the higher the survival ratio will be during that time interval. The KM curve also allows control of a few categorical variables at the same time.

Kaplan Meier curves are a non-parametric model, meaning that they do not follow parametric criteria, like regression analysis. These models make no assumptions about the probability distributions of the variables being studied beforehand, making them less restrictive and more robust. Non-parametric models are generally used when trying to assess something that can be ranked but with no exact numerical value, like the preferences of consumers when purchasing video games. Kaplan Meir uses lifetime data to estimate the survival function previously detailed. Ten KM curves will be created; one set of five focuses on comparing microtransactions against no microtransactions and a second set comparing predatory microtransactions between non-predatory microtransactions. The two sets will have a KM curve that focuses on the two primary groups and four additional KM curves that will take into account four explanatory variables seen in our regression model of determinants: PS4, XBONE, Action, and FPS. Each of these KM survival curves will show us the survival ratios of the two groups. A log-rank test for equality of survivor functions is used to determine if the difference between the survival ratios of both groups is statistically significant.

$$Log-rank\ test\ statistic = \frac{(O_1 - E_1)^2}{E_1} + \frac{(O_2 - E_2)^2}{E_2}$$

Where *O* is the total number of observed events for each group and *E* is the calculated number of anticipated events. The null hypothesis of this test is that there is no statistically significant difference in survival rate between the two groups. If the test has a p-value less than 0.05, the null hypothesis is rejected; a significant difference exists between the groups' survival rates.

The second model, Cox proportional hazard model, is another type of regression model, like linear or logistic regression. Its main difference is that it's a semi-parametric model; as the name implies, it has characteristics of both parametric and non-parametric models. Semi-parametric models ignore the unknown parameters non-parametric models purposefully create to become more flexible, usually using them as nuisance parameters, a parameter of no interest that is nevertheless needed to analyze a more important parameter. The Cox proportional hazards model uses the baseline hazard function as a nuisance parameter; the hazard can vary over time; the downside of this is that the model cannot estimate the hazard ratio at a particular point in time; because the risk can change over time, the baseline hazard ($HAZ_\circ$) is unspecified; it does not have a fixed value. The baseline hazard is the hazard at time t for observations when all predictors are zero.

$$Log\ HR(x) = log[HAZ(t)/HAZ_\circ(t)] + b_1x_1 \dots b_kx_k$$

What it can do is estimate the hazard ratios from our coefficients to compare the hazard ratios between groups. The Cox regression compares the hazard of a group (HAZ) with the baseline hazard, modeling the ratio of the risk of experiencing an event at a given

time between two groups($HR(x)$). If the hazard ratio is less than one, the group with the characteristic being studied, in this case, Microtransactions/Predatory microtransactions (x=1), would have a lower hazard than the other group ($x = 0$) and a higher survival rate. The opposite is true if the hazard ratio is more than one; the group of interest would have a higher instantaneous risk of experiencing the event and a lower survival rate. All these models will be estimates using the STATA statistical program.

IV. Results & Analysis

The multiple linear regression model of the determinants of video game demand estimated with all the categorical variables give the following results; only one of the categorical variables, Action, came remotely close to statistical significance.

Table 1

Multiple Regression Analysis of all categorical variables

Source	SS	Df	MS	Number Of Observations = 60		
Model	2.7850e+14	15	1.8567e+13	F (15, 44) = 0.83		
Residual	9.8536e + 14	44	2.2395e+13	Prob >F = 0.6415		
Total	1.2639e+15	59	2.1421e+13	R-Squared = 0.2204		
				Adj R-Squared = -0.0454		
				Root MSE = 4.7e + 06		
Sales	Coefficient	Std. Error	t	P > | t |	[95% Confidence Interval]	
Review	37258.87	93444.5	0.40	0.692	-151066.1	225583.9
Micro	-2832.347	1996640	-0.00	0.999	-4026796	4021132
PS4	2289257	2232142	1.03	0.311	-2209329	6787843
XBONE	1374615	2383025	0.58	0.567	-3428055	6177286
SWITCH	-144486.1	1887038	-0.08	0.939	-3947561	3658588
PC	-1288483	3161178	-0.41	0.686	-7659419	5082453
Exclusive	-343859.2	3756891	-0.09	0.927	-7915376	7227657
Sequel	-370014.9	1488207	-0.25	0.805	-3369298	2629268
License	158709.7	2114049	0.08	0.940	-4101875	4419295
Action	-5190746	3003828	-1.73	0.091	-1.12e + 07	863072
FPS	2852663	2574172	1.11	0.274	-2335241	8040566
Adventure	1499132	2151234	0.70	0.490	-2836396	5834659
RPG	744166.2	2207705	0.34	0.738	-3705171	5193503
Sports	-3867642	3031772	-1.28	0.209	-9977777	2242492
Other	-541510.3	2791905	-0.19	0.847	-6168226	5085205
_cons	3666604	1.04e + 07	0.35	0.727	-1.74e + 07	2.47e + 07

This first regression is simplified by taking out some dummy determinant variables and maintaining the ones demonstrating significance in Sales. The only console determinant variable kept was the PS4, the highest-grossing console of the generation. The other dummy variables that stay are the Actions, FPS, and Sports genres since they had the

lowest p values. Out of this new simplified regression, only two categorical variables show statistical significance: Action and Sports.

Table 2

Multiple Regression Analysis of statistically significant categorical variables

Source	SS	Df	MS	Number Of Observations = 60		
Model	2.3423e+14	6	3.9038e+13	F (15, 44) = 2.01		
Residual	1.029e + 15	53	1.9427e+13	Prob >F = 0.0806		
Total	1.2639e+15	59	2.1421e+13	R-Squared = 0.1853		
				Adj R-Squared = 0.0931		
				Root MSE = 4.4e + 06		
Sales	Coefficient	Std. Error	t	P > | t |	[95% Confidence Interval]	
Review	32390.32	81206.33	0.40	0.692	-130489	195269.6
Micro	-369078	1556693	-0.24	0.814	-3491409	2753253
PS4	2991894	1637726	1.83	0.073	-292966.9	6276756
Action	-6538885	2181007	-3.00	0.004	-1.09e + 07	-2164340
FPS	2589870	1328616	1.95	0.057	-74996.11	5254735
Sports	-4522341	2171817	-2.08	0.042	-8878454	-166227.5
_cons	5303771	7725992	0.69	0.495	-1.02e + 07	2.08e + 07

The coefficient of the microtransactions variable is negative, meaning that the presence of microtransactions as a characteristic of a video game leads to a decrease in sales. On the other hand, the Review variable has a positive coefficient. However, out of all the regressions estimated, neither Micro nor Reviews reached any statistical significance; during the first ten weeks a videogame is on the market, the implementation of microtransactions is not a determinant for videogame sales Figures. Microtransactions have no direct impact on the sales Figures of big-budget video games. In the same vein, Reviews do not impact the sales Figures enough to be considered significant; a linear regression of the relationship between Reviews and Microtransactions demonstrates that microtransactions do have an impact on review scores, but since review scores are not a

determinant, this does not demonstrate any effect microtransactions can have on a video game in its opening launch weeks through reviews.

