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Freemium games, paid games, or mixed games. What is the most profitable strategy for game publishers?

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Abstract:

The video game industry is increasing rapidly every year. In 2017 video game industry earned around 120 billion dollars and by 2024 that number is expected to be around 282.30 billion of dollars. There are a few revenue models that dominate the market. There is the traditional model, which plan is to sell as much games as possible to the player, since that is the only way these games earn revenue. Second one is the mixed model. It is called like that since it also relies on revenue from selling the game, but it also includes in-game purchases, also known as microtransactions, and the game tries to differentiate the ways it earns revenue. And the last and the newest revenue model, the freemium model, is when the games are free and available to anyone, and the game relies on microtransactions to earn revenue. In recent years, this model has become popular among publishers especially in mobile gaming. In recent years it has made a transition also on PC gaming, with games such as Fortnite and PUBG. In this research I am going to show which model out of these three generates the most revenue. Also, some other factors, such as downloadable content, known as DLCs, and online reviews, will be tested to see their effect on revenue. The data is some of the biggest and well known 125 video games, their lifetime revenue, average revenue, and number of copies sold of the game. The results show that critics reviews have a positive and significant effect on revenue, while user reviews are insignificant, and it shows ambiguous results for the effect of microtransactions and DLCs, meaning the effect of mixed model on revenue is still not confirmed, while the effect of the freemium model is positive and significant on revenue, showing that this model is the best in generating revenue.

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1. Introduction

The video game industry is one of the fastest growing and highest grossing industries. It follows a fast-paced development in technology. The projected revenue for 2024 is 282.30 billion of dollars and it is expected to grow at an annual rate of 8.76% (Statista Search Department, 2024). For example, the film industry is worth at around 79 billion, while the music streaming industry is worth around 33.6 billion of dollars. Also, one of the most popular and well-known games, Grand Theft Auto V, holds the Guinness record as the fastest entertainment property to gross 1 billion dollars, and it did it in just three days. This just shows how huge this industry is.

The research about the video game industry is increasing rapidly in recent years. Souza and Freitas (2017) research the attributes of video games which influence players to play them. They did a survey with 600 video game players, and they found that constructs challenge, diversion, fun, fantasy, and social interaction have a positive impact on playing and paying for a game. There has been also a lot of research on learning benefits of games such as a paper from Chang et al. (2015) where they look at the effect of introducing a video game in mathematics class. The variety of the research on video games is vast. While the research is vast, it is still lacking in the economic research, with only a few papers dwelling into the profits and revenues of games.

In this paper I will look at more than 100 games to compare the different revenue generating models under which these games are released in. Similar work was done by Klimas (2017), where the researcher looked at and explained different revenue models which are present in video game industry. Compared to that paper where the author only looked to explain the models, here we will take a look at how these models differentiate in how much revenue they generate. That is why the question of this research paper is *"Freemium games, paid games, or mixed games. What is the most profitable strategy for game publishers?."*

There is not much research on the different revenue models. Klimas (2017) shows that by the time the paper was released there were only about 12 articles connected to this topic. Since then, the number of articles increased, however almost none of them look at the revenue of individual games to compare these models. This paper can be a starting point for future research on individual game revenue and how does different revenue model affect it. Also, the effect of microtransactions,

downloadable contents and online reviews will be examined. Microtransactions is big focus in lot of these research in recent years since the rise of mobile game industry, which is valued at almost 100 billion of US dollars in 2024,and release of Fortnite, which brings in huge revenues. Here we will observe if there is really an effect of these factors on game revenue.

Six different regressions will be done to see the effects of microtransactions, freemium model, downloadable content, and online reviews (critics and user reviews) on game lifetime revenue, average revenue the game generates per year, and number of copies of game sold.

The results showed that the games that are released under freemium business model generate more revenue than those that are not, while for microtransaction and downloadable content the results were ambiguous, where first they were positive and significant, and later just insignificant, meaning that the effects of these two factors could not be determined in this paper, with this sample. Critics review had positive effect, whilst user reviews had no effect on the revenue.

This paper is divided in several section. In the next section, the literature review, I will describe the research articles that helped in shaping the four hypotheses and mention these hypotheses. In the third section, I will talk about data collection, and I will describe the data and variables used in the regressions. In the fourth section, I will write about the results from these 6 regressions and how does each independent variable affect the dependent variables. And in the last and fifth section, discussion, and conclusion, I will talk about the meaning of these results and if the hypotheses were correct or not. I will also, in this section talk about the limitations this research faced and what could be done in the future research to improve this paper and gain better understanding of the results.

