Impact of COVID-19 on Stock Prices in the Global Video Game Market

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Abstract

The COVID-19 pandemic has profoundly impacted various sectors, including the global video game market. This study investigates how the pandemic influenced the stock prices of leading video game companies, such as Electronic Arts, Ubisoft, Square Enix, Nintendo, Sony, and Activision Blizzard. The purpose of this research is to understand the relationship between the surge in COVID-19 cases and the stock performance within this industry, providing insights into the sector's resilience and adaptability during unprecedented times. Using a Vector Autoregression (VAR) model, we analysed weekly stock prices and the number of new COVID-19 cases from January 2020 to August 2023. Our methodology included determining the optimal number of lags for the VAR model, verifying data stationarity through the Augmented Dickey-Fuller test, and interpreting impulse response functions to gauge the impact of new COVID-19 cases on stock prices. The main findings reveal that Western companies, such as Activision Blizzard and Electronic Arts, showed more positive responses to changes in COVID-19 case numbers compared to their Eastern counterparts, like Sony and Square Enix. These results underscore the differing impacts based on geographical and market presence factors. Theoretically, this research contributes to the understanding of market dynamics and investor behaviour in the face of global crises. Practically, the findings highlight the video game industry's potential as a resilient sector during economic downturns, offering valuable insights for investors and policymakers.

Key words

video game industry, stock market analysis, crisis response, VAR model, economic resilience, investor behaviour, pandemic impact.

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Introduction

The realm of video games stands as a prominent force within the expansive domain of entertainment and media, showcasing itself as one of the most rapidly expanding industries on a global scale. From its humble beginnings, the industry has swiftly traversed through various evolutionary stages, progressing from traditional arcade machines to cutting-edge virtual reality platforms. Building upon the insights of Belyaeva et al. (2022), who delved into the intricate determinants shaping the landscape of the video game industry amidst socio-economic and technological progressions in the global arena, it becomes evident that several pivotal factors play significant roles in its growth trajectory. Economic indicators such as esports revenue and the size of the economically active populace are crucial drivers, while technological advancements, including the import of ICT services, employment within knowledge-intensive sectors, robust server infrastructure, and innovative business models, serve as pillars supporting industry expansion. The multifaceted actors within the video game market, ranging from hardware manufacturers, developers, and publishers to distributors, retailers, consumers, governmental entities, and video game associations, collectively contribute to the dynamic ecosystem that propels the industry forward (González-Piñero, 2017). The landscape of this industry is prominently shaped by three leading console manufacturers: Sony, Microsoft, and Nintendo. Alongside these giants, video game developers like Activision Blizzard play a pivotal role in driving innovation and content creation. Notably, some console manufacturers, such as Microsoft, Sony, and Nintendo, have expanded their influence by not only manufacturing consoles but also developing and distributing their own video games either through subsidiary companies or subcontractors. Collaboration between video game developers and producers stands as a cornerstone in game creation, with developers contributing their expertise to bring ideas to fruition. Following development, games are distributed through various channels facilitated by distributors, ensuring their availability across multiple platforms. This interconnected ecosystem underscores the reliance of video game developers and distributors on console compatibility, while producers hinge their success on the widespread availability of games (Piñeiro-Chousa et al., 2023). The video game industry has been recognized in literature as a fertile environment for studying the dynamics of innovation related to the introduction of disruptive technologies and subsequent changes in market leadership. The first milestone was the replacement of initial arcade games installed in establishments with console games that allowed for home play, leading to an increase in game diversity. Since then, several generations can be distinguished, marked by significant technological changes and competitive scenarios (Lantano et al., 2022).

The COVID-19 pandemic has presented unprecedented challenges across various sectors, reshaping economies and altering consumer behaviours globally. One industry that has shown remarkable resilience and adaptability during this period is the video game sector. As lockdowns and social distancing measures were implemented, the demand for digital entertainment surged, making the video game industry a focal point of interest for both researchers and policymakers. This study investigates the impact of the COVID-19 pandemic on the stock prices of major video game companies, providing insights into the sector's robustness and its role in economic resilience.