This result suggests that most video game consumers do not use reviews when making their purchasing decisions; a minority of the consumer base would use a review when they are on the fence about buying the product. Out of all the platform categorical variables, PS4, the bestselling console of the previous generation, is the only one that comes remotely close to being statistically significant even though it still falls short. Its positive coefficient reflects a boost in sales if the title is available in the console, an expected outcome since it's the videogame console with the most sales in its respective hardware market.

The regression results for the genre categorical variables are contradictory to the market trends seen in the industry. Although it is the most significant variable from all the regression, the negative coefficient indicates that being classified as an Action video game leads to a decrease in sales. An explanation for this result can be the over the categorization of the sixty titles as Action video games: forty-nine out of the sixty can be easily considered action games just because of the nature and premise of the game. Even though all the games chosen for this study had good sales numbers, some exceeded the others by significant margins. Those that didn't have astronomical sales are being taken into account when estimating the impact of Action games, hence a drastic reduction in their estimated positive effects.

The FPS genre performed significantly better than the other genres, but it was the only one that didn't reach any statistical significance. First-person shooters are also

Actions games, and coincidentally they are also the highest-selling games from the forty-nine Action categorized games. With fewer underperforming titles, the FPS genre is estimated to be a positive characteristic for sales but not enough to have any significance whatsoever. Based on these results, it can be argued that Action as a genre overreaches too much, making it difficult to assess its impact; when almost every game can be considered an action game, its impact as a genre is undermined. The results given by the Sports genre are even more challenging to comprehend when it's estimating that there is a negative impact on Sales for sports games even though the two titles with the highest sales figures are sports games, the FIFA franchise. Lack of enough sports titles could be a possible explanation since there are only ten out of the sixty; more data, in general, would help clarify the results of this regression analysis.

The Survival analysis models give a different outlook on what the regression analysis demonstrates; a look at the life tables of survival data indicates that between two groups of videogame titles, one without microtransaction implementation and the other with the implementation, those with microtransactions have a slightly higher survival ratio. The survival ratios follow different paths from the fourth week and onwards until the last few weeks of the study, where they once again reach similar values.

Table 3

Life Table of survival data on Microtransactions (n=60)

Week Intervals	Beginning Total	Event Observed	Censored Subject	Survival Ratio	Standard Error	[95% Confidence Interval]	
Micro = 0							
3 – 4	30	11	0	0.6333	0.0880	0.4365	0.7775
7 – 9	19	1	0	0.6000	0.0894	0.4045	0.7495
8 – 9	18	2	0	0.5333	0.0911	0.3428	0.6914

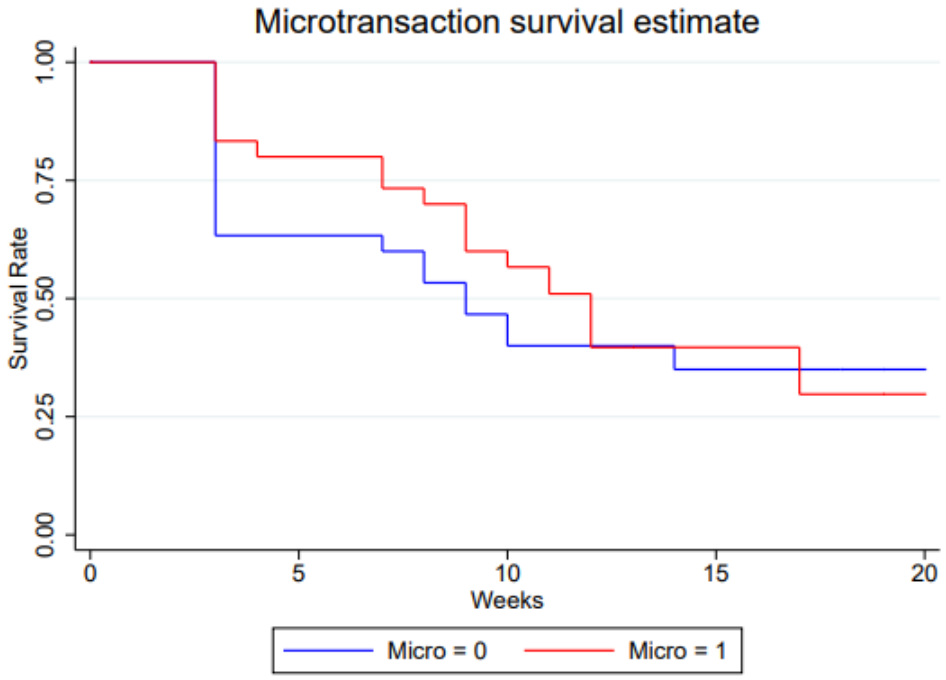
9 – 10	16	2	0	0.4667	0.0911	0.2839	0.6304
10 – 11	14	2	4	0.3889	0.0910	0.2155	0.5593
14 – 15	8	1	0	0.3403	0.0917	0.1721	0.5166
17 – 18	7	0	2	0.3403	0.0917	0.1721	0.5166
18 – 19	5	0	1	0.3403	0.0917	0.1721	0.5166
19 – 20	4	0	1	0.3403	0.0917	0.1721	0.5166
20 – 21	3	0	3	0.3403	0.0917	0.1721	0.5166
Micro = 1							
3 – 4	30	5	0	0.8333	0.0680	0.6450	0.9270
4 – 5	25	1	0	0.8000	0.0730	0.6080	0.9048
7 – 8	24	2	0	0.7333	0.0807	0.5369	0.8567
8 – 9	22	1	0	0.7000	0.0837	0.5026	0.8312
9 – 10	21	3	0	0.6000	0.0894	0.4045	0.7495
10 – 11	18	1	7	0.5586	0.0924	0.3621	0.7162
11 – 12	10	1	0	0.5028	0.0986	0.3005	0.6749
12 – 13	9	2	1	0.3845	0.1050	0.1875	0.5793
17 – 18	6	1	0	0.3204	0.1053	0.1348	0.5239
19 – 20	5	0	1	0.3204	0.1053	0.1348	0.5239
20 – 21	4	0	4	0.3204	0.1053	0.1348	0.5239

Through the first three weeks of sales, all sixty videogame titles did not experience the event of a decrease in 50% of sales from one week to the next. In the fourth week, interval 3-4, we see the first decline in the survival ratio in both groups. The microtransaction group (Micro=1) only had five titles experience a decrease in sales. In comparison, the group with no microtransactions (Micro=0) had eleven titles decline in sales, a little more than double the number of events observed compared to the other group. This leads to a lower survival ratio for video games without microtransactions (0.6333) than those with microtransactions (0.8333). As previously stated, survival ratios in this study measure the probability of surviving until the following week. This gap of twenty percent is maintained through the first half of the study until week thirteen, where both survival ratios have a survival ratio of 0.39. At the end of the study, the Micro=0 group has a survival ratio of 0.3403 while the Micro=1 group has one of 0.3204; at the end of the twenty-week period, videogames with or without microtransactions have

almost the same survival ratio. The Kaplan Meir survival curve on the following page graphs these results.