2. Literature review

Most of the past research focuses on microtransactions in the gaming industry. Evans (2016) looks at three mobile freemium games that with their gameplay try to influence impatient players to pay for in-game currency to progress the game faster and easier. Tomić (2018) looks at the impact of in-game purchases, microtransactions, on the video game industry business model where he discovers while unpopular among gamers these microtransactions lead to economies of scale and raise profits for publishers. Adji et al. (2019) studies the preference of consumers on

microtransactions from the way the play the game by separating them to different sectors depending on their behavior toward the game they play. This research aims to help developers make different profitable business models for their online games aimed at specific sectors

There is a lot of innovation in the process of making games as well as in the ways of making profit. Kimppa et al. (2016) mentions that business models of the companies operating in this industry have developed from traditional freeware, shareware, and pay-once methods to a variety of options, such as the freemium model used for game consoles, PCs, and mobiles. Toyama et al. (2019) want to describe the recent changes in gaming industry, especially the rise of microtransactions through economic and social views. They find that because of this change the strategies used by publishers, such as having games where focus is to maximize the players the use of microtransactions. This leads to not thinking of the game as a product, like in the past, but as a service, where a player needs to buy several parts of the game and spend money on microtransactions to get the full experience.

The traditional business model is to sell a product, in the form of a cartridge, a disk or digital download, or a license to play the product for a price (Zendle et al., 2020). This model was the most popular model used by developers in the 90s and early 2000s. It is still used today, although not as much as the other popular business model.

The freemium business model is when the product, its core services, are free, but it is possible to buy additional products and premium services to earn revenue (Kumar, 2014). For mobile phone games its gameplay tries to influence impatient players to pay for in-game currency to progress the game faster and easier (Evans,2016). These types of games are called pay to pass or pay to win which use game-external mechanics to make the play easier, faster, and more interesting (Kimppa, 2016). Neely (2021) differentiates three types of in-game purchases, fixed and random awards, these are loot boxes, cosmetics and those that help in gameplay. There also exists a business model which is the most hated among the gaming community and that is paid games with microtransactions, in this paper it will be called as a mixed model. The most obvious example of these are games such FIFA, now known as EAFC, NBA2K games, Star Wars Battlefront II, Call of Duty games and many more. These games have a 60$ price tag and a lot of expensive microtransactions, which can be either just cosmetics or can also be paid to win. Gamers are not

fond of this strategy, as when they pay a full price for a product, they do not except any other costs associated with that game.

With microtransactions the idea is to test firstly if the freemium and mixed model are superior compared to the traditional model, and then later to test if the freemium model is the one that is superior or is the mixed model the best one.

Hypothesis 1: The presence of microtransactions will increase the revenue a game generates.

Hypothesis 2: Freemium games generate more revenue than paid and mixed games.

Paid and mixed games get most of their sales within the 1st year. Because of that there is a need to release new games constantly, to keep the revenue flowing. There is an easier and cheaper way to keep the revenue flowing without releasing a new game, and that is to rejuvenate the sales of a previously released game. The most popular way to do that is to release new content for the game through downloadable content, so called DLCs. Lizardi (2012) explains DLCs as new gaming and additional content not found on an original game. Researcher explains that this method is getting players to pay for new services and thus extending the lifetime of a game. This leads to hypothesis:

Hypothesis 3: The DLCs are increasing the sales of paid and mixed games.

Cox and Kaimann (2015) look how both the professional critics score, and fan reviews effect sales performance of video games. The results show that good reviews from professional critics increase the sales of the game, while user reviews do not affect the sales. Zhu et al. (2006) examine how user reviews effect sales of video games. They find that these reviews have an influence on sales, especially the negative reviews. They also find that this is mostly concerned with less popular games and not so much with the biggest games. More modern research by Lin et al. (2018) where they look at the reviews of games on Steam and compare it with mobile game reviews. They discover that having a number of hours played before posting a review is effective and valuable characteristic. Also, both positive and negative reviews can be helpful to see what is good or wrong about the game, with negative reviews being more useful. Research by Zhou et al.(2022) shows the importance of online reviews for competition. They compare situation where there is only sales volume information available, the leader firm that first entered the market always has competitive advantage, and there is both sales volume information and online reviews available, the follower firm that joined the market later can be competitive.

Table 2.1: Critics and User score depending on if the game has Microtransaction

Variables	Mean score without	Mean score with
Critics score	87.02	83.83
User score	8	6.26

Note: Critics score is on a scale from 0 to 100, while User score is on scale from 0 to 10 and in decimal points; All score are rounded to two decimal points.