The aim of this paper is to analyse how the COVID-19 pandemic influenced the stock prices of leading video game companies, including Electronic Arts, Ubisoft, Square Enix, Nintendo, Sony, and Activision Blizzard. By employing a Vector Autoregression (VAR) model, this research seeks to elucidate the dynamic relationship between the weekly number of new COVID-19 cases and the corresponding stock prices of these companies.

This study's originality and contribution to the theoretical framework lie in its comprehensive approach to understanding market dynamics during a global health crisis. By focusing on a sector that blends technology and entertainment, this research bridges gaps in contemporary literature, offering new perspectives on how digital industries can serve as economic buffers. Practically, the findings provide valuable insights for investors, policymakers, and industry stakeholders on the resilience and potential growth trajectories of the video game sector in times of crisis.

The structure of the paper is as follows: the next section provides a detailed literature review, highlighting relevant studies and identifying the research gap this study aims to fill. The methodology section outlines the data collection process, the VAR model's application, and the analytical techniques used. The results section presents the findings of the study, followed by a discussion that interprets these results in the context of existing literature and practical implications. The paper concludes with a summary of key insights, limitations of the study, and suggestions for future research.

1. Literature review

In recent years, several studies have emerged that have analysed the impact of COVID-19 on the economy, business, and even human behaviour (King et al., 2020; Kim, 2021; Galindo-Martín et al., 2021; Liu et al., 2020). The pandemic has influenced people's lives worldwide in many ways, including how they spend their leisure time and cope with unprecedented circumstances. The implemented restrictive measures had a profound effect on the social situation, and the overall economy suffered a significant slowdown. However, certain sectors remained unaffected; for instance, the entertainment and video game industry diversified during COVID-19, experiencing an increase in growth rate due to a rise in the number of players and the entry of new companies into the market (Szopik-Depczyńska et al., 2020). Testimonies suggest that many individuals turned to playing video games during the pandemic (Barr & Copeland-Stewart, 2022). Empirical studies and technical analyses have effectively documented shifts in gaming behaviours amid the global pandemic, showcasing a notable surge in player engagement metrics. Research conducted by Şener et al. (2021) underscores a marked rise in the player base, accompanied by increased durations of gameplay sessions and heightened viewership on streaming platforms. In 2020, the number of video game players worldwide dramatically surged to 2.6 billion, and video game sales reached record-breaking figures. It is interesting that many individuals reported extending the time spent playing video games during the early stages of the COVID-19 crisis, believing that gaming helped them cope with such demanding life experiences, reduced their anxiety levels, and alleviated loneliness (Pallavicini et al., 2022). Particularly in the initial phase of the COVID-19 pandemic, video game industry revenues surpassed those of the film industry, and the number of consumers playing video games experienced a dramatic increase (Kim, 2021). This was due to the fact that consumers worldwide were encouraged or even compelled to work from home to protect themselves from the COVID-19 virus and prevent its spread (Bick et al., 2023). During periods of enforced confinement, individuals found themselves confined to their homes, save for essential outings such as grocery shopping, while those infected with the virus and their close contacts were mandated to observe strict isolation protocols (Iorio et al., 2020). Amidst these circumstances, the emergence of digital technologies emerged as a beacon of solace, facilitating remote work, educational pursuits, and social interactions, thereby mitigating the repercussions of physical distancing and the dearth of traditional face-to-face engagements in the tangible world. By the end of 2023, the number of video game players is expected to exceed 3 billion (Boldi et al., 2022). According to a proposal by the International Monetary Fund (IMF), the contagious disease COVID-19 triggered a very distinct economic crisis from the past. The difference lies in its multifaceted and unpredictable nature, while simultaneously having a profound impact on the entire world (Mazur et al., 2021).

This paper aims to analyse how the COVID-19 pandemic influenced the stock prices of companies, which is a critical area of study given the pandemic's unprecedented impact on global financial markets. Recent studies have extensively explored the relationship between health crises and stock market performance. For instance, Yilanci & Pata (2023) employed wavelet-based analysis to examine the impact of COVID-19 on stock prices, exchange rates, and sovereign bonds in Brazil and India, finding significant correlations between COVID-19 cases and stock prices in both countries, particularly in high-frequency ranges. Similarly, Teitler & Tavor (2024) conducted a comparative study on the varied impact of COVID-19 on stock markets in low- and high-infection-rate countries, highlighting the importance of country-specific strategies and policies to mitigate the pandemic's effects. Fasanya et al. (2023) explored the effects of the pandemic on stock indices in the USA, France, China, and Italy, using an autoregressive distributed lag (ARDL) model, and found significant short-term and long-term impacts, with variations across different countries. Another study by Mamilla et al. (2023) utilized GARCH models to examine the volatility of nine National Stock Exchange indices before, during, and after the pandemic, concluding that COVID-19 significantly increased market volatility and risk, affecting investor returns.

