Gaming industry under Covid-19

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ECON 4901D Guided Study in Current Economic Problems II

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1. Background information and Motivations

Under the outbreak of coronavirus (COVID-19) in 2020, the world economy has been damaged a lot. The World Bank had forecasted a 5.2 percent contraction in global GDP in 2020[1] which is also predicted as the deepest recession in decades (see Figure 1). The unemployment rate increase was also experienced by countries all around the world (see Figure 2).

While many are grieving for the bad economy, one sector had experienced huge boost at the same time, which is the gaming industry. In the second quarter (April-June) in 2020, U.S. video game sale was at $11.6 billion, an increase of 30% when compared to the same time in 2019 and also experienced a 7% increase over Q1's record at $10.9 billion[2]. Steam (a popular PC gaming platform) recorded an all-time high concurrent user count at over 20 million people in March[3]. Even the hardware sales for PC gaming had recorded a 486% increase from March to April in the UK (see Figure 3).

This paper will discover how the pandemic benefited the gaming industry with more focus on the PC platform. Also compare with other platforms to discover how will the PC gaming transform after the global pandemic.

2. Questions and Hypothesis

With the use of various graphs, regression tables and economic modeling, this paper would examine on the following's hypotheses:

[1] https://www.worldbank.org/en/news/feature/2020/06/08/the-global-economic-outlook-during-the-covid-19-pandemic-a-changed-world#:~:text=The%20baseline%20forecast%20envisions%20a,fiscal%20and%20monetary%20policy%20support.
[2] https://www.nnbw.com/news/video-game-sales-esports-industry-surging-in-age-of-coronavirus/
[3] https://www.washingtonpost.com/video-games/2020/05/12/video-game-industry-coronavirus/

1. The pandemic reduces people opportunity cost to play computer games.
2. Government policies to deal with the pandemic play a significant role to the number of PC player.

After testing the above hypotheses, this paper will compare PC games with mobile games behavior under the pandemic and try to discover how can the PC platform be improved with the information and insight provided under the coronavirus.

3. Past Literature Review

In past literature, we can understand that gaming usually required experience and learning in previous games[4]. Also, gamers are concern about their PC performance because experienced gamers are willing to play more complex games which required larger downloads[5] and better hardware performance. Gaming is also a good option for social distancing since playing games need no fiscal contact with other people[6]. While gamers can still make social interaction with friends and family.

4. Methodology

(4.1) Description of the study:

This paper will first discover the significant level of how the coronavirus influenced PC gaming by focusing on the in-game users of famous PC platform – Steam, using multilinear regression.

[4] https://cyberpsychology.eu/article/view/4221/3263
[5] https://www.limelight.com/resources/white-paper/state-of-online-gaming-2019/
[6] https://news.cision.com/simon-kucher---partners/r/new-study--gamers-around-the-world-are-spending-more-time-and-money-on-video-games-during-the-covid-,c3166869

Next, we will compare PC games behavior with mobile games with the findings in the regression result. Later, we will discuss the future development of PC gaming using economic models.

(4.2) Data selection:

All time-series data or observations in this paper will be from 23 January to 17 September that is 239 days/observations in total. The start of the COVID-19 was ambiguous due to lack of information, but WHO stated that there was evidence of human-to-human transmission in Wuhan[7] in 22-23 January, so the data collected will start from 23 January. This paper will use the daily confirmed case record provided by WHO and the "Stay-At-Home Orders" across the state in U.S. from March to April to account for the corona side. The "Stay-Home-Order" by US federal will also be used in the study and it was recorded by the US government.

Steam is a famous PC gaming platform which launched in 2004 and have over 95 million active users in 2019[8]. PC games publishers will choose to launch their games on Steam and allow players from all around the world to buy them. Steam is extremely popular in the US and have over 30% users been Americans. Steam is globally famous and contain the greatest number of games across all PC gaming platforms. We will use the number of in-game users daily and new games publish daily in Steam. Since the new game published record is by week, so this paper will make correction to divide the number by 7 so that it will get the approximate daily new game publish count.