From the table 2.1 there is a clear difference in user ratings between games with and games without microtransactions, while for the critics score they are quite similar. Games without it have an average rating of 8, while games with it have average score of 6.26. That is a 1.74 score difference. This leads to the hypothesis:

Hypothesis 4: Online user reviews have a significant and positive effect on game revenues.

In the next section there will be a talk about the data, how it is measured, which variables and methodology will be used for this research.

3. Data and Methodology

3.1 Data collection

For this research I will be using revenues of the biggest freemium pc and mobile games and number of copies sold of some of the biggest paid and mixed games to determine what effect the different business models have on their profits. The data of the biggest freemium video games is found on Stata, while the data on the biggest paid and mixed games copies sold is found on VGChartz. The sample consists of 21 freemium games and 86 paid and mixed games. From VGChartz information on game franchises was gathered. Franchise means if a game is in a series of related games. This is included because being a part of a successful franchise can have a huge influence on sales of the game since these franchises have a loyal fanbase that will always buy new games from these franchises, no matter how bad the game is. From Metacritic data on critics scores and user scores of the paid and mixed games was collected. For the paid and mixed games, the data is on the number of copies sold, so to transform these numbers into profits, I used the average price of a video game either 50$ or 60$ depending on the game release date price.

3.2 Methodology

For the first three hypothesis the relationship between the revenue the games make and different types of microtransactions under which the game are operated and will be looked at with the robust linear regressions. The regression model which will be used is:

$$Revenue_i = \alpha_i + \beta_j M_i + \gamma_j O_i + \varepsilon_i$$

The M variable is representing different types of microtransactions and will differ for each hypothesis. For the first hypothesis the independent variable used will be the dummy variable Microtransaction, which shows if the game has microtransactions, in-game purchases, with 1 indicating it has, and 0 it does not. In the second hypothesis the M variable is a dummy variable freemium, which shows if the game is run on the freemium business model then the variable is equal to 1 or not, then it is equal to 0. And in the third regression the M variable is the DLCs, which present how many downloadable contents for the game have been released.

For all three hypotheses there is the dummy variable oldgame, for which if the game was published before 2017 it is equal to 1, and if it was released after 2017 then it is equal to 0.

For the first and third hypothesis there are three dependent variables for revenue, Average revenue, Lifetime revenue, and Copies sold, while for the second hypothesis only the first two dependent variables will be used. Average revenue displays the revenue per year earned by a game. Lifetime revenue is the total revenue earned by the game since it was published. And Copies sold is the total number of copies of the game sold since it was released.

And for the fourth hypothesis I will look at the relationship between revenue and user's score to see how these games are received by fans, and does it affect the sales or how much the game earns. The robust linear regressions, will also be used in this hypothesis

$$Revenue_i = \alpha_i + \beta_j US_i + \beta_j CS_i + \varepsilon_i$$

With the revenue representing the same dependent variables as in the first three hypotheses. US variable is the user score from Metacritic, and CS variable is the critics score from Metacritic.

In all four hypotheses α_i is the game fixed revenues and ε_i is the error term.

3.3 Data description

Table 3.1: Descriptive statistics

Variables	Observations	Mean	Median	Std. dev.	Min	Max
Copies sold	99	21.677	13.4	35.594	3	300
Critics_score	99	85.505	86	7.01	68	98
User score	99	7.171	8	1.919	1.6	9.2
Publ year	125	2017	2017	4	2004	2023
Microtransactions	125	0.584	1	0.495	0	1
Lifetime revenue	125	2.376	0.8	4.276	0.148	26.4
Average revenue	125	0.381	0.195	0.516	0.15	3.771
Oldgame	125	0.424	0	0.497	0	1
Freemium	125	0.208	0	0.482	0	1
DLCs	74	1.284	1	1.438	0	9

Note: Table 1 represents the descriptive statistics of all the variables used for all hypotheses. Lifetime revenue and Average revenue are all given in Billions of U.S. dollars. Copies sold is given in Millions. Critics score is on scale from 0 to 100, while User score is on scale from 0 to 10 and in decimal points. Microtransactions, Oldgame and Freemium are dummy variables and can only be 1 or 0. DLCs is the number of downloadable contents released.

Table 3.1 contains descriptive statistics of all variables used is all hypotheses. The Table reports the mean, standard deviation, maximum and minimum of the variables in our sample. There is a total of 112 observations in the sample.

Lifetime revenue of the games is how much the game has earned since it was published. For paid and mixed games, finding their revenue was mostly done with the help of the number of copies of the game sold since that is what, in most cases, is the only statistics released about the game's economic performance. While for the freemium games the data about the game's revenue is easily found on Stata. This is one of the dependent variables which the regression will be run on. The mean value is 2.376 billion, median value is 0.8 and standard deviation is 4.276 billion of US dollars. The least lifetime revenue was generated by Pro Evolution Soccer 2018 at 0.148 billion of US dollars. And the highest lifetime revenue is generated by Fortnite at 26.4 billion of US dollars.