The endeavour to forecast stock market prices stands as a pivotal objective within both scientific inquiry and business endeavours. Traditionally, a significant focal point of research has been the modelling of time series data (Stefko et al., 2022). The COVID-19 pandemic inflicted considerable adverse effects on stock markets, particularly in its initial stages, as it posed severe threats to public health and overall safety. To scrutinize the correlation between the weekly stock prices of the selected companies and the weekly tally of new COVID-19 cases, we employ a VAR (Vector Autoregression) model. Aliu et al. (2023) utilized a VAR model with impulse response functions, variance decomposition, Granger causality test, and vector error correction model to examine the impact of the Russian invasion of Ukraine, which accelerated the growth of agricultural commodity prices and heightened global food uncertainties. Hossain et al. (2021) investigated the statistical influence of COVID-19 on intraday momentum of S&P500 and CSI300. Additionally, they employed the predictability of time-conditioned strategies to forecast intraday momentum of stock returns. Vochozka et al. (2020) explored the extent to which fluctuations in oil prices affect the value of the Euro against the US Dollar. They conducted a regression analysis using neural networks, based on 10,000 networks generated for each experimental combination. The research followed a consistent procedure with incremental variations of a single parameter across time frames (1, 5, 10, and 30 days). Podhorska et al. (2019) used an econometric model created through multiple regression to identify a significant source of valuation and verification of corporate goodwill. Gavurová et al. (2017), on the other hand, conducted a multilevel logistic regression analysis to describe the temporal trend, age, and gender distribution of diabetes-related deaths as a significant component of endocrine, nutritional, and metabolic diseases. When selecting methods for future value prediction, both the static models and fuzzy logic are employed. The choice of method depends on the specific situation and data analysis requirements. Fuzzy logic allows, to some extent, addressing the issue of insufficient knowledge by providing a straightforward way to reach a conclusion based on unclear, imprecise, or missing input data (Polishchuk et al., 2019). Hašková (2021) introduces a general fuzzy algorithm formulated within Zadeh's fuzzy approach for solving predictive economic problems under the conditions of internal uncertainty of the model and external uncertainty of related conditions using input data. Building upon prior research, Hašková et al. (2023) introduce a forward-looking analysis utilizing a fuzzy multi-criteria evaluation framework. This system, grounded in a non-fuzzy neural methodology, showcases the ability to incorporate a learning mechanism and handle ambiguous concepts. Nowak & Romaniuk (2014) address the issue of evaluating European options when the underlying asset follows a geometric Levy process. Using stochastic analysis and fuzzy theory, formulas for the valuation of European call and put options are derived when employing ESMM and MCMM. The proof of these valuation formulas and the presentation of certain numerical option pricing analyses are conducted within a fuzzy environment in the financial market. Hašková et al. (2023) propose that while a fuzzy neural network demonstrates efficiency in solving prediction problems with input data, offering quicker outputs than a traditional fuzzy system, it remains more accessible. However, they argue that a well-informed and experienced expert may achieve faster convergence in the learning process using a fuzzy system, especially with a minimal range of input data containing essential information. Therefore, the fuzzy system emerges as a potential alternative to a fuzzy neural network in predictive tasks (Hašková et al., 2023). Over the past fifty years, a history of macroeconomic forecasts and their accuracies has been established. Economists do not agree on how the economy operates, and these disagreements are reflected, among other things, in the specification of relationships in macroeconomic models. However, over time, no single approach has yielded better predictive results than any other (Nyman & Ormerod, 2017).

This study uniquely contributes to the empirical literature by utilizing a VAR model to analyse the impact of the COVID-19 pandemic on the stock prices of leading video game companies. While previous studies have explored the broader economic impacts of the pandemic (Kim, 2021; Liu et al., 2020), our research is distinct in its focus on the video game sector and its granular analysis of specific firms such as Electronic Arts, Ubisoft, Square Enix, Nintendo, Sony, and Activision Blizzard.