[7] https://www.who.int/news/item/27-04-2020-who-timeline---covid-19
[8] https://www.statista.com/statistics/733277/number-stream-dau-mau/#:~:text=Steam%27s%20owner%2C%20Valve%2C%20reported%20that,monthly%20active%20users%20in%202019.

(4.3) Regression Analysis:

Multiple linear regression model will be used in the analysis, as the data are all time-series, the equation is as follow:

$$SteamInGame_t = \beta_0 + \beta_1 NewCase_t + \beta_2 NewGamePublish_t + \beta_3 US\_lockdown_t + \beta_4 US\_case_t + u$$

Variables:	Descriptions:	Sources:
$SteamInGame_t$	Daily In-game Users on Steam platform	Steam Official Database
β_0	A Constant Intercept	N.A.
$NewCase_t$	Daily New Confirmed Case Worldwide	World Health Organization
$NewGamePublish_t$	Weekly New Games Publish on Steam (divided by 7 to get an approximate new game daily)	Steam Official Database
$US\_lockdown_t$	A Dummy Variable 1/0 to Indicate A Specific Time (t) is Under "Stay-Home-Order" Across US	US government
US_case_t	Daily New Confirmed Case Only in US	World Health Organization
u	Some unobserved effect in the regression	N.A.

In this paper, we only care about the significant level of the independent variables, there is no need to normalize the data, we will use the raw data for analyzing. The coefficients values are also not important in our study, but we care about rather it is positive of negative.

If our model is valid, we can expect the β of *NewCase* and *US_cas*e will be positive. meaning that when the confirmed case increase, the number of gamers will also increase as people observed the seriousness of COVID-19.

The release of digital version of games will also increase the number of player, but we can expect a smaller coefficient because people who interested in new games are mostly active gamers, the release can only attract a little amount of new ones.

Most importantly, we can predict the β of *US_lockdown* has the highest significant level among all other variables because this will decrease people opportunity costs for playing games.

5. Regression Analysis Result

(5.1) Correlation between the Variables:

After running a correlation table (see Figure 4) between all variables selected in the previous process, the regression will drop out the *NewCase* variable to avoid the multicollinearity problem due to it has high correlation with *US_case* at 0.87.

So, the regression equation now becomes:

$$SteamInGame_t = \beta_0 + \beta_1 NewGamePublish_t + \beta_2 US\_lockdown_t + \beta_3 US\_case_t + u$$

(5.2) Regression result:

As we can see from the result below, NewGamePublish as predicted, although the coefficient is relatively small, it will have positive relation with the number of gamers, and it is statistically significant at 99% level. Surprisingly, US_case is not statistically significant at 95%level, this may deal to the time delay for citizens to response and the geographic problem as US 3,143 counties. US_lockdown has the most impact on the number of gamers compare to other variables and it is statistically significant at 99% level. Where we can see that the "Stay-Home-Order" by the government provide incentive for citizens to play games and this will be explained in later part.

Variables:	Coefficients	Standard Error	t Stat	**P-value**
β_0	4.323e+06	3.73e+05	11.577	**0.000**

$NewGamePublish_t$	1308.7952	522.134	2.507	**0.013**
$US\_lockdown_t$	1.065e+06	8.1e+04	13.153	**0.000**
US_case_t	2.6682	2.194	1.216	**0.225**

(5.3) Analysis on regression results:

(5.3.1) *NewGamePublish*:

This variable performed as predicted. With or without the pandemic, publishing new game is expected to attract gamers return. For example, the game "Among Us" launch on Steam in September and its alone account for nearly 400,000 concurrent players[9]. While game launching is a seasonal data because more games will be out during summer holiday to boost the sale, in this study we cannot account for this change. So, there is no evidence to show that the number of gamers return for new games increase during pandemic compare to the time without COVID-19.

(5.3.2) *US_case*:

Originally, we predicted this variable will have significant effect on the number of gamers but turns out the p-value is greater than 0.05 at 0.225. To explain this result, it may be due to the time needed for citizens to response. US has 3,143 counties and county-equivalents in the 50 states, this will create huge response time even for governments. For this, the citizens may not be sensitive to the number of confirmed cases on the same day.