Average revenue per year present the game revenue, from the year it was published until 2024. The mean revenue per year is 0.381 billion, the median is 0.195 billion and standard deviation is

0.516 billion of US dollars. The minimum average revenue is 0.15 billion, while the maximum average revenue is 3.771 billion of US dollars. This is the second dependent variable of the regressions which will be run.

Out of 112 observations 86 of the sample are paid and mixed games, which is more than 80% of the total sample. For all of these paid and mixed games there is a number of copies sold of these games. Mean of the number of copies sold of these games is 21.677 million and the standard deviation is 35.594. The median number of copies sold is 13.4 million. The lowest selling game in this sample has 3 million sales, while the highest has 300 million sales. There are two high selling games that distort the mean and standard deviation of this variable, GTA V with 200 million sales and Minecraft with 300 million sales. This is the third and last dependent variable in this research.

The most important variable in the first hypothesis is the dummy variable Microtransactions which shows if the game has in-game purchases or not. If the value of the dummy variable is 1 that means that the game has some sort of microtransactions, and if it is 0 than it does not have. The mean is 0.584 and the median is 1 which means that there are more games with microtransactions than games without it in this sample.

The variable Publ year shows in what year the game was published. The mean publishing year of these games is 2016, the median year is 2017, and the standard deviation is 4 years. The oldest game in this database is World of Warcraft, which is published in 2004, and the newest games in this database are published in 2023. With this data the dummy variable oldgame is created. Oldgame variable indicates if the game is released before 2017 if equal to 1, or after 2017 then it is equal to 0. The mean for this variable is 0.424, meaning the games in this database are newer and more recently published. This dummy variable is used in the first three hypotheses.

Critics and User scores are collected from Metacritic and only for paid and mixed games. There is 99 observations for each variable. Critics score is on a scale from 0 to 100, and user score is on a scale from 0 to 10 in decimals. Mean critics score is 85.5 and user score is 7.17. Median critics score is similar to the mean score at 86, while user median score is a bit higher at 8. Standard deviation is 7 for the critics score and 1.919 for the user score. The minimum critics score is 68, while the highest critics score in this database is 98. For the users score the minimum score is 1.6, while the highest score is 9.2. This shows that users will show their dislike for the game or game mechanic and will be more critical than the critics.

The dummy variable Freemium is used to indicate whether the game is run on the freemium business model or not. The mean is 0.208, which means that every fifth game in the sample is a freemium game. This variable is used in the second hypothesis.

And the last variable used in the third hypothesis is the variable DLCs. This variable show how many downloadable contents the game has released. This is only considered for paid and mixed games. The mean of this variable is 1.284, the median is 1 and the standard deviation is 1.438. The minimum number of DLCs in this sample is 0, and the maximum number is 9.

In the next section there will be a look at the results of these regressions and how does each variable affect the revenue of games.

4. Results

In this section the results of regression analysis will be shown. In the first four regression tables with three or two regressions there is a one-to-one relationship for each of the four hypotheses. Then the last two table show how does these hypotheses hold up when having multiple variables together and testing them all at the same time. All regressions are represented using three decimals. Paragraph 4.1 presents the table 4.1 and one-to-one relationship of the first hypothesis by regressing variable microtransactions on three revenue based dependent variables. Paragraph 4.2 shows the table 4.2 and one-to-one relationship of the second hypothesis with the relationship between freemium variable and two revenue based dependent variables. Paragraph 4.3 points out the table 4.3 and one-to-one relationship of the third hypothesis with the regression between DLCs variable and three revenue based dependent variables. And in Paragraph 4.4 there is a table 4.4 and the test for fourth hypothesis which includes the regression between user reviews, critics review and three revenue based dependent variables. And in the Paragraph 4.5 and Paragraph 4.6 all four hypotheses are tested when all the variables used in previous regressions are put in the tables 4.5 and 4.6 in regressions between those variables and all three revenue based dependent variables.

4.1 Regression analysis first hypothesis

The table 4.1 represents three linear regressions with different dependent variables. The first regression is on the average revenue per year of a game since its release until now, second regression is on the lifetime revenue of a game, and the third one, only for paid and mixed games, is on the copies of games sold since its release. These three regressions will be used to evaluate the first hypothesis.