2. Methodology

For the purposes of this research, data on stock prices of video game companies Electronic Arts, Ubisoft, Square Enix, Nintendo, Sony, and Activision Blizzard were collected. Data from the period of January 1, 2020, to August 2, 2023, was obtained from the Yahoo Finance website (Yahoo! Finance, 2023). The data set includes information about the weekly closing, maximum, and minimum stock prices, as well as data on the volume of their sales. The basic descriptive statistics of the data set containing weekly closing stock prices are presented in Table 1. Stock prices are retained in their respective currencies, namely US Dollars for Electronic Arts and Activision Blizzard, Euros for Ubisoft, and Japanese Yen for Square Enix, Sony, and Nintendo.

Table 1. ADF test results.

Variables	Mean	Sd	Se	Median	Min	Max	Skew	Kurtosis
Activision Blizzard	77.75	9.87	0.72	77.79	52.92	100.77	-0.21	-0.03
Electronic Arts	127.46	10.89	0.79	127.32	92.88	146.92	-0.61	0.12
Ubisoft	50.96	19.05	1.39	50.12	18.93	84.30	-0.04	-1.26
Sony	10633.36	2111.43	153.58	11149.96	5708.52	14823.13	-0.45	-0.61
Nintendo	4917.51	798.49	58.08	5026.31	2786.26	6519.00	-0.54	-0.12
Squre Enix	5819.05	623.24	45.33	5962.62	3996.23	7540.00	-0.54	0.07

Source: Authors using package "psych" in RStudio.

The descriptive statistics include the mean, standard deviation, standard error, median, minimum and maximum values, skewness coefficient, and kurtosis coefficient. Furthermore, the values of weekly new COVID-19 cases have been collected from the beginning of the pandemic, covering the period from January 8, 2020, to August 2, 2023. The dataset containing these values was downloaded from the Our World in Data website (Our World in Data, 2023). For analysis, the time series of new COVID-19 cases was adjusted to reflect the percentage changes in weekly counts. This adjustment was made to normalize the data and capture the relative growth or decline in new cases. The percentage change for each week was calculated as follows:

$$\text{Percentage Change} = \left(\frac{\text{Current Week Cases - Previous Week Cases}}{\text{Previous Week Cases}}\right) \times 100 \tag{1}$$

Both the new weekly COVID-19 cases and their percentage changes are depicted in the graphs in Figure 1.

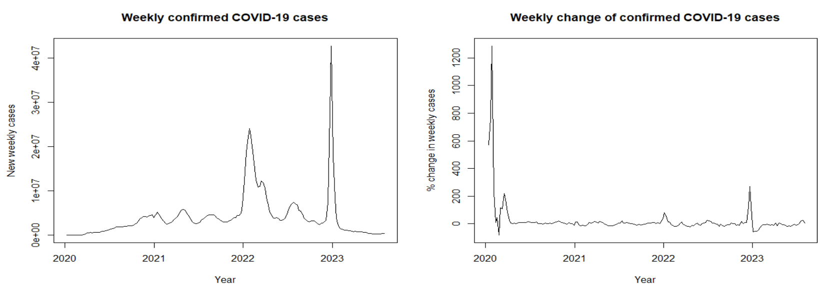

Figure 1. Weekly confirmed COVID-19 cases.
Source: Authors using RStudio.

VAR (Vector Autoregressive) model is a statistical tool used for the analysis and prediction of time series, particularly for multivariate data. It's a system of equations in which variables in time series mutually influence each other through their previous values and the values of other variables in the system. The VAR model enables capturing complex dynamic relationships between variables and temporal dependencies, making it a valuable instrument for econometric analysis, macroeconomic forecasting, financial market analysis, assessment of financial crises, and macroeconomic and monetary shocks (Feng et al., 2021). In this study, VAR models will be created for individual time series of weekly closing prices of investigated video game companies' stocks, along with the adjusted time series of new weekly COVID-19 cases. The general formula for the VAR model is as follows:

$$y_t = c + A_1 y_{t-1} + A_2 y_{t-2} + \cdots + A_p y_{t-p} + e_t \tag{2}$$

where y_t represents a vector of length k, containing the values of variables at time t, c is a constant vector, A_p is a matrix of autoregressive coefficients for the given lag with dimensions k x k, e_t is a vector of errors with a zero mean.