(5.3.3) *US_lockdown*:

[9] https://screenrant.com/among-us-pubg-concurrent-players/

This variable account for the most changes in the number of in-game users during April to May and statistically significant in our regression. Which also contributed to the peak in Steam record (see Figure 5). While the "Stay-Home-Order" required citizens to stay in-door and restricted on out-door activities, it reduces people's opportunity cost to play computer. From past literatures, we know that playing PC games usually required time and experience, while citizens do not need to go to work or go out, their opportunity cost for playing computer games decreased a lot, this explains why a sudden increase in the in-game users on Steam.

A research done by OpenVault recorded a huge increase in broadband usage by household (see Figure 6) with April's average household usage 26% more than in January[10]. Which this provided the evidence of increasing PC gamers on Steam during the lockdown period.

(5.3.4) ***A saturation point:***

Although in-game users increase a lot after the US government announced the "Stay-Home-Order", the number was kept decreasing when the order was still in effect. This shows that even with the decreased opportunity cost for citizens to play computer games, the number of gamers won't endlessly increase but rather hitting a saturation point (see Figure 5, the purple arrow).

Under this observation, we can assume that the increased number of gamers are mostly the one who lack of gaming time and willing to expose to PC gaming (in this study, the Steam platform). In other words, it is still difficult for PC game industry to attract those

[10] https://www.wsj.com/articles/coronavirus-lockdown-tested-internets-backbone-11597503600

non-gamers even with the decreased opportunity cost. The decreasing trend of in-game users after the saturation point may also cause by people lacking interest to PC games where their marginal utility turns zero after gaming for a while.

6. Compare with Mobile Games

In this section, we try to compare mobile and PC platform that we can understand the differences between them and foresee how the PC platform can improve.

Since the mobile platform (Apple's App Store & Google's Play Store) don't provide accurate statistics for the games, we will rely on reliable third parties.

Unlike PC, the mobile sector seems to keep on increasing in revenue and player count. The impact of the pandemic isn't that significant compare to Steam. As we can see from the report by SensorTower, the quarterly gams download in Google play and App Store kept increasing in Q1 and Q2(see Figure 7). Global spending on mobile games shows a consistent increase in 2020, from $17.5 billion in Q1 2020 to $19.3 billion in Q2 and $20.9 billion in Q3[11].

The growth and performance in mobile games is relatively stable under the outbreak of coronavirus. Here we will list out some difference in nature between PC and mobile games to account for the performance different under coronavirus:

a. Mobile games have much lower barrier to entry (Easier of gameplay)
b. Lower opportunity cost to play mobile games (play everywhere)
c. Percentage of people owning a smartphone/tablet >>> owning a personal computer

[11] https://londonlovesbusiness.com/global-consumer-spending-on-mobile-games-surges-by-27/

7. Future Development of PC Games

After comparison of mobile and PC, how can PC platform transform to break the saturation point with the information provided by the worldwide pandemic? In this section we will discuss how the new 5G network and cloud gaming benefited to the growth of PC game industry.

In recent years, cloud gaming (the logic behind cloud gaming see Figure 8) was developed and the latest 5G network technology makes cloud gaming even more possible for public as it provides more stable and faster network connection. The combine effect between these two technologies can lead to a new era in PC gaming and change the economics behind it.

In the demand side of PC games, 5G Cloud Gaming can lower the opportunity cost for playing. Since using cloud gaming no longer depends on one's personal computer performance and system, for consumers there will be no need to search or upgrade computer hardware, reducing the money cost to play computer games. We can also expect the price elasticity of demand for PC hardware to increase.

With lower barrier to entry, PC games now can expose to wider user base, not only to those have gaming PC but also to those with smartphone, tablet, and below average performance computer. The demand for PC games may increase and shift outward under 5G Cloud Gaming. To the supply side, with the 5G Cloud Gaming become popular, the supply for games may also increase in quantity and quality but may result in a monopoly.