Graph 1

Kaplan Meir survival curves on microtransactions & no-microtransaction (n=60)



In the KM survival curve, the survival ratio is measured in the Y-axis while the time passed is on the X-axis. At the beginning of the study, both curves are the same. In the fourth week, we can see the gap between the survival ratios formed when the eleven titles with no microtransactions experience the event against the five with microtransactions. Both have a decrease in survivability, but the x=0 group has a steeper drop, over double compared to the other group. This is the twenty percent gap previously mentioned, graphed. The curves also demonstrate when the survival ratios once again have the same values in the thirteen weeks of the study. In the end, both groups have very

similar proportions, but to determine for certain if there is a significant difference between the survivability of the two groups, a log-rank test is required.

Table 4

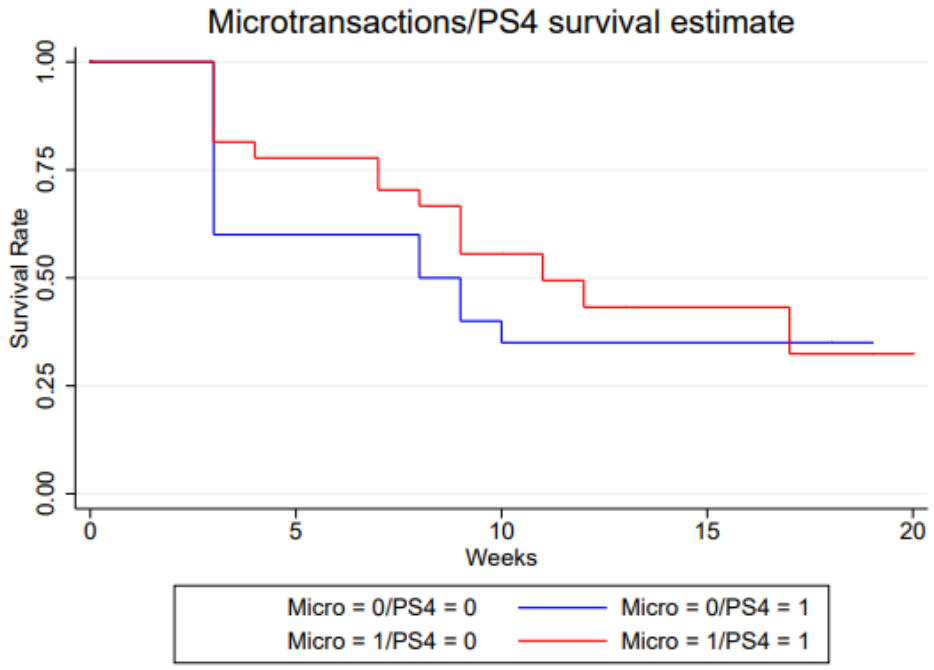
Log-rank test of equality of survivor functions (n=60)

Micro	Events Observed	Events Expected
0	19	17.27
1	17	18.73
Total	36	36.00
		Chi2(1) = 0.39
		Pr>chi2 = 0.5301

The null hypothesis of this test is that there is no difference between the survival rates of both groups, and with a p-value of 0.5301, this null hypothesis cannot be rejected. Both models, the regression and KM models, estimate there is no effect in videogame demand given the presence of implemented microtransactions. The following KM curves show the exact same results, controlling for the four other categorical variables chosen to a more considerable or lesser degree. The first one is the categorical variables dealing with platform availability; PS4 and XBONE.

Graph 2

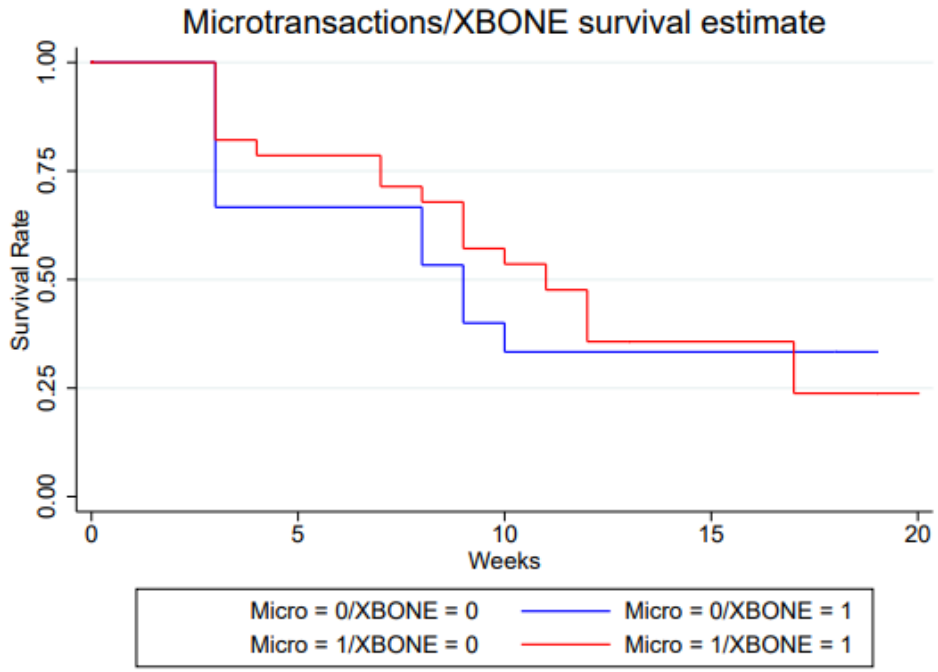
Kaplan Meir survival curves on microtransactions & no-microtransaction, controlling for PS4



The KM survival curve controlling for the PS4 categorical variable follows the same path that the previous KM curve had, but with fewer observations of the event occurring. This can be seen in the longer horizontal segments of the curves; fewer steps in the staircase graph signify fewer observed events and a more stable survival ratio during these intervals. At the end of the study, however, they end up with similar survival ratios again. Similar results are obtained from the KM curves controlling for XBONE.

Graph 3

Kaplan Meir survival curves on microtransactions & no-microtransaction, controlling for XBONE