An essential step in creating a VAR model is determining the optimal number of lags (p), which specifies the number of past values to be included in the model. The optimal lag length was determined using several information criteria, including the Akaike Information Criterion (AIC), the Hannan-Quinn Information Criterion (HQ), the Schwarz Information Criterion (SC), and the Final Prediction Error (FPE). These criteria were computed using the 'VARselect' function in RStudio, which evaluates different lag lengths and selects the model with the lowest values for these criteria. The information criteria are calculated as follows:

$$AIC(n) = \ln \det(\Sigma_u(n)) + \frac{2}{T} n K^2 \tag{3}$$

$$HQ(n) = \ln \det(\Sigma_u(n)) + \frac{2 \ln(\ln(T))}{T} n K^2 \tag{4}$$

$$SC(n) = \ln \det(\Sigma_u(n)) + \frac{\ln(T))}{T} n K^2 \tag{5}$$

$$FPE(n) = \left(\frac{T + n^*}{T - n^*}\right)^K \det(\Sigma_u(n)) \tag{6}$$

where $\Sigma_u(n)$ is the estimated covariance matrix of the residuals for a model with lag order n, T is the sample size, K is the number of equations in the system, n is the lag order, $n*$ is the total number of parameters in each equation.

The model with the lowest values for these criteria was selected as it indicates a better fit with a balance between model complexity and goodness of fit. Typically, a lower number of lags results in a simpler model, while a higher number of lags can better capture the dynamic relationships but may lead to overfitting. The selected number of lags influences the model's accuracy and reliability by determining how well it can capture the temporal dependencies in the data without introducing unnecessary complexity.

Creating a VAR model requires data stationarity, which will be verified using the Augmented Dickey-Fuller test (ADF), where the p-value must be lower than 5% to confirm stationarity. The 'tseries' package in RStudio will be utilized for this purpose. If stationarity is rejected, the time series will be transformed into a stationary series through differencing, which is a mathematical technique commonly used in time series analysis to stabilize non-stationary data. Differencing involves calculating the differences between consecutive terms in a sequence. By doing so, the original data's fluctuations around its trends or patterns are emphasized, making the data more suitable for statistical analyses that assume stationarity. Another essential characteristic of the VAR model is its stability. Stability implies that the model exhibits consistent and predictable behaviour over time. Stability is verified by computing the roots of the characteristic polynomial of the VAR model. If all the roots are inside the unit circle, the model is stable, signifying that the variables will gradually return to the long-term equilibrium state after a sudden shock or change. In RStudio, we can assess the stability of the VAR model using the 'roots' function. This function calculates the roots of the characteristic polynomial. If all the polynomial's roots are within the unit circle (with absolute values less than 1), the model is stable.

Individual VAR models will be interpreted using the Impulse Response Function (IRF), which illustrates how one variable responds to a unit impulse (a sudden change of magnitude one) in another variable within the system over time. This approach will reveal the impact of a unit impulse in the variation of weekly COVID-19 case counts on the stock prices of the investigated video game companies.

3. Research results

For the verification of data stationarity, the Augmented Dickey-Fuller test was applied to the time series, and its results are recorded in Table 2. The first column examines stationarity on the unadjusted weekly closing stock prices. Here, stationarity is only met by the time series of Square Enix company. Therefore, the data underwent initial differencing. After the initial differencing, all time series exhibit stationarity.

Table 1. Augmented Dickey-Fuller test.

Variables	Closed price		In first difference	
	Dickey-Fuller	P-Value	Dickey-Fuller	P-Value
ACTIVISION BLIZZARD	-2.1813	0.5004	-10.142	0.01
ELECTRONIC ARTS	-3.0140	0.1521	-9.9744	0.01
UBISOFT	-3.0695	0.1289	-9.6926	0.01
SONY	-2.1402	0.5175	-8.9416	0.01
NINTENDO	-2.5121	0.3620	-9.9555	0.01
SQUARE ENIX	-3.7352	0.0236	-9.5933	0.01

Source: Authors using package "tseries" in RStudio.