Game developers must account for the PC performance of gamers to provide a game suitable for the market, which there will be extra cost to provide the game to meet all needs (such as 4K, 160fps, graphic details and storage sizes). With cloud gaming, all gamers will have the same performance "PC", the extra cost generated by system requirement will be gone. Game developers now can exceed the hardware limit and provide the game with standardize performance compatible with the cloud server provider. The competition between games may no

longer in graphic performance but in gameplay experience. As the result we have analysis, new games launching can always attract gamers return or entry, with providing newer gameplay experience, the consumer base may increase under 5G Cloud Gaming.

In the negative side, monopoly may easier to exist under 5G Cloud Gaming. Originally PC gamers can choose from different PC platforms as there will be no cost to create an account before playing the game. If one can provide cloud service with the lowest cost, they can create entry barrier in the industry. Consumers will choose the cloud platform with the lowest price when the server have small or no difference in performance. Non-price competitions may also create monopoly. If one can collusion with game developers and agree to launch the game exclusively on his own server, this will decrease the competitiveness of other cloud service providers. The difference between mobile and PC games (a, b and c in part 6) may disappear with the 5G Cloud Gaming become more popular in the future, the saturation point may also be improved with exposure to wider consumer base just like mobile sector

8. Conclusion and Suggestions for Further Study

The outbreak of coronavirus indeed flavored the PC platform indirectly with the government policy on restricting out-door activities and lead to a decrease in the opportunity cost to play computer games. Many gamers are just lack of gaming time, the “Stay-Home-Order” provided them the reason to get back on the chair.

From the regression analysis, we understand that the reduce in opportunity cost for playing PC game can attract gamers, but the increase are not long lasting. For PC games to perform like mobile sector under the pandemic, fundamental changes are needed to break the saturation point. Where the new technology as 5G Network and Cloud Gaming can be the next trend for PC game industry to have a huge breakthrough in the future.

To further the study, one can focus on the cloud service. It did not only affect the gaming industry but also many IT related industry such as hardware market, internet security and applications & systems developers. This will be aa very interesting topic to work on as this may open a new era for our internet activities and digital market economics. If cloud service become worldwide popular, how can the virtual production (E.g.: game exchangeable, in-game currency) fit to our economic model?

9. Evaluation & Limitation

The main limitation in this study is the missing data. We can only have concurrent users on Steam daily but not the data on new users on Steam, our explanation on attracting return users can have more evidence. The true data for mobile games are not provided by the companies (e.g., Google and Apple) so we must use third party estimation data to do our study. The best scenario is that we can have data for gaming users in both PC and mobile platform with the same game.

United State account for around 70% of Steam users, we used U.S. data for analyzing the gaming industry via Steam. While Steam recorded the users all around the world, our analyze may have forbidding variables such as the situation in China, which also account for a huge percentage of Steam users. Also, since many of China players used to connect VPN for playing games (China government has great restrictions on games) and we do not know where they connected to. So, the in-game users in U.S. may have a great percentage that they are Chinese people. These limitations may cause us the level of significant when we want to find out the relation between the pandemic and gaming habit.