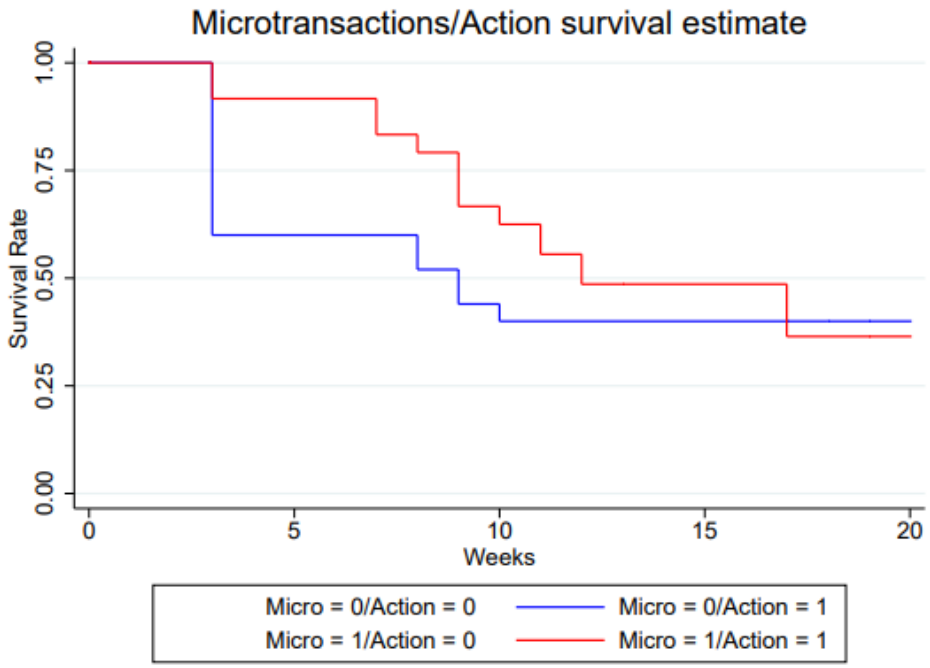


The only difference between this KM curve and the previous one is the longer vertical segments in both curves; more observations of the event of a fifty percent drop in sales are recorded when controlling for availability in the Xbox One than when controlling on PS4. It is widely known that the Xbox One has a much smaller player base than the PS4 as direct competitors; the sales figures drop faster on Xbox One because of the difference between consumers, there are fewer people buying games on Xbox than on PS4 by a large margin. The following two KM curves deal with genre categorical variables, Action and FPS. The KM curves controlling for Action are nearly identical to the original KM curve of microtransactions. The only difference is that the gap created in the fourth week between both groups is even more significant. In the twentieth week, however, games

with microtransactions once again end with a lower survival ratio than those without microtransactions.

Graph 4

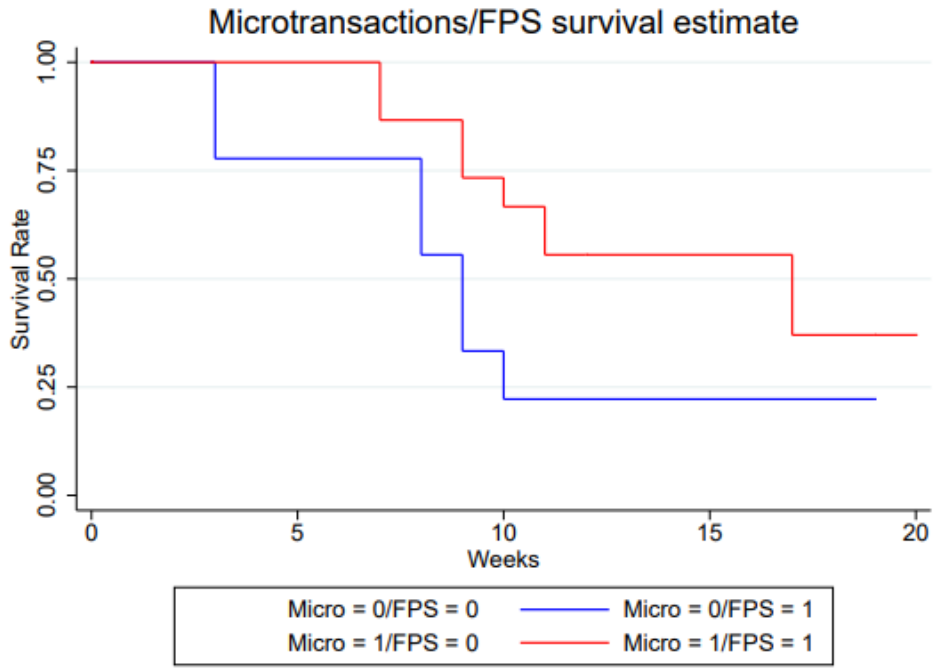
Kaplan Meier survival curves on microtransactions & no-microtransaction, controlling for Action



The one outlier of this consistent result is the KM curves controlling for the FPS genre. This survival curve for the group that does not have microtransactions is the only one that doesn't achieve a higher survival ratio than the group with implemented microtransactions at the end of the study.

Graph 5

Kaplan Meier survival curves on microtransactions & no-microtransaction, controlling for FPS



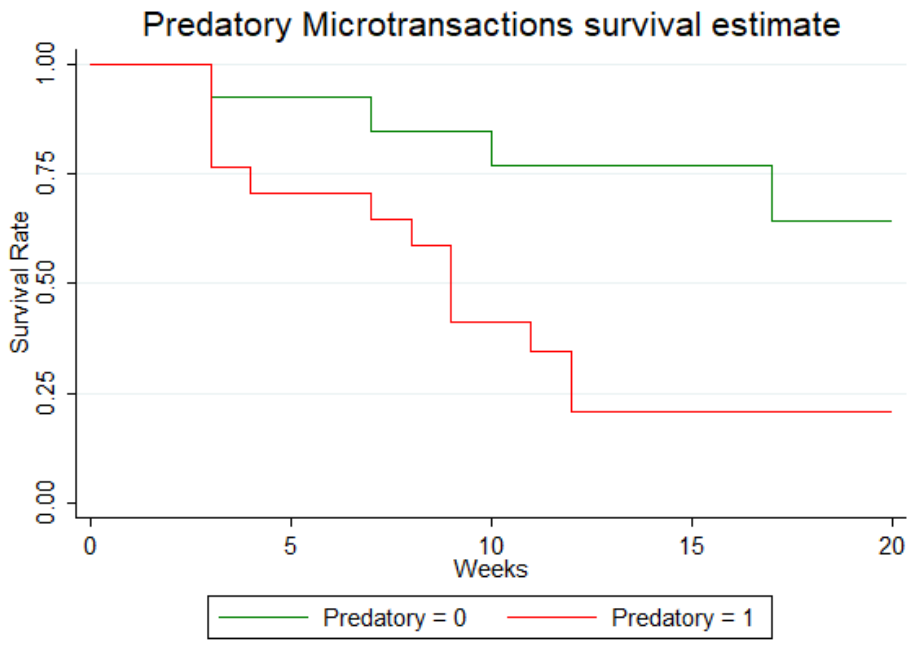
A possible answer for this behavior is that the FPS genre was the first to adopt the microtransaction business model and quickly incorporate it into the best-selling titles the genre offers. When comparing two groups of FPS's, those that have and those that do not have the model implemented, the titles that sell millions of copies all fall in the category of Micro=1. Almost all the FPS titles that do not have microtransactions are single-player games that can be quickly beaten. In contrast, those that do have the implementation are multiplayer games with high rates of replayability. These KM curves demonstrate that having microtransactions does not negatively impact the demand for video games.

On the contrary, for most of them, the first twenty weeks of being available in the market, it would be slightly better to have microtransactions. But as we previously stated

in the literature review, microtransactions are a business model like any other; it is the way these models are implemented that truly matters. Usability and playability must not be affected by the business model to minimize potential sales losses. Taking this into account, the second set of Kaplan Meir curves that focus on the difference in survival ratio between videogame titles with predatory microtransactions and those with non-predatory microtransactions produce the following results.

Graph 6

Kaplan Meir survival curves, predatory & non-predatory microtransactions (n=30)



Out of the thirty test subjects, thirteen were categorized by non-predatory microtransaction (Predatory=0), while the other seventeen had predatory microtransactions implemented (Predatory=1). The results demonstrate that non-predatory microtransactions in video games lead to a much higher survival ratio during the whole observation period compared to their counterparts. The life table below shows

that the survival ratio for non-predatory titles does not drop below fifty percent. In contrast, the predatory microtransaction titles reach the lowest survival rate yet with nineteen percent (0.1906). There are three vertical sections on the KM curve of the predatory microtransaction where most of the events occurred. The first one is in the fourth week, the second one is in the tenth, and the last is in week thirteen. During the final week of the study, non-predatory videogames held a survival rate of sixty-one percent (0.6154).