The optimal number of lags was determined by comparing the information criteria AIC, HQ, SC, and FPE. The information criteria are presented in Table 3.

Table 2. Optimal lag testing.

Activision Blizzard								
Lags	1	2	3	4	5	6	7	8
AIC(n)	8.4889	**8.3737**	8.3780	8.3965	8.4226	8.4649	8.5083	8.5399
HQ(n)	8.5327	**8.4467**	8.4803	8.5280	8.5833	8.6548	8.7275	8.7883
SC(n)	8.5970	**8.5538**	8.6302	8.7208	8.8189	8.9332	9.0487	9.1524
FPE(n)	4861	**4332**	4351	4432	4550	4748	4960	5121
Electronic Arts								
Lags	1	2	3	4	5	6	7	8
AIC(n)	9.4274	**9.3062**	9.3098	9.3274	9.3186	9.3545	9.3858	9.4217
HQ(n)	9.4712	**9.3793**	9.4120	9.4589	9.4794	9.5445	9.6050	9.6701
SC(n)	9.5354	**9.4864**	9.5619	9.6517	9.7149	9.8229	9.9262	10.0342
FPE(n)	12424	**11007**	11046	11244	11147	11557	11928	12368
Ubisoft								
Lags	1	2	3	4	5	6	7	8
AIC(n)	8.1192	**8.0046**	8.0185	8.0272	8.0536	8.0928	8.0817	8.1073
HQ(n)	8.1630	**8.0776**	8.1208	8.1587	8.2144	8.2828	8.3009	8.3557
SC(n)	8.2273	**8.1847**	8.2707	8.3515	8.4500	8.5612	8.6221	8.7198
FPE(n)	3358	**2995**	3037	3064	3146	3273	3237	3323
Sony								
Lags	1	2	3	4	5	6	7	8
AIC(n)	18.4532	18.3407	**18.3396**	18.3544	18.3949	18.4370	18.4645	18.4762
HQ(n)	18.4971	**18.4137**	18.4419	18.4859	18.5556	18.6270	18.6837	18.7246
SC(n)	18.5613	**18.5208**	18.5918	18.6786	18.7912	18.9054	19.0049	19.0887
FPE(n)	1.03E+08	9.23E+07	**9.22E+07**	9.36E+07	9.75E+07	1.02E+08	1.05E+08	1.06E+08
Nintendo								
Lags	1	2	3	4	5	6	7	8
AIC(n)	16.7123	**16.5857**	16.6035	16.6274	16.6522	16.6917	16.7185	16.7196

HQ(n)	16.7562	**16.6588**	16.7058	16.7589	16.8129	16.8817	16.9377	16.9680
SC(n)	16.8204	**16.7659**	16.8557	16.9517	17.0485	17.1601	17.2590	17.3321
FPE(n)	1.81E+07	**1.60E+07**	1.62E+07	1.66E+07	1.71E+07	1.78E+07	1.82E+07	1.83E+07
Square Enix								
Lags	1	2	3	4	5	6	7	8
AIC(n)	17.4419	17.3239	**17.2847**	17.2848	17.3194	17.3471	17.3849	17.4117
HQ(n)	17.4858	17.3969	**17.3870**	17.4163	17.4801	17.5371	17.6041	17.6601
SC(n)	17.5500	**17.5040**	17.5369	17.6090	17.7157	17.8155	17.9254	18.0242
FPE(n)	3.76E+07	3.34E+07	**3.21E+07**	3.21E+07	3.33E+07	3.42E+07	3.55E+07	3.65E+07

Source: Authors using RStudio.

From Table 3, it can be observed that the optimal number of lags for the majority of time series is two lags. Companies Activision Blizzard, Electronic Arts, Ubisoft, and Nintendo exhibit the lowest information criteria and errors at this lag level. For companies Sony and Square Enix, the results are inconclusive. Considering a lower predictive error, VAR models with three lags will be created, while for the others, models with two lags will be established.

To examine the impact of sudden changes in the number of new COVID-19 infections on the weekly stock prices of video game companies, we employed the Impulse-Response Function (IRF). The resulting functions are depicted graphically in Figure 2.