Independent variable Microtransaction is significant at 1% significance level ($p<0.01$) in the first two regressions, when looking at revenue of all games in the database, and is not significant when looking at copies of games sold for paid and mixed games. There is a positive and significant effect in the first two regressions, about the revenue of games, while positive, but insignificant in the third regression, about the number copies sold. If a game has microtransactions its revenue per year increases by 0.248 billion, and by 2.532 billion of US dollars in lifetime revenue. These two results support the hypothesis that microtransactions increase the revenue of the games, while the insignificance in the third regression shows there is no effect of microtransactions on the sales of the game.

The dummy variable oldgame, which shows if the game was published before 2017, has a negative effect and it is significant at 10% significance level ($p<0.1$) in the average revenue per year regression. If a game is an older game than the average revenue per year decreases by -0.149 billion of US dollars. In the second regression the dummy variable has a positive and significant effect on the lifetime revenue of the games. This variable is significant at 5% significance level ($p<0.05$). On average, if the game is published before 2017, the lifetime revenue of the game increases by 1.696 billion of US dollars. This makes sense since older games are longer in the market and can earn more in total revenue, and also because the game is longer on the market, the average revenue per year will fall, since for the paid and mixed games most of the sales comes within the first year and then it drastically slows down, meaning the longer they are on the market, more the average revenue falls. For the third regression on the copies of game sold, there is a positive effect, however it is insignificant ($p>0.1$).

Constant is significant in the first and in the third regression at 1% significance level ($p<0.01$), while it is insignificant in the second regression. In the first regression, when all the other variables

are 0 the average revenue per game is -0.299 billion of US dollars, which is impossible since revenue cannot be less than 0. While for the third regression, it is 0.642 billion of US dollars.

For the first and second regression the F-statistics is significant, while for the third regression it is insignificant. R-squared is low for the first and third regression, it is lower than 0.05, while for the second regression it is high at 0.132.

Table 4.1: OLS regression between the dependent variables Average revenue, Lifetime revenue and Copies sold, and independent variables Microtransactions and oldgame

Variables	Average revenue	Lifetime revenue	Copies sold
Microtransactions	0.248***	2.532***	0.326
	(0.082)	(0.613)	(0.272)
oldgame	-0.149*	1.696**	0.49
	(0.087)	(0.76)	(0.319)
constant	-0.299***	0.179	0.642***
	(0.054)	(0.312)	(0.132)
observations	125	125	99
R-squared	0.008	0.132	0.0478
F-statistic	5.04***	9.67***	1.32
	(0.008)	(0.000)	(0.271)

*Note: The standard errors are in brackets; microtransactions and oldgame variables are dummies; revenues are in billions of US dollars and copies of games sold is in millions. Significance is displayed as * p<0.10, **p<0.05, ***p<0.01.*

4.2 Regression analysis second hypothesis

In the table 4.2 regression results show the effect if the game is a freemium game or not. There are two regressions, one with the dependent variable Average revenue per year and the other with Lifetime revenue. Independent variables used are the dummy variables freemium, which represents if the game is operated on a freemium business model or not, and the dummy variable oldgame. The dependent variables are average revenue the games earn per year and the lifetime revenues of these games.

The first and second regressions indicate that the freemium dummy variable has a positive and significant effect on the Average revenue of games per year and Lifetime revenue of a game. Freemium variable is significant at 1% significance level ($p<0.01$) in both regressions. If a game

is run on a freemium business model than the average revenue per year increases by 0.786 billion of US dollars on average, while the lifetime revenue increases by 6.503 billion of US dollars on average.

The oldgame dummy variable is significant in both regressions at 1% significance level ($p<0.01$). In the first regression the dummy variable has a negative effect, while in the second regression it has a positive effect. If a game is an old game, than the average revenue the game earns per drops by -0.184 billion on average, while the lifetime revenue increases by 1.445 billion of US dollars.

The constant is significant and positive in both regressions. It is significant at 1% significance level ($p<0.01$) in the first regression, and at 10% significance level ($p<0.1$) in the second regression. If all variables are equal to 0, then the average revenue of a game is 0.295 billion, and lifetime revenue is 0.411 billion of US dollars.

The F-statistics is significant for both of these regressions at 1% significance level ($p<0.01$). The R-squared is high for both of these regressions at 0.3998 and 0.429, respectively.