Table 5

Life Table of survival data on predatory & non-predatory microtransactions (n=30)

Week Intervals	Beginning Total	Event Observed	Censored Subject	Survival Ratio	Standard Error	[95% Confidence Interval]	
Predatory = 0							
3 – 4	13	1	0	0. 9231	0.0739	0.5664	0.9888
7 – 8	12	1	0	0. 8462	0.1001	0.5122	0.9591
10 – 11	11	1	4	0. 7521	0.1256	0.4072	0.9137
17 – 18	6	1	1	0. 6154	0.1608	0.2480	0.8444
19 – 20	4	0	1	0.6154	0.1608	0.2480	0.8444
20 – 21	3	0	3	0.6154	0.1608	0.2480	0.8444
Predatory = 1							
3 – 4	17	4	0	0. 7647	0.1029	0.4883	0.9045
4 – 5	13	1	0	0. 7059	0.1105	0.4315	0.8656
7 – 8	12	1	0	0. 6471	0.1159	0.3771	0.8234
8 – 9	11	1	0	0. 5882	0.1194	0.3254	0.7782
9 – 10	10	3	0	0. 4118	0.1194	0.1858	0.6264
10 – 11	7	0	1	0. 4118	0.1194	0.1858	0.6264
11 – 12	6	1	0	0. 3431	0.1176	0.1348	0.5650
12 – 13	5	2	1	0.1906	0.1036	0.0428	0.4182
14 – 15	2	0	1	0.1906	0.1036	0.0428	0.4182
20 – 21	1	0	1	0.1906	0.1036	0.0428	0.4182

For this KM survival curve, the log-rank test below demonstrates that there is a significant difference between both groups in their survival ratio. The null hypothesis of no significant difference is rejected when the p-value is less than 0.05; in this case, the value is 0.0164. Therefore, the null is rejected, and the alternate hypothesis of significant difference between the groups is accepted.

Table 6

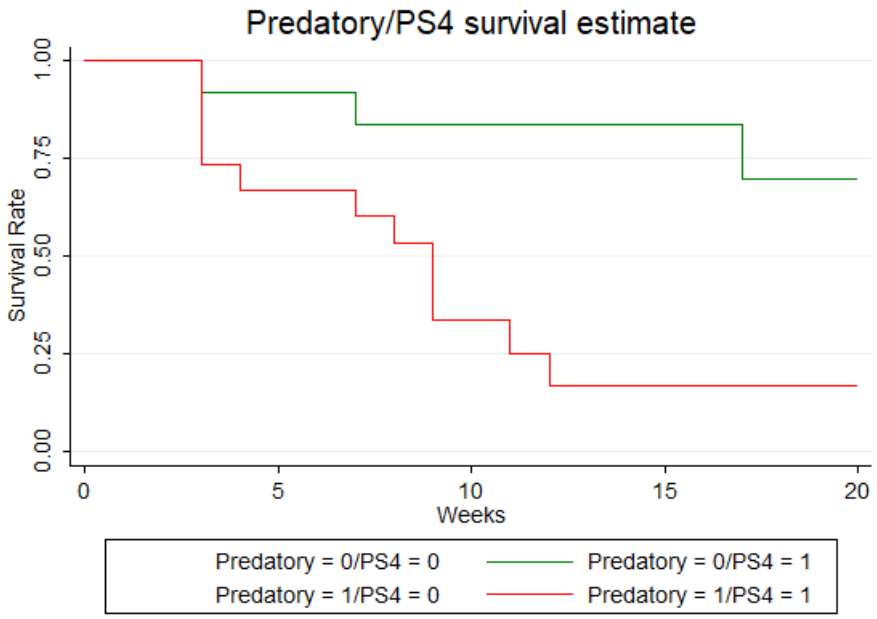
Log-rank test of equality of survivor functions (n=30)

Predatory	Events Observed	Events Expected
0	4	8.69
1	13	8.31
Total	17	17.00
		Chi2(1) = 5.76
		Pr>chi2 = 0.0164

When estimating KM survival curves controlling for other categorical variables using this sample of test subjects, the wide gap between the survival rates of the groups is maintained. Regarding the platform categorical variables, both have similar tendencies as the KM curve without controls. The only difference seen is that the survival curve for Xbox One decreases below fifty percent survivability. However, this survival curve still maintains a considerable gap between the other survival curves of predatory microtransactions. Both KM curves controlling for platforms suggest that no matter what platform the title is available in, it is better to have non-predatory microtransactions since it tends towards a higher survivability rate.

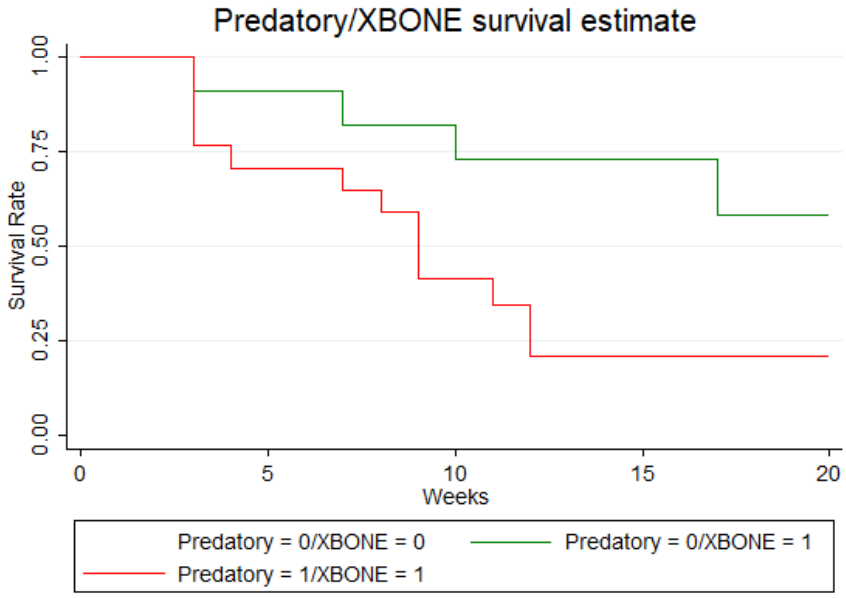
Graph 7

Kaplan Meir survival curves on predatory & non- predatory microtransactions, controlling for PS4