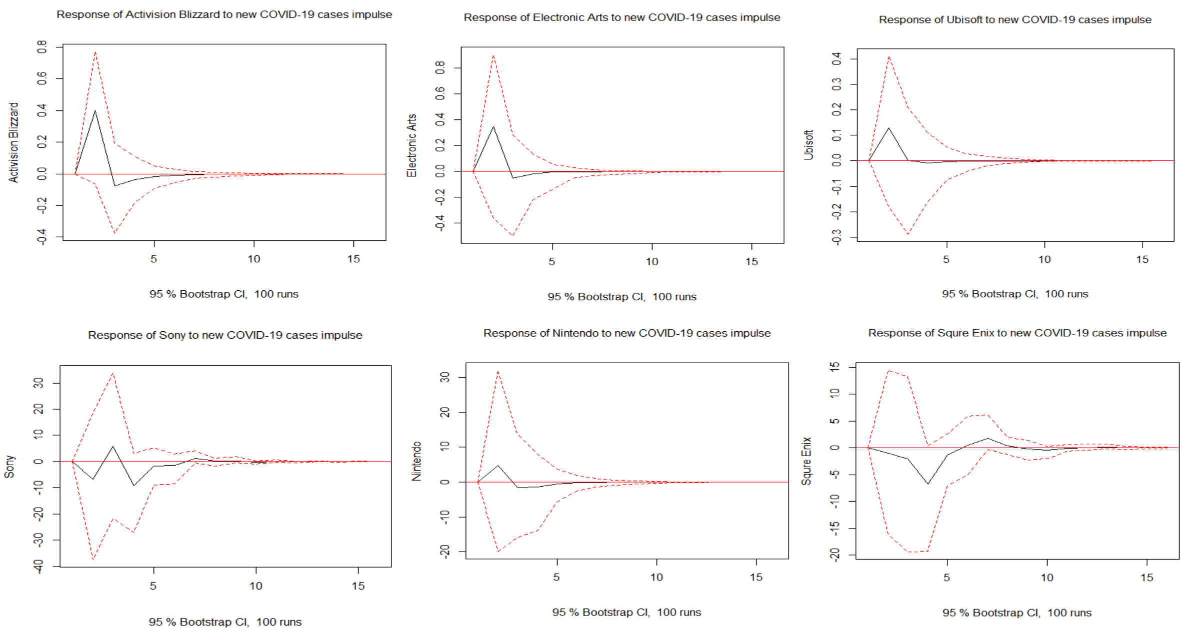

Figure 2. Impulse-response functions.
Source: Authors using RStudio.

In these graphs, the black (solid) lines represent the anticipated responses in stock prices to a one-time impulse in the change of new COVID-19 cases, while the red (dashed) lines indicate the level of model certainty.

From the graphs, it can be observed that the VAR models for Activision Blizzard, Electronic Arts, Ubisoft, and Nintendo exhibit greater confidence in the positive effect of a one-time impulse in case counts. In contrast, companies like Sony and Square Enix show more uncertainty regarding the impact of the impulse. Activision Blizzard demonstrates the most positive response to the new case count. Along with Electronic Arts, Ubisoft, and Nintendo, it anticipates a slight decrease in stock prices following an initial surge. This suggests that the stock values of these companies responded more favourably to the increase in new COVID-19 cases.

This favourable response can be attributed to these companies capitalizing on the heightened demand for digital entertainment as consumers sought indoor activities during lockdowns. Financially, this surge in demand translated to increased revenues, higher profit margins, and boosted investor confidence, making their stocks more attractive and stable investments during the crisis. Overall, the expected impact of the impulse on company prices diminishes and fades within seven weeks of the initial impulse. However, for Sony and Square Enix, whose VAR models were constructed with three lags, the impact shows more fluctuations and uncertainty.

The stability of the model was determined by calculating the roots of the characteristic polynomial for the VAR model. These calculations are documented in Table 4. The results in the table demonstrate that none of the variables exceeded the value of 1, thus we can consider the models as stable.

Table 3. VAR models stability.

Variables	1	2	3	4	5	6
Activision Blizzard	0.544447	0.203358	0.203358	0.154449		
Electronic Arts	0.536150	0.137592	0.137592	0.083726		
Ubisoft	0.512740	0.182413	0.182413	0.144241		
Sony	0.530157	0.523529	0.523529	0.248878	0.138843	0.138843
Nintendo	0.529865	0.229648	0.229648	0.043895		
Square Enix	0.635350	0.635350	0.605287	0.162568	0.138514	0.138514

Source: Authors using RStudio.

