Impact of COVID-19 on the Video Gaming Industry

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Introduction

- Covid-19 has widely affected the economy and society
- Quarantine and social distancing implemented
- Positive effect on the video game industry
- We examine player and stock trends before and during Pandemic in US

Data

Three data sources:

- Steam db for Steam players
- Yahoo Finance for stock prices
- CDC Covid-19 tracker for Covid-19 cases

We chose March 1st, 2020 as the beginning of the pandemic

- Collected daily data 18 months prior to and following March 1st
- Divided each data set into before and during Covid-19

Methodology

We perform a series of hypothesis tests on our sample data, primarily T-test:

- Population variance unknown
- Requires normally distributed sample means
- Central Limit Theorem accounts for normality

Also performed correlation and variance hypothesis tests:

- Used Shapiro-Wilk normality test
- Used Kendall correlation, Fligner-Killeen test, and F-test

Hypothesis Test 1

The number of Steam players has increased during the Pandemic

$$H_0 : \mu_0 = \mu_1$$
$$H_A : \mu_0 < \mu_1$$

$\bar{x}_1$	$\bar{x}_2$	t	df	α	p-value
15296300	22918550	-73.632	850.6	0.05	$< 2.2e\text{-}16$

Figure 1: T-test results for player data

Hypothesis Test 2

The number of daily concurrent Steam players has increased since the pandemic began.

$$H_0 : \mu_0 = \mu_1$$
$$H_A : \mu_0 < \mu_1$$

$\bar{x}_1$	$\bar{x}_2$	t	df	α	p-value
4459485	6022452	-43.676	1057.4	0.05	$< 2.2e\text{-}16$

Figure 2: T-test results for concurrent player data
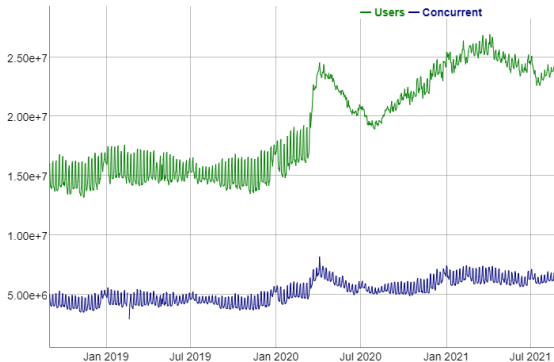
Steam Users

Figure 3: Steam users before and during pandemic

Hypothesis Test 3

There exists a correlation between change in daily Steam players and new daily Covid-19 cases.

$$H_0 : \tau = 0$$
$$H_A : \tau \neq 0$$

z	τ	α	p-value
-5.1772	-0.1480494	0.05	2.252e-07

Figure 4: Kendall correlation test results for User-Case data
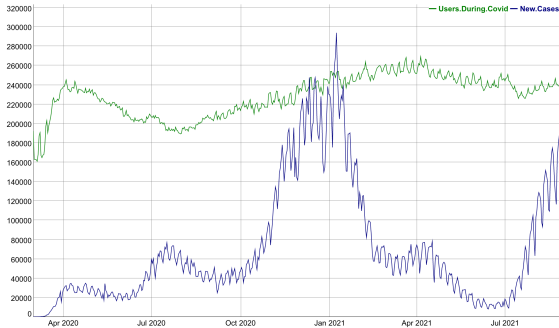
Covid-Steam

Figure 5: Covid-Steam correlation

Hypothesis Test 1,2 & 3 Interpretation

- Both total daily users and concurrent daily users show dramatic increase
- Suggests significant increase in total real players
- More players suggests more demand, which should positively affect industry
- Small correlation suggests pandemic caused surge in players, but doesn't maintain them

Hypothesis Test 4

The stock price for game companies has increased since Covid-19 began.

$$H_0 : \mu_0 = \mu_1$$
$$H_A : \mu_0 < \mu_1$$

$\bar{x}_1$	$\bar{x}_2$	t	df	α	p-value
379.5541	589.2899	-44.605	571.68	0.05	$< 2.2\text{e-}16$

Figure 6: T-test results for stock prices

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Hypothesis Test 5

The growth rate of stock prices for game companies has increased since Covid-19 began.

$$H_0 : \mu_0 = \mu_1$$
$$H_A : \mu_0 < \mu_1$$

$\bar{x}_1$	$\bar{x}_2$	t	df	α	p-value
0.02836586	0.14360207	-0.96509	726.31	0.05	0.1674