Graph 8

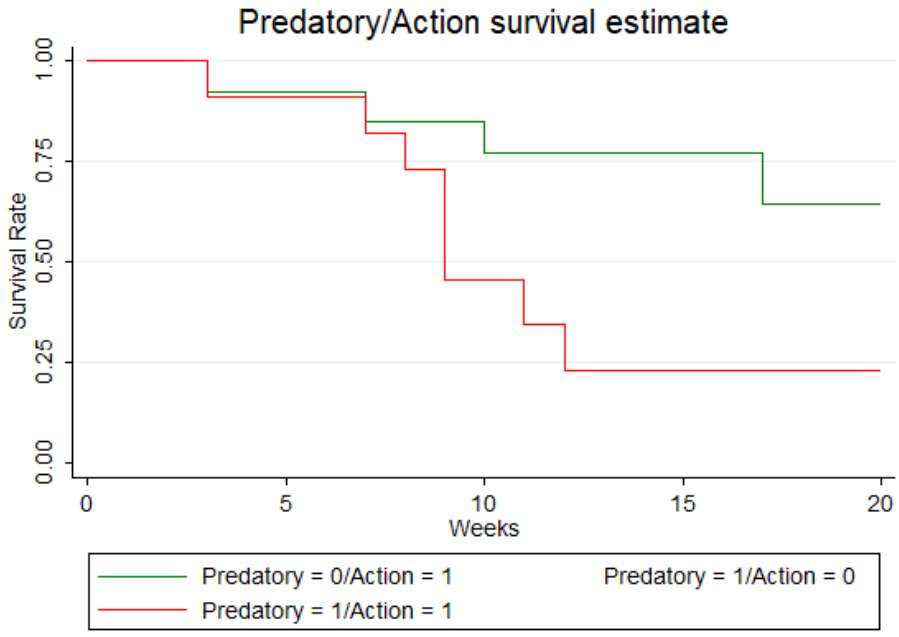
Kaplan Meir survival curves on predatory & non-predatory microtransactions, controlling for XBONE



The KM curves controlling for genres maintain the same trend, showing a survival rate constantly above the fifty percentile for the non-predatory group. The curves controlling for Action keep the survival ratios almost equal through the first six weeks of sales. On the seventh or eighth week, the ratios separate a little with moderate decreases in the survivability of the predatory videogames. By the end of the ninth week, another massive reduction in the survival ratio creates the usual gap between the survival rates. When the Action genre is concerned, both groups have similar survival rates at the start; however, those with non-predatory microtransactions experience a decrease in their sales figures to a much lesser degree.

Graph 9

Kaplan Meir survival curves on predatory & non-predatory microtransactions, controlling for Action

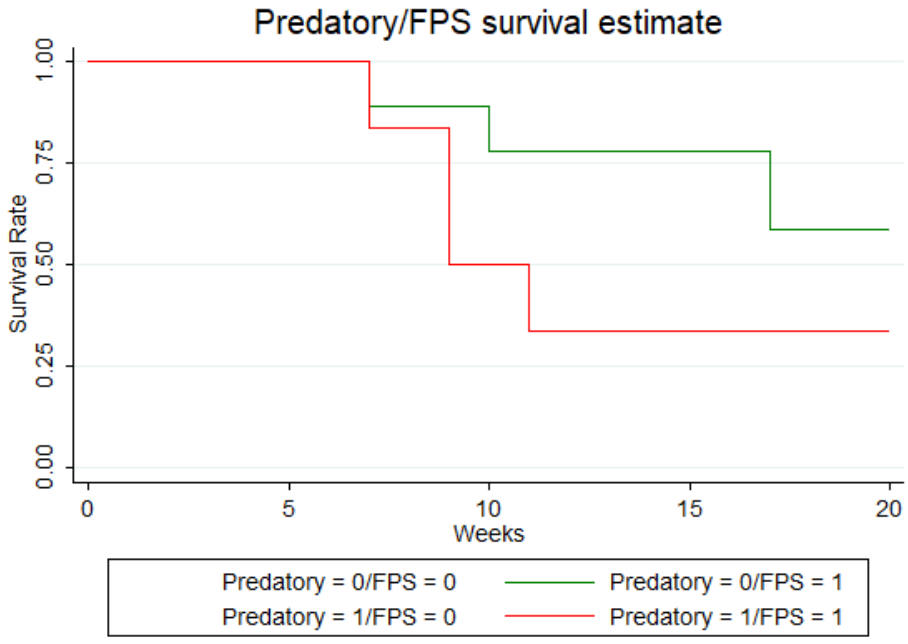


Recalling back to the analysis of the KM survival curve controlling for FPS, studying the groups of no microtransactions vs. microtransactions, it was mentioned that

FPS is a genre where the highest-selling titles all have microtransaction implementation. In the KM survival curve below, the analysis was made using these titles exclusively. When comparing non-predatory to those with predatory microtransactions, they act similarly to the KM curves controlling for Actions in the previous page. The high sales figures of these blockbuster titles make their survival ratios high during the opening weeks. The only difference between the FPS and the Action genre is that in FPS, the survival ratios close the gap between the two groups a bit more.

Graph 10

Kaplan Meir survival curves on predatory & non-predatory microtransactions, controlling for FPS



Now that the survival ratios of both "Non-implementation/Implementation" and "Predatory/Non-Predatory" studies are known, we move on to the final section of the survival analysis, the hazard ratio. Recall that the HZ is the probability of a subject experiencing the event, a drop in sales figures of fifty percent, given a particular

characteristic it possesses. For the study composed of all sixty videogame titles, that characteristic is the presence of microtransactions (Micro=1). For the study composed exclusively of the thirty titles with implemented microtransactions, it is the presence of predatory microtransactions (Predatory=1).

Table 7

Cox proportional hazards model for Microtransaction variable (n=60)

	No. Of Subjects = 60 No. of failures = 36 Time at risk = 590			Number Of Observations = 60		
				LR chi (1) = 0.41		
	Log likelihood = -133.65002			Prob > chi2 = 0.5204		
	Haz. Ratio	Std. Error	z	P > | z |	[95% Confidence Interval]	
Micro	.8066436	.269964	-0.64	0.521	.4186057	1.554384

The HR for implemented microtransactions has a value of 0.8066; if the HR is less than one, the x=1 group will have a lower hazard, the probability that the event happens, compared to the x=0 group. This would mean that having microtransactions would reduce the chances of experiencing a decrease in sales by twenty percent, and it also means they have a higher median survival time. However, the coefficients of the Micro variable are not statistically significant since the p-value is higher than 0.05. Therefore, having microtransactions implemented in a videogame is not statistically significant when determining the hazard of experiencing a drop in sales figures.

Table 8

Cox proportional hazards model for Predatory variable (n=30)

No. Of Subjects = 30 No. of failures = 17 Time at risk = 322 Log likelihood = -133.65002				Number Of Observations = 30 LR chi (1) = 5.89 Prob > chi2 = 0.0152		
	Haz. Ratio	Std. Error	z	P > | z |	[95% Confidence Interval]	
Predatory	3.701381	2.179573	2.22	0.026	1.16716	11.73809

With a value of 3.7014, the HR for predatory microtransactions demonstrates that at a given point in time, the group of videogames with a presence of predatory microtransactions have an immediate risk of experiencing a reduction in sales figures of fifty percent from one week to the next that is four times as likely as the risk if they had non-predatory microtransactions. Suppose a videogame has predatory microtransactions (x=1). In that case, it is four times more likely that they will experience a loss in sales than games with non-predatory microtransactions only (x=0). The p-value is less than 0.05, meaning the coefficients are statistically significant and the confidence interval is above the value of one; the HR for predatory microtransactions suggests a negative impact on sales; it will always throw a value higher than one. The addition of other control variables in the Cox proportional hazards model maintains consistency with these results.