Appendix

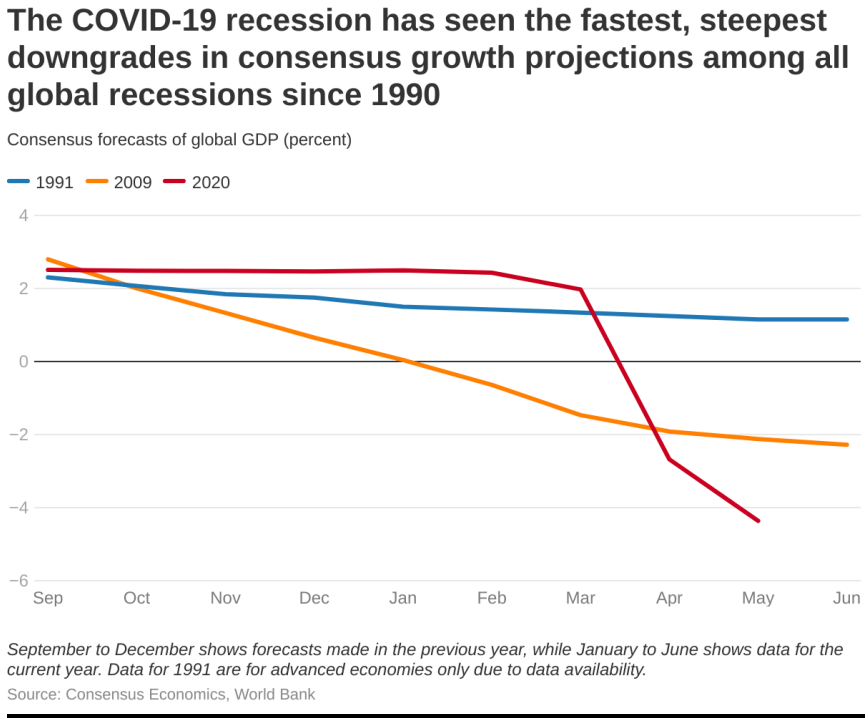

Figure 1: Global Recession in 2020 compare with 1991 and 2009

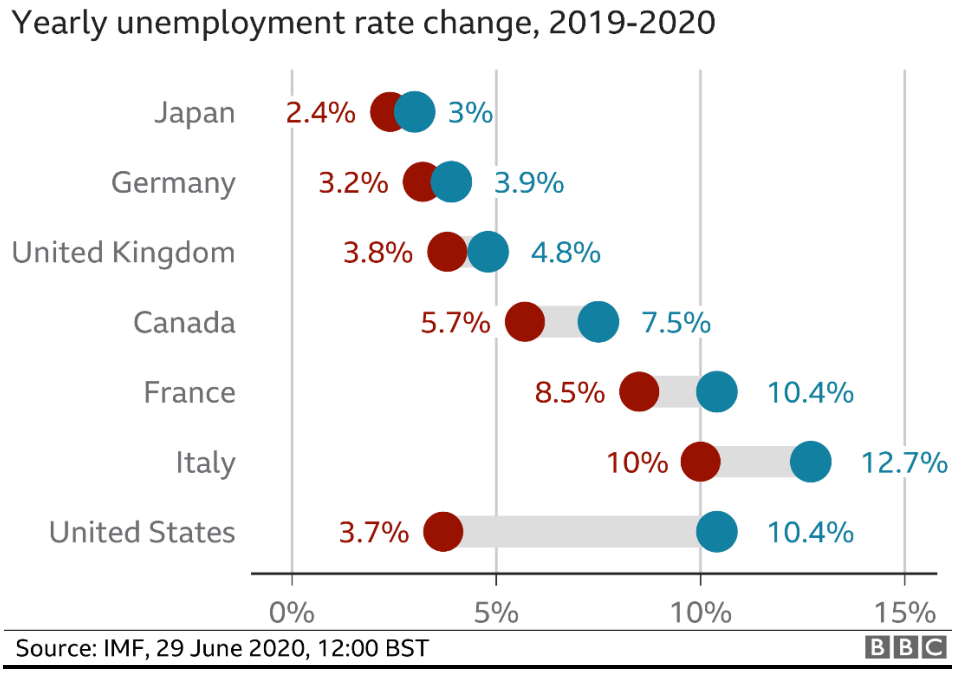

Figure 2: Unemployment Rate Change in 2019-2020