Figure 7: T-test results for stock rate

Stock Prices
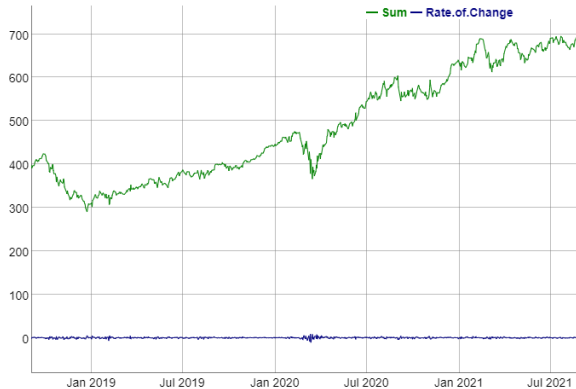
Figure 8: Video Game Industry Stock

Hypothesis Test 4 & 5 Interpretation

- Gaming companies continue to grow steadily during pandemic
- Growth rate is approximately the same as before
- Suggests negative factors counter effect from increase in players
- Also suggests resilience of video game industry to recession

Hypothesis Test 6

The variance in the growth rate of stock prices for gaming companies changes during Covid-19.

$$H_0 : \sigma_0^2 = \sigma_1^2$$
$$H_A : \sigma_0^2 \neq \sigma_1^2$$

χ^2	df	α	p-value
1.4078	1	0.05	0.2354

Figure 9: Fligner-Killen results for change in stock price growth rate during Covid-19

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Stock Price Variance
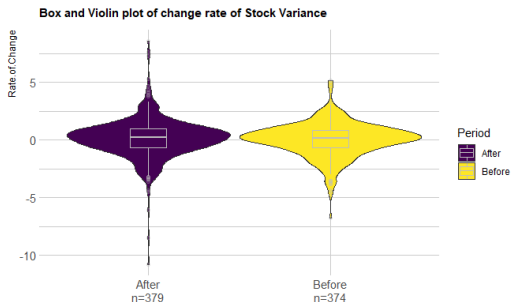
Figure 10: Violin and Box Plot of Stock Variance

Hypothesis Test 7

The variance in the short term growth rate of stock prices for gaming companies changes during Covid-19.

$$H_0 : \sigma_0^2 = \sigma_1^2$$
$$H_A : \sigma_0^2 < \sigma_1^2$$

S_0^2	S_1^2	F	num df	denom df	α	p-value
3.215967	21.15861	6.5792	29	29	0.05	1.181e-06

Figure 11: F-Test results for change in stock price growth rate during Covid-19
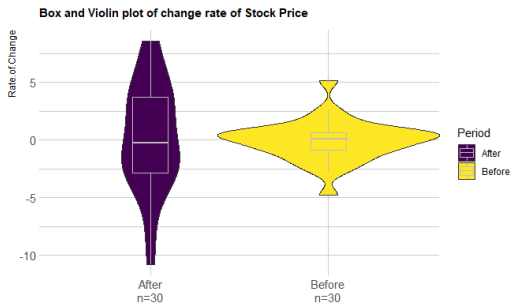
Short Term Stock Price Variance

Figure 12: Short Term Violin and Box Plot of Stock Variance

Hypothesis Test 6 & 7 Interpretation

- No significant change in long term variance further supports resilience to recession
- Short term variance suggests the introduction of Covid-19 as a pandemic had an immediate and dramatic impact

Conclusions

- Evidence strongly suggests Covid-19 caused a surge in players
- A small correlation exists between current cases and current players
- The continued impact of Covid-19 on players seems to be minimal
- This suggests that entering the pandemic introduced many new people to gaming, and this increase will likely not fall back to precovid levels when the pandemic ends.
- The rate of change in stock prices seems to be the same, suggesting resilience to recession
- Short term impact was dramatic, but in the long term the industry is not heavily effected

Further Research

- More player sources should be analyzed
- Stock analysis should continue with different representative groups from the gaming industry
- Compare video game industry to rest of market
- Impact of vaccine
- Group trends, such as gender distribution, should be analyzed before and during pandemic

Sources

- https://steamdb.info/
- https://finance.yahoo.com/
- https://covid.cdc.gov/covid-data-tracker/datatracker-home
- Cowen | Video Games and Covid: In Which We State the Obvious

Questions?