Table 9

Cox proportional hazards model for Predatory and other control variables (n=30)

No. Of Subjects = 30 No. of failures = 17 Time at risk = 322 Log likelihood = -133.65002				Number Of Observations = 30 LR chi (1) = 7.31 Prob > chi2 = 0.0627		
	Haz. Ratio	Std. Error	z	P > | z |	[95% Confidence Interval]	
Predatory	3.624273	2.196813	2.12	0.034	1.104776	11.8896
PS4	1.922315	1.549393	0.81	0.417	.3960522	9.330317
Action	.5335029	1.407877	0.73	0.468	.3761159	8.395958
FPS	.5748568	.3020169	-1.05	0.292	.2052851	1.609763

Predatory microtransactions still hold a high hazard ratio, and it's the only control variable with any statistical significance having a p-value below 0.05. The genre control variables and the console control variable did not contain any statistical significance on their part. The genre variables show a low hazard ratio, demonstrating less probability of diminishing demand in action and FPS video games; similar to Sacranie's results, but the lack of statistical significance makes this an assessment that cannot be made.

On a similar note, an additional linear regression was done. The predatory having microtransactions would be the focused study group; these titles would be compared to a group composed of non-predatory having microtransaction videogames and videogame titles with no microtransaction implementation. The regression results are shown below; even though there is no significance based on their p-values, the coefficients for predatory microtransactions and reviews are positive, the opposite compared to the simplified regression model shown at the beginning of this analysis. The high p-values given by the regression do not let us reject the null hypothesis; microtransactions,

predatory or not, have no significant impact on the sales numbers of video games. The two methods of analysis used have given opposing answers to the second specific question that is put forward in this study.

Table 10

Multiple Regression Analysis of statistically significant categorical variables for predatory microtransactions (n=60)

Source	SS	Df	MS	Number Of Observations = 60		
Model	2.4884e+14	6	4.147e+13	F (6, 53) = 2.17		
Residual	1.0150e + 15	53	1.915e+13	Prob >F = 0.0609		
Total	1.2639e+15	59	2.1421e+13	R-Squared = 0.1969		
				Adj R-Squared = 0.1060		
				Root MSE = 4.4e + 06		
Sales	Coefficient	Std. Error	t	P > | t |	[95% Confidence Interval]	
Review	67817.71	75632.99	0.90	0.372	-83341.31	218976.7
Predatory	1381361	1525248	0.91	0.369	-1677898	4440621
PS4	2736601	1621377	1.69	0.097	-515468.4	5988670
Action	-6174271	2201619	-2.80	0. 007	-1.06e + 07	-1758383
FPS	2511060	1282163	1.96	0.055	-60634.29	5082754
Sports	-5071890	2080659	-2.44	0.018	-9245163	-898617.4
_cons	1751883	7292065	0.24	0.811	-1.29e + 07	1.64e + 07

V. Conclusions

The multiple linear regression analysis, Kaplan Meir survival curves, and the Cox proportional hazards model results go against the general rhetoric that microtransactions affect the sales performance of the videogames that incorporate them. It can be safely concluded with the data previously shown that microtransaction implementation on its own has no significant impact on the demand for video games. In the linear regression, the categorical variable reflecting the presence of microtransactions did not demonstrate any statistical significance. In the KM curve, it was estimated that there is no significant difference between the survival rates of a group of titles that have no microtransactions and another with implemented microtransactions. Lastly, the Cox proportional model showed no statistical significance of the categorical variable Microtransaction in the hazard of experiencing a decrease in sales. Microtransactions on their own do not negatively impact videogame demand; there is no statistical difference between having or not having them. In some cases, it could benefit the product instead of hindering it. Even when controlling for other important categorical values, the same results are maintained.

If microtransaction implementation has no effect, the second set of duration analyses demonstrates that the way the implementation is done substantially affects sales performance. When comparing the survival rates of the non-predatory group against the predatory microtransactions group, the log-rank test estimates a significant difference between them. Videogames with non-predatory microtransactions have greater chances of not experiencing a drop in sales figures of fifty percent from one week to the next. On the flip side, the hazard ratio estimated for videogames with predatory microtransactions is almost four times the hazard rate for non-predatory. When creating a videogame, there

must be checks and balances when using the desired business model into the product to protect the usability and playability of the video. It's possible to do this with the freemium business model added to the classical model of paying upfront; the predatory/non-predatory KM survival curves demonstrate this. These results are in accordance with the hypothesis postulated in the study; if the microtransaction affects already established mechanics and progression systems in a game, the demand for the products is negatively impacted.

The final linear regression made does not demonstrate the same results that the duration analysis has shown. Due to the high p-values, not even predatory microtransactions have any statistical significance in sales numbers, even though they had a positive coefficient. More data is needed to assess the determinants of video game demand since very few held any significance whatsoever, and the few that did harm said demand.

The prevalent use of predatory microtransactions is explained by the additional revenue publishers receive through them. Still, as the duration analysis shows, this comes with the cost of an overall loss in sales. If the consumer base does not buy the product, the implemented microtransactions will not generate any revenue from consumers who desist from the purchase. There are also non-monetary consequences to these predatory business practices; the reputation of the development team and the publisher are put on the line, risking the possibility of being blocklisted by sectors of the videogame community.

VI. Epilogue

The video game industry has evolved and continues to do so rapidly during the last five years. Technological advances in hardware have given video game developers more opportunities to experiment with game design. These advancements directly affect the integration of monetization systems that take advantage of newer video games. Microtransactions have been the most successful new monetization model to be successfully implemented. This study focused on how this business model affected sales if implemented while hindering the quality of the product at the same time, a practice received with negativity by the consumer base. Various publishers and developers have taken note of this and made adjustments to their products, minimizing the backlash in the new console generation that launched in 2020. This industry's new reality has demonstrated that it has outgrown some of the problems studied in this paper; the following pages explore how it happened.

During 2017 and 2018, when most of the videogame titles used for this study were put on the market, the implementation of microtransactions was in its initial phase. For years, developers working in the industry had no previous knowledge of the new business model being pushed by the publishing companies. This push from the corporate bosses stemmed from high revenue figures being reached in the mobile market. Mobile games, however, are very different from console games. Implementing a business model on an already established formula like a console game would not be possible without a few issues.

The first and most glaring issue with the implementation seen previously was the use of two revenue streams in video games; the price of the video game plus the added microtransaction marketplace. Thanks to the launch of new video game consoles, popular video games from well-established franchises have started to go in the free-to-play route. Microsoft, Ubisoft, Electronic Arts, and others have used the success of Epic Games with Fortnite as a blueprint for their own titles. Games with a sixty dollar-cost have been broken up into different components that players can choose from. Video games with a multiplayer offering will be free-to-play with a microtransaction marketplace. At the same time, if there is a single-player campaign that was previously part of the sixty-dollar cost, it will be offered at a much lower price. What was once a single product is now divided into two, sometimes three services.

This evolution of the video game, from a one-time purchased product to "live services", has been happening for the last five years. The microtransaction implementation that was the focal point of this study finds itself in the middle of this change, a period of trial and error. The dissolution of the product into smaller videogame experiences is convenient because it lets publishers utilize different revenue models while at the same time giving developers the necessary leeway to create fun and engaging games. Previously, developers had to integrate marketplace systems that held the risk of damaging usability and playability. This risk is now minimized considerably by using different business models for the different parts of the game; that way different development teams can integrate the model that best suits the gameplay experience they are each creating.