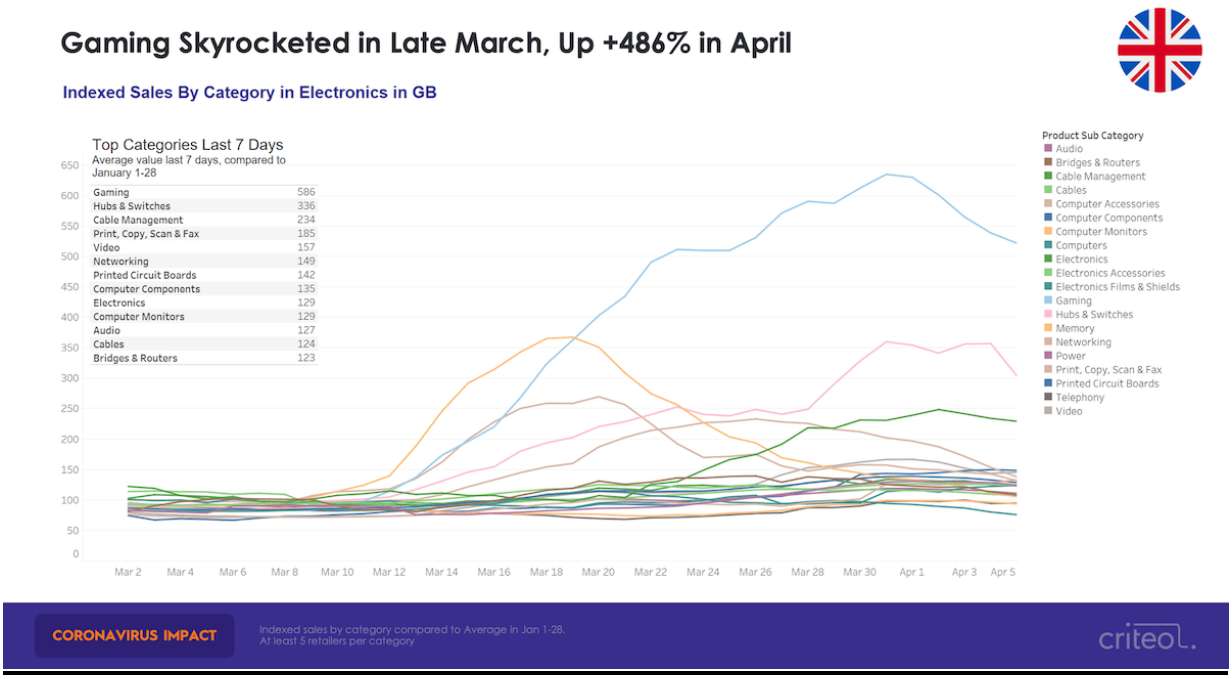

Figure 3: Gaming Hardware sales increase in UK

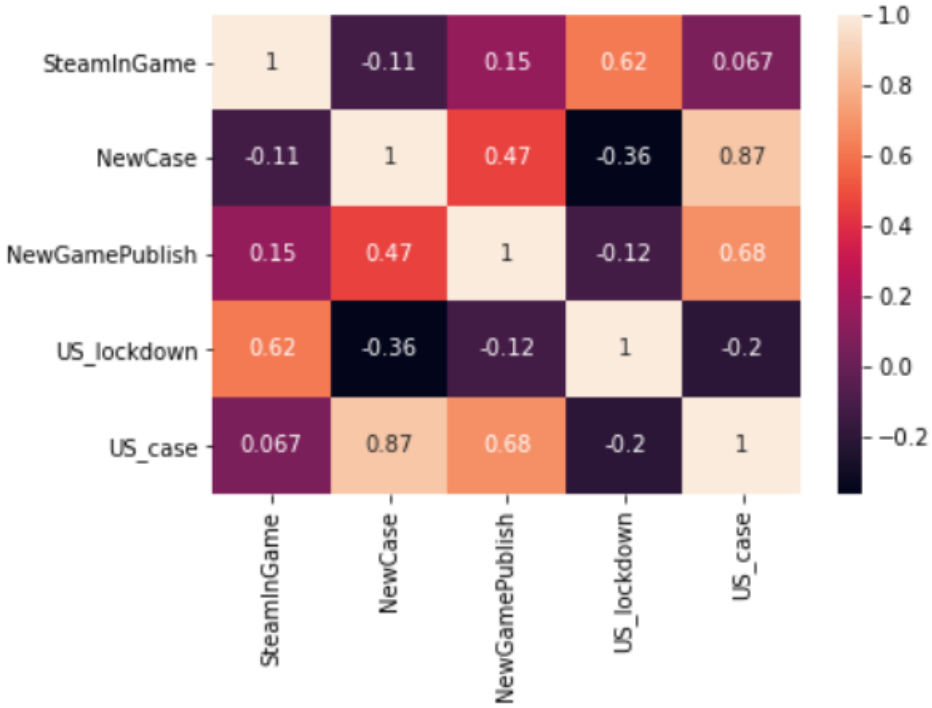

Figure 4: Correlation Table Between Variables