Table 4.2: OLS regression between the dependent variables Average revenue and Lifetime revenue, and independent variables Freemium and oldgame

Variables	Average revenue	Lifetime revenue
Freemium	0.786***	6.503***
	(0.152)	(1.306)
oldgame	-0.184***	1.445***
	(0.072)	(0.76)
constant	0.295***	0.411*
	(0.054)	(0.312)
observations	125	125
R-squared	0.3998	0.429
F-statistic	14.38***	17.41***
	(0.000)	(0.000)

*Note: The standard errors are in brackets; freemium and oldgame variables are dummies; revenues are in billions of US dollars and copies of games sold is in millions. Significance is displayed as * p<0.10, **p<0.05, ***p<0.01.*

4.3 Regression analysis third hypothesis

For the third hypothesis two regressions were run, one on the dependent variable average revenue and one on the lifetime revenue. The independent variables used in these regressions are the DLCs variable, which represents if the game publishers released downloadable content for the game, and oldgame dummy variable. In the table 4.3 are the results of these regressions. The dependent variables are the same as in the last hypotheses.

DLCs variable is insignificant ($p>0.1$) in the first regression and significant at 1% significance level ($p<0.01$) in the second regression. In the second regression the variable has a positive effect on the dependent variable, lifetime revenue. For every DLC released game lifetime revenue increases by 0.647 billion of US dollars on average.

The dummy variable is the opposite, it is significant at 1% significance level ($p<0.01$) in the first regression and insignificant ($p>0.1$) in the second regression. It has a negative effect on the dependent variable, average revenue. If a game is an old game its average revenue per year decreases by 0.108 billion of US dollars on average.

The constant is positive and significant in both regressions. In the first regression it is significant at 1% significance level ($p<0.01$), while in the second regression it is significant at 10% significance level ($p<0.1$). If all variables are equal to 0, then the average revenue per year of a game is 0.191 billion, and the lifetime revenue is 0.328 billion of US dollars.

F-statistics is significant in the first and in the second regression at 1% significance level ($p<0.01$). R-squared is high in both regressions. In the first regression it is 0.134 and in the second regression it is 0.157.

Table 4.3: OLS regression between the dependent variables Average revenue and Lifetime revenue, and independent variables DLCs and oldgame

Variables	Average revenue	Lifetime revenue
DLCs	0.01	0.647***
	(0.02)	(0.213)
oldgame	-0.108***	0.278
	(0.036)	(0.509)
constant	0.191***	0.328*
	(0.026)	(0.188)
observations	74	74
R-squared	0.134	0.157
F-statistic	5.41***	4.71**
	(0.006)	(0.012)

*Note: The standard errors are in brackets; DLCs variable is in numbers of DLCs released and the oldgame variable is a dummy; revenues are in billions of US dollars and copies of games sold is in millions. Significance is displayed as * p<0.10, **p<0.05, ***p<0.01.*

4.4 Regression analysis fourth hypothesis

In the fourth hypothesis the effect of online reviews on game revenues and sales. There is a distinction between user reviews and critics reviews. User reviews are given by customers and fans who are not professional in giving criticisms, while the critics are. That is why the independent variables in these regressions are User score and Critics score. The dependent variables are Average revenue the game earn per year, their Lifetime revenue, and the of Copies sold of the game.

User score variable is only significant in the first regression, with the dependent variable Average revenue. It is significant at 10% significance level ($p<0.1$), and it has a negative effect on average revenue games per year. For every increase in score of 0.1 the average revenue decreases by 0.003 billion of US dollars.

Critics score variable is significant in the first two regressions, with dependent variables Average revenue and Lifetime revenue, respectively. In both regressions it is significant at 5% significance level ($p<0.05$), and has a positive effect on dependent variables. For every increase of critics score by 1, the average revenue increases by 0.013 billion, and Lifetime revenue increases by 0.07 billion of US dollars.

Constant is significant also in the first two regressions. In both cases it is significant at 10% significance level ($p<0.1$), and in both cases it is negative. If all variables would equal to 0, then the Average revenue would be -0.655 billion, and Lifetime revenue would be -4.265. This is impossible since revenue cannot go below zero.

F-statistics is significant in the first two regressions. In the first regression it is significant at 5% significance level ($p<0.05$), and in the second regression it is significant at 10% significance level ($p<0.1$). R-squared is less than 0.05 in the third regression, while in the first and second regression it is 0.086 and 0.082, respectively. All variables and the constant are insignificant in the third regression.