As a consequence of these business decisions, the barrier to entry of many games is also reduced. Video games are a notoriously expensive hobby; many people cannot afford to

purchase sixty-dollar games frequently. Premium free-to-play titles make blockbuster franchises much more accessible to the ever-growing consumer base of gamers. Developers have also learned what works and doesn't when creating game economies in their video games. For example, microtransactions that give unfair gameplay advantages are no longer being implemented in high-budget titles. There is also pressure from ongoing lawsuits against video game companies for questionable business practices regarding microtransactions that target vulnerable consumers. These lawsuits started to appear in Europe and are now being seen in the United States (Ramirez v. Electronic Arts, Inc., 2020). As companies begin to be held accountable for unethical business practices, a safer and more welcoming environment is more likely to emerge in the virtual spaces they provide.

The revenue made by microtransactions has also led to courtroom confrontations between the biggest companies in the industry; Epic Games has purposely entered litigation against Apple Inc. in an attempt to undermine their app store policy. The policy takes 30% of the total revenue made by third-party apps, including income from microtransaction purchases made in video games played on iPhone devices (Higgins, 2021). Even though the case was dismissed in all accounts but one, this clash between big names in the industry demonstrates how important microtransactions have become for the long-term plans of video game companies.

These rapid and constant changes to the video game industry's status quo make it a compelling field of study. Virtual economies are starting to be integrated into all types of online services. Due to their nature, video games are spearheading the adoption of this new branch of economic thinking and have incorporated it into the design of their

products. As games are being built from the ground up, game economy designers are working together with Art, Levels, and Progression System designers to help create the best possible product that is monetizable and at the same time respects the consumer base.

A vastly different type of economic analysis is performed when dealing with a virtual economy. The focus is primarily directed to the consumers' needs, creating an in-game economy tailored to them. Implementation of microtransactions must follow this analysis, always keeping the consumer's best interest in mind, offering them the best possible entertainment experience. Without the constraints of using physical materials, virtual goods have become the go-to alternative in maintaining a thriving online community. The maintenance of the consumer base is crucial if video games ever want to compete in the ever-growing attention economy.

With the release of new videogame platforms, marking the beginning of a new console generation, the videogame industry will continue to experience changes in its business strategies. The new consoles are designed with the digital market in mind, as are the videogames in development for them. All these changes affect how microtransactions will be implemented from now on. The effects a new console cycle brings on how microtransactions are used in video games will be visible once more titles hit the shelves for these new consoles. In the meantime, the silent discontinued use of predatory microtransactions is a good sign of a healthier video game industry in the future.

References

- Aleem, S., Capretz, L. F., & Ahmed, F. (2018). A consumer perspective on digital games: Factors for successful game development. *IEEE Consumer Electronics Magazine,* 56-61.
- Close, J., & Lloyd, J. (2021). Lifting the Lid on Loot-Boxes Chance-Based Purchases in Video Games and the Convergence of Gaming and Gambling.
- Evers, E. R., Van de Ven, N., & Weeda, D. (2015). The Hidden Cost of Microtransactions: Buying In-Game Advantages in Online Games Decreases a Player's Status. *International Journal of Internet Science*, *10*(1), 20-36.
- Fielt, E. (2013). Conceptualizing Business Models: Definitions, Frameworks, and Classifications. *Journal of Business Models, 1*(1), 85-115.
- Gomagias, N., Cabras, I., Fernandes, K. J., Li, F., Nucciareli, A., Cowling, P., . . . Kudenko, D. (2014). A Phylogenetic Classification of the Video-game Industry's Business Model Ecosystem. *IFIP Advances in Information and Communication Technology*.
- Green, W. H. (n.d.). *ECONOMETRIC ANALYSIS*(5th ed.). Upper Saddle River, NJ: Prentice-Hall.
- Guindon, E. (2014). The impact of tobacco prices on smoking onset in Vietnam: Duration analyses of retrospective data. *The European Journal of Health Economics,15*(1), 19-39.
- Gujarati, D. N. (2004). *Basic Econometrics*(4th ed.). McGraw-Hill.
- Haddon, L. (1999) The development of interactive games. In H. Mackay and T. O'Sullivan (eds) The Media Reader: Continuity and Transformation. London: Sage.
- Hamari, J., Alha, K., Jarvela, S., Kivikangas, J. M., Koivisto, J., & Paavilainen, J. (2017). Why do players buy in-game content? An empirical study on concrete purchase motivations. *Computers in Human Behavior, 68,* 538-546.
- Hamari, J., & Lehdonvirta, V. (2010). Game design as marketing: How game mechanics create demand for virtual goods. *Int. Journal of Business Science and Applied Management, 5*(1), 14-29.
- Hao-Chen Huang, (2016) "Freemium business model: construct development and measurement validation," Internet Research, Vol. 26 Issue: 3, pp.604-625
- Higgins, T. (2021, May 9). *'Fortnite' Maker Targets Apple's 'Walled Garden' in Courtroom Fight Over App Store*. The Wall Street Journal. https://www.wsj.com/articles/fortnite-maker-targets-apples-walled-garden-in-courtroom-fight-over-app-store-11620568659
- Higgins, T., & Kendall, B. (2021, May 2). *Epic vs. Apple Trial Features Battle Over How to Define Digital Markets*. The Wall Street Journal.

https://www.wsj.com/articles/epic-vs-apple-trial-features-battle-over-how-to-define-digital-markets-11619964001

- Johns, J. (2015). Video games production networks: Value capture, power relations, and embeddedness. *Journal of Economic Geography*, 1-30.
- King, D. L., & Delfabbro, P. H. (2018). *Society for the Study of Addiction*.
- Lehdonvirta, V., & Castronova, E. (2014). *Virtual Economies: Design and Analysis (Information Policy)* (Reprint ed.). The MIT Press.
- Marchand, A., & Hennig-Thurau, T. (2013). Value Creation in the Video Game Industry: Industry Economics, Consumer Benefits, and Research Opportunities. *Journal of Interactive Marketing, 27*(3), 141-157.
- Miles, T. J. (2005). Estimating the Effect of America's Most Wanted: A Duration Analysis of Wanted Fugitives. *The Journal of Law & Economics,48*(1), 281-306.
- Ramirez v. Electronic Arts, Inc., No. 5:2020cv05672 - Document 49 (N.D. Cal. 2021)
- Prax, P. (n.d.). Game Design and Business Model: An Analysis of Diablo 3. *Informatics and Media*.
- Sacranie, J. (2010). Consumer Perceptions & Video Game Sales: A Meeting of the Minds. *The Park Place Economist,18*(1), 48-53.
- Tassi, P. (2013, November 25). The Ten Commandments Of Microtransactions. Retrieved from https://www.forbes.com/sites/insertcoin/2013/11/25/the-ten-commandments-of-microtransactions/#6b1b50ea8cd3
- Tassi, P. (2018, July 26). 'Overwatch' Killed All Its Competition, But Now 'Fortnite' Has Changed The Battlefield. Retrieved from forbes.com/sites/insertcoin/2018/07/26/overwatch-killed-all-its-competition-but-now-fortnite-has-changed-the-battlefield/#d650b104f528
- Zhu, F., & Zhang, X. (2006). The Influence of Online Consumer Reviews on the Demand for Experience Goods: The Case of Video Games. *ICIS 2006 Proceedings*, 367-382.