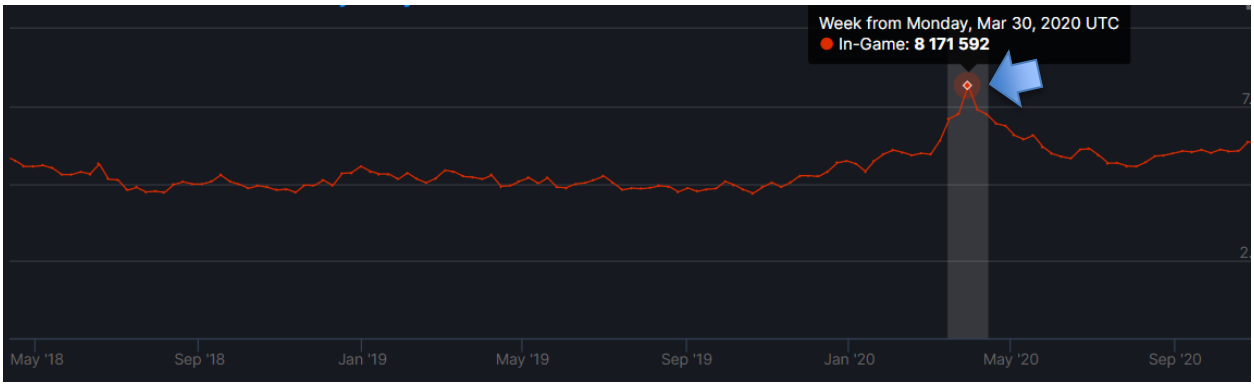

Figure 5: In-game users on Steam

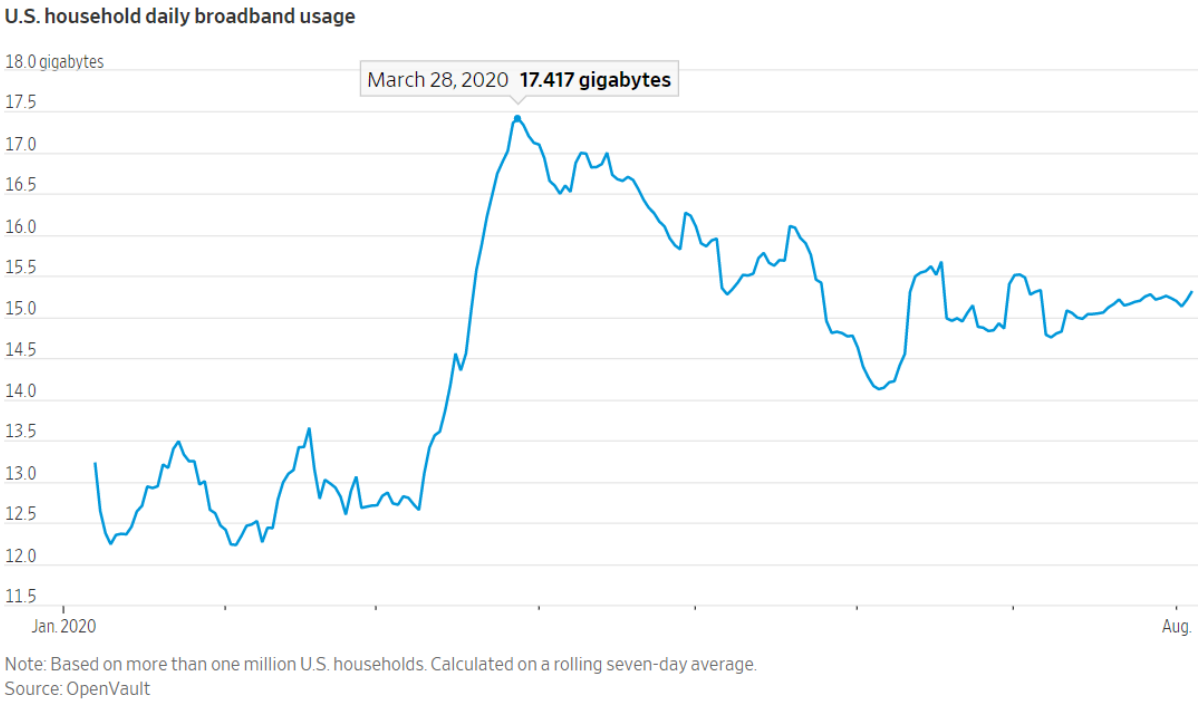

Figure 6: OpenVault record on US internet broadband usage

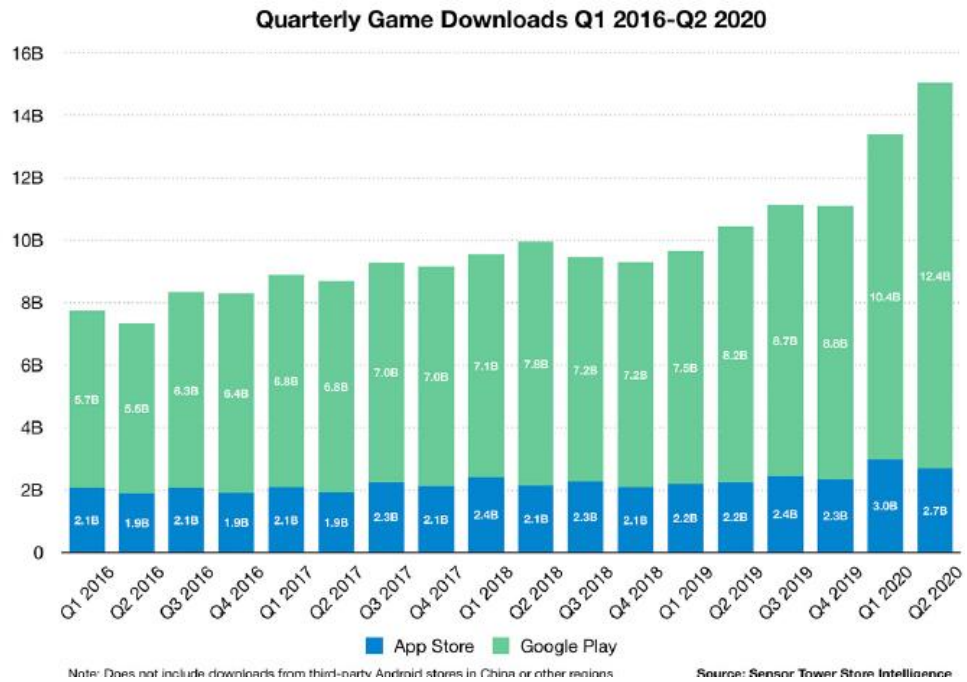

Figure 7: SensorTower record on global mobile game downloads

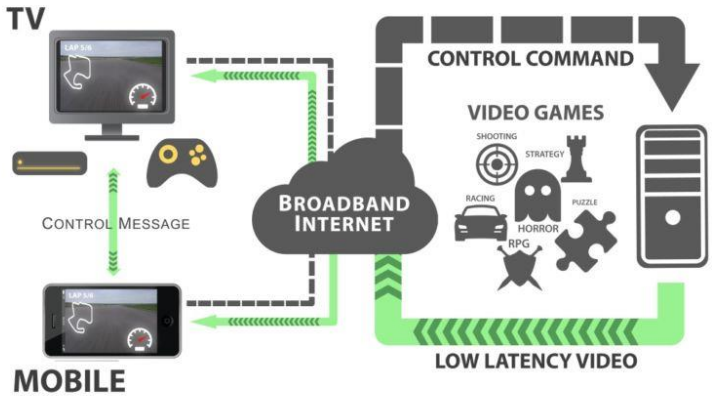

Figure 8: What is cloud gaming

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