Table 4.4: OLS regression between the dependent variables Average revenue, Lifetime revenue and Copies sold, and independent variables User score and Critics score

Variables	Average revenue	Lifetime revenue	Copies sold
User score	-0.031*	-0.09	0.6
	(0.016)	(0.064)	(2.083)
Critics score	0.013**	0.07**	0.635
	(0.005)	(0.031)	(0.792)
constant	-0.655*	-4.265*	-35.316
	(0.368)	(2.301)	(57.122)
observations	86	86	86
R-squared	0.086	0.082	0.019
F-statistic	3.75**	2.48*	1.53
	(0.028)	(0.09)	(0.223)

*Note: The standard errors are in brackets; Critics score is on scale from 0 to 100, while User score is on scale from 0 to 10 and in decimal points; revenues are in billions of US dollars and copies of games sold is in millions. Significance is displayed as * p<0.10, **p<0.05, ***p<0.01.*

4.5 Regressions with all variables

These regressions look at how the independent dummy variables Microtransactions and Freemium have an effect on game revenues. The dependent variables are Lifetime revenue and Average revenue. These results will be compared to the one done in the first and second hypothesis, where there was only one to one comparison of these two variables.

The Microtransactions variable is insignificant in these regressions. This is quite a difference when comparing to the first hypothesis regressions where the variable had a positive significant effect on game lifetime revenue and average revenue.

The Freemium variable is significant at 1% significance level ($p<0.01$) in both regressions. It has also a positive effect on revenue in both regressions. If a game is a freemium game the average revenue per year will increase by 0.806 billion and the lifetime revenue will increase by 6.353 billion of US dollars on average. This aligns with the results from the second hypothesis. Freemium variable has absorbed the effect of Microtransactions variable on revenue. This also shows that microtransactions may not have a significant effect when comparing paid and mixed games. This will be tested in the next regressions.

The oldgame control variable is significant at 5% significance level ($p<0.05$) in both regressions. It has a negative effect on Average revenue and positive effect on Lifetime revenue. If a game is an oldgame its average revenue will decrease by -0.182 billion, while its lifetime revenue will increase by 1.435 billion of US dollars. This aligns with previous results for the oldgame variable.

The constant is significant only in the first regression, with the dependent variable Average revenue. It is significant at 1% significance level ($p<0.01$). If all the variables are the average revenue of the game would be 0.312 billion of US dollars.

The R-squared is high for both of these regressions, it is higher than 0.4 in both regressions. F-statistics is significant at 1% significance level ($p<0.01$) in both regressions.

Table 4.5: OLS regression between the dependent variables Average revenue and Lifetime revenue, and independent variables Microtransactions, Freemium and oldgame

Variables	Average revenue	Lifetime revenue
Microtransactions	-0.037	0.287
	(0.048)	(0.29)
Freemium	0.806***	6.353***
	(0.154)	(1.328)
oldgame	-0.182**	1.435**
	(0.072)	(0.616)
constant	0.312***	0.279
	(0.051)	(0.257)
observations	125	125
R-squared	0.401	0.43
F-statistic	9.23***	11.77**
	(0.000)	(0.000)

*Note: The standard errors are in brackets; freemium, microtransactions, freemium and oldgame variables are dummies; revenues are in billions of US dollars. Significance is displayed as * p<0.10, **p<0.05, ***p<0.01.*

4.6 Regressions with all variables for paid and mixed games

With these regressions there will be a look at the effects of Microtransaction, DLCs, User and Critics scores on the revenues and copies sold of paid and mixed games. The dependent variables are Average revenue, Lifetime revenue and Copies sold, in that order.

Critics score variable is significant in all three regressions. In the first regression it is significant at 5% significance level ($p<0.05$), while in the second and third regressions it is significant at 1% significance level ($p<0.01$). For every increase by one in critics score, the average revenue increases by 0.01 billion, lifetime revenue increases by 0.06 billion of US dollars, and the number of copies sold increases by 0.745 million.

Oldgame dummy variable is only significant in the first regression. It is significant at 1% significance level ($p<0.01$) and has a negative effect on average revenue. If a game is an oldgame its average revenue per year decreases by 0.202 billion of US dollars.

Constant in significant in the second and third regression at 5% significance level ($p<0.05$), while it is insignificant in the first regression. It is negative in both regressions. If all variables are equal to 0 then the lifetime revenue of a game is -4.035 billion of US dollars, and the number of copies sold is -42.059 million. This is not possible since revenue and the number of copies sold cannot be less than zero.

Both DLCs and Microtransactions variables are insignificant in all three regressions. This means that these business strategies are not viable solutions to increase the revenues of paid games.