Shapiro-Wilks: Covid-Steam Correlation

W	α	p-value
0.93446	0.05	9.211e-15

Figure 13: Shapiro-Wilk results for change in users

W	α	p-value
0.91337	0.05	< 2.2e-16

Figure 14: Shapiro-Wilk results for new Covid-19 cases

Q-Q Plots: Covid-Steam Correlation
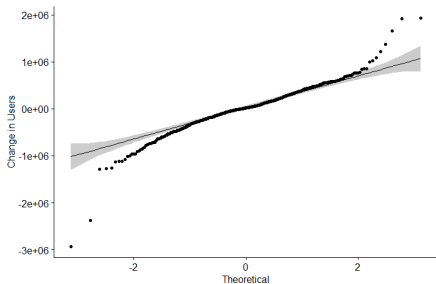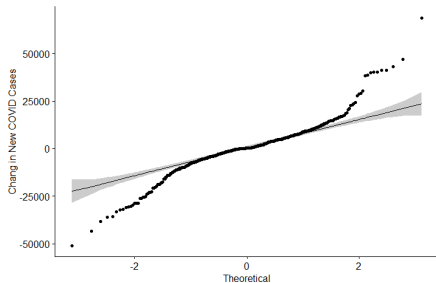

Figure 15: Change in Users Q-Q Plot.

Figure 16: New Covid-19 Cases Q-Q Plot.

Shapiro-Wilks: Long Term Stock Variance

W	α	p-value
0.96522	0.05	9.457e-08

Figure 17: Shapiro-Wilk results for change in stock price growth rate before Covid-19

W	α	p-value
0.90742	0.05	1.848e-14

Figure 18: Shapiro-Wilk results for change in stock price growth rate during Covid-19

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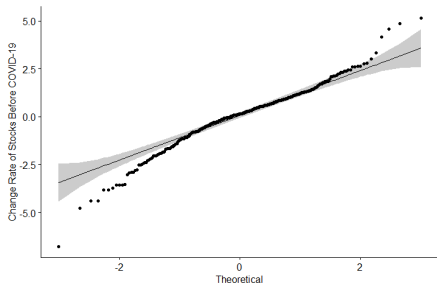
Q-Q Plots: Long Term Stock Variance
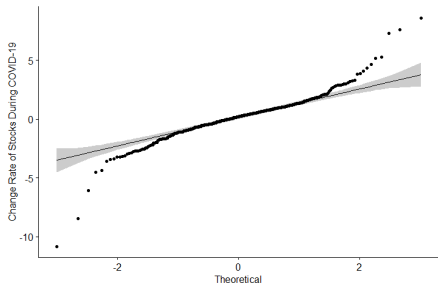

Figure 19: Long Term Stock Rate Before
Covid-19 Q-Q Plot.

Figure 20: Long Term Stock Rate During
Covid-19 Q-Q Plot.

Shapiro-Wilks: Short Term Stock Variance

W	α	p-value
0.94851	0.05	0.1542

Figure 21: Shapiro-Wilk results for short term change in stock price growth rate before Covid-19

W	α	p-value
0.97629	0.05	0.7206

Figure 22: Shapiro-Wilk results for short term change in stock price growth rate during Covid-19

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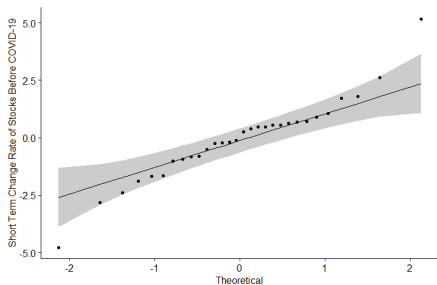# Q-Q Plots: Short Term Stock Variance

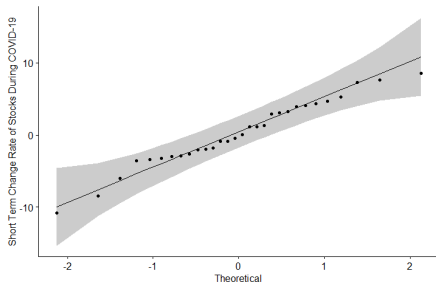
Figure 23: Short Term Stock Rate Before Covid-19 Q-Q Plot.

Figure 24: Short Term Stock Rate During Covid-19 Q-Q Plot.

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