4. Discussion

The COVID-19 pandemic had a unique impact on the video game industry compared to other global sectors. One reason for this could be the virtual nature of the industry. Physical copies of games are no longer necessary, as players can purchase and download games from their homes, minimizing the risk of disease exposure. Despite this, our study found differences in how various companies were affected, likely due to their geographical locations.

Western companies, with their global player bases, generally responded more positively to the increase in COVID-19 cases. For example, Şener et al. (2021) observed a significant rise in player engagement and game sales during the pandemic. This aligns with our findings that companies like Activision Blizzard, Electronic Arts, and Ubisoft benefitted from the higher demand. Among these, Ubisoft showed the most uncertainty and the least positive response, possibly due to its struggling stock prices.

Japanese companies like Sony, Nintendo, and Square Enix had different reactions to the pandemic. Nintendo's response was similar to Western companies but with higher uncertainty and a weaker positive response. This might be because of their strong presence in the global market and loyal fan communities, even among non-Asian players. Square Enix, despite being popular in the West, focuses on Asian aesthetics and gameplay, resulting in a primarily Asian fanbase. This could explain the longer-lasting negative impact of COVID-19 on their stock prices. Sony, a major player in both game development and console manufacturing, showed minor fluctuations in stock prices due to COVID-19. This might be because of their dual focus on games and the launch of the PlayStation 5 during a global chip shortage, affecting their stock prices.

Kim (2021) noted that video game industry revenues surpassed those of the film industry early in the pandemic due to increased home confinement. Our study supports this by showing that the demand for digital entertainment helped buffer the economic downturn. Our analysis adds depth by illustrating how different companies responded to this demand. While many traditional markets faced severe downturns, the video game industry provided a unique refuge for consumers and businesses. Its digital nature allowed continued operations and even expansion during lockdowns and social distancing measures.

This resilience is reflected in the rising stock prices of companies like Activision Blizzard and Electronic Arts, which capitalized on the increased demand for home entertainment. The pandemic drove consumers to seek new forms of engagement, leading to a boom in video game sales and player engagement. As Szopik-Depczyńska et al. (2020) noted, the industry's ability to diversify and attract new players and companies was crucial to its strong performance. This diversification not only sustained the industry during the crisis but also highlighted its potential for continued growth and innovation.

Conclusions

The COVID-19 pandemic has had a significant impact on various sectors, including the global video game industry. This study has investigated how the pandemic influenced the stock prices of leading video game companies such as Electronic Arts, Ubisoft, Square Enix, Nintendo, Sony, and Activision Blizzard using a Vector Autoregression (VAR) model. Our analysis revealed that Western companies, such as Activision Blizzard and Electronic Arts, showed more positive responses to changes in COVID-19 case numbers compared to their Eastern counterparts like Sony and Square Enix. This could be attributed to the fact that video game companies in Western countries have their player communities extending beyond Asian players.

This research contributes to the understanding of market dynamics and investor behaviour in the face of global crises. By focusing on a sector that blends technology and entertainment, this research bridges gaps in contemporary literature, offering new perspectives on how digital industries can serve as economic buffers. The findings highlight the video game industry's potential as a resilient sector during economic downturns, offering valuable insights for investors and policymakers.

However, it is important to acknowledge the limitations of this study. The research focused primarily on the impact of COVID-19 without considering other concurrent factors that might have influenced the video game industry, such as technological advancements or changes in consumer behaviour unrelated to the pandemic. Additionally, the data analysis was limited to publicly available stock prices and COVID-19 case numbers, which may not capture the full complexity of market dynamics. Future research should explore these additional factors and their interplay with global health crises to provide a more comprehensive understanding of the video game industry's evolution. Investigating the long-term impacts of the pandemic on consumer behaviour and market strategies within the video game industry could also offer valuable insights for policymakers and investors.

In conclusion, while the video game industry has demonstrated notable resilience during the COVID-19 pandemic, ongoing research and policy support are essential to sustain and enhance this sector's growth and stability in the face of future global challenges.

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