Table 4.6: OLS regression between the dependent variables Average revenue, Lifetime revenue and Copies sold, and all independent variables for paid and mixed games

Variables	Average revenue	Lifetime revenue	Copies sold
Microtransactions	-0.042	0.212	2.047
	(0.041)	(0.227)	(3.555)
oldgame	-0.202***	-0.282	0.99
	(0.042)	(0.249)	(2.834)
DLCs	-0.004	0.381	0.899
	(0.02)	(0.251)	(0.939)
User score	-0.003	-0.092	-1.021
	(0.018)	(0.071)	(1.042)
Critics score	0.01**	0.06***	0.745***
	(0.004)	(0.021)	(0.242)
constant	-0.536	-4.035**	-42.059**
	(0.355)	(1.035)	(20.625)
observations	82	82	82
R-squared	0.255	0.344	0.168
F-statistic	6.10***	1.69	2.91**
	(0.001)	(0.148)	(0.019)

*Note: The standard errors are in brackets; microtransactions and oldgame variables are dummies; DLCs variable is in numbers of DLCs released for a game; Critics score is on scale from 0 to 100, while User score is on scale from 0 to 10 and in decimal points; revenues are in billions of US dollars and copies of games sold is in millions. Significance is displayed as * p<0.10, **p<0.05, ***p<0.01.*

5. Discussion and Conclusion

This research examines how different types of business models have an effect on how much revenue the games generate. The focus is mostly on the effect of microtransactions and releasement of additional downloadable contents on revenue. In three different ways the revenue is looked at: Lifetime revenue, Average revenue per year and the number of Copies sold of a game. There are a few papers that examine the effect of microtransactions and different business models on the video game industry (Davidovici-Nora, 2014; Evans, 2016; Zendle et al., 2020; Tomić, 2018). But there has been little research on the direct effects of microtransactions and freemium business model on the revenue earned from a single game. That is why this research on the effects of microtransactions and freemium models have on the video game revenue is a good new addition to the literature about video games which is still quite bare, especially when it comes to how much money they generate.

These results show that the freemium model is the best revenue generating model out of the mentioned three. While the mixed model was insignificant on revenue and number of copies sold of a game. Microtransactions and DLCs had ambigous results in this paper, first time it showed significant and positive effect on revenue in tables 4.1 and 4.3, respectively, however in tables 4.5 and 4.6 it showed insignificant effect. This could be because of several limitations affect this paper, such as there is no full revenues that the game earned from microtransactions, or the sample is too small.

Compared to the results found in the research by Tomić (2018), where the researcher got positive effects of microtransactions on games, results in this paper were more ambigous. However, results from Table 4.1 give some confirmation that some positive effect of microtransactions on revenue exists. Results for user and critics reviews effect on revenue are similar to results from Cox and Kaimann (2015), critics reviews had a positive and significant effect, while user reviews had no effect on sales and revenue. While the other regressions were done on the to compare results to previous paper, the effect of freemium games, at least mathematically, lacks in research. This paper started to look at freemium games separately from other games to see its real effect on game revenue.

There are several limitations affecting the results of this research. First limitation is that the full revenues of some games are missing, so there is only revenue from selling of game copies and little or no released revenue from microtransactions, and some revenues are a bit outdated since these numbers are not officially released on a monthly or yearly basis. This would help in finding the answer to the first and third hypothesis, about the effect of microtransactions and DLCs on game revenue, since the findings in this paper are ambiguous.

Second limitation is that the sample is not big enough. There are 125 video games, and 99 out these games are paid and mixed games, and 26 are freemium games. With a higher sample size there would be better and more accurate results.

And the third limitation is the endogeneity, that there are other factors affecting both the revenue and the variables used in these regressions, such as Freemium and Critics score which are not considered and controlled for. That is why the causality cannot be interpreted for these results.

Trying to find up to date full revenue numbers, with the revenue that a game earned from in-game purchases, and increasing the sample size should be the main goal for future research. Finding full revenue could be done by trying to contact the publishers directly and to see if they are willing to share the information. New variables could be introduced to get closer to the causal relationship. Some of these variables could be player related which the researchers can get from surveys.

This paper did not look at the effect of morality on earning game revenue. There has been a lot of controversy with freemium and mixed models and the way they earn profit. Kelly Li (2017) mentions how these freemium games use different exploitations of human psychology to earn profit. This can hurt gamers' autonomy, lead to an addictive behavior, and harm the ability to access problems. Dredge (2015) wrote in the Guardian that more freemium games are making mechanics that forces players to pay, instead of making them enjoy playing the game. These problems have raised an ethical question about how to earn profit in the gaming industry. In the paper by Heimo et al. (2016) authors examine how virtuous each business model in the gaming industry is. They look at business decisions in the gaming industry from an Aristotelian virtue ethics perspective. They argue that if individuals wish to follow Aristotelian virtue ethics, then the way they make revenue is essential. It is worth mentioning it as a good idea for future research as there are still big questions about the morality of this new business models dominating the video game industry.

This is hard to measure, but if it is possible to find a way to do it can be a great factor in seeing if the benefit of higher revenue outweighs the morality of how to earn it.

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