Prediction of Physical Therapy Stock Prices by Telehealth Stocks and Covid Cases

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Abstract:
Introduction: COVID 19 is a global pandemic that affects the stock market and is the main player that empowers telehealth stocks that may affect other professions.
Purpose: to investigate the impact of the number and rate of COVID19 cases, deaths, and Telehealth stock prices on the physical therapy stock prices.
Methods: Stocks data were extracted from yahoo finance while covid data were extracted from CDC (Center for Disease Control).
Results: Results showed The first difference of the log was used for transformation and the best lag is lag 1. Also, var results showed adjusted R-squared: 0.01305 with F-statistic equaled 1.793 and p-value equaled 0.0762.
Conclusion: Only covid test volume could be used to predict physical therapy stock.
Keywords: Physical therapy; Telehealth; COVID-19.

1.Introduction:

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) virus causes Coronavirus Disease 2019 (COVID-19). The first known case was discovered in December 2019 in Wuhan, China. Since then, the disease has spread globally, resulting in the continuing COVID-19 pandemic. Several publications have reported on the influence of covid on stock markets [1].

The COVID-19 epidemic was officially recorded in December 2019 in Wuhan, China, and it affected all continents except Antarctica [2]. COVID-19 is a unique black swan occurrence, and we are completely ignorant of its existence, expansion, width, depth, scale, and even disappearance [3].

World Health Organization (WHO) officially declared COVID-19 a pandemic on 11th March 2020 [4]. The pandemic has severely hit global economies [5].

It has disrupted the life and lifestyle of almost everyone [6].

According to an OECD analysis (2020), the impact of COVID-19 and containment measures on OECD economies where persons were prevented from working resulted in a considerable decline in economic activity and unprecedented job losses. The capital markets are at the forefront of every country's economy, and stock markets are seen as an economic barometer [7]. The COVID-19 epidemic has disrupted victims' economic situations and presented a substantial danger to global economies and financial systems [8].

The bulk of the world's stock markets have sustained trillion-dollar losses (9), and international financial institutions have been compelled to lower their growth forecasts for 2020 and the years ahead (10).

In certain nations, millions of people were forced to work less hours, and the majority of people worked up to 10 times fewer hours. Furthermore, the rate of total employment loss is relatively high. Some persons are at a higher risk of contracting the pandemic than others. As a result of fewer secure and unskilled professions, young people and women workers are more vulnerable. They are also linked to the businesses worst hit by this unusual shock, such as restaurants, cafés, and tourism (11).

Physical therapy was the most severely impacted specialty during the pandemic when it came to payment through the Medicare physician fee schedule, with an estimated 34 percent drop in spending from January to June 2020, as many individuals self-isolated instead of seeking care, according to a March 2021 American Medical Association analysis (12).

According to American Physical Therapy Association (APTA), physical therapist services were in short supply as many Americans stayed at home to avoid illness and curb the spread of the coronavirus. As a result, revenue and income were impacted significantly. One year into the pandemic, more than a quarter of PTs (28%) and more than half of PTAs (49%) were still losing money. As a result, 19% of PTs and 38% of PTAs reported that the pandemic was still having an effect on their key expenditures. Among those whose essential expenditure remained unaffected, 34% of PTs and 42% of PTAs reported that their flexible spending was still challenging to manage in comparison to pre-pandemic flexible spending (13).

Despite financial concerns, PTs and PTAs reported that the pandemic's impact on their jobs and personal life was more stressful than the pandemic's impact on their finances. Nonetheless, PTs and PTAs were more likely to report that the epidemic increased rather than decreased their professional pride (14).

Telehealth is the distribution of health-related services and information via electronic information and telecommunication technologies. Telemedicine is sometimes used as a synonym or is used in a more limited sense to describe remote clinical services, such as diagnosis and monitoring. When rural settings, lack transport, a lack of mobility, conditions due to outbreaks, epidemics or pandemics, decreased funding, or a lack of staff restricts access to care, telehealth may bridge the gap (15).

Teladoc Health is the global leader in whole-person virtual care—offering the technology to connect, expertise you can trust and the power to improve health for all (16).

Prior to the epidemic, just 2% of physical therapists were providing video-based care. One year later, over half of them were offering some type of telehealth. However, the majority of individuals delivering telehealth (54 percent) were treating fewer than one people each week via live video chats (13).

Previous pandemics triggered fragile stock markets. Impeded stock market participants' decision-making abilities by lowering their active participation in stock market trading (17). The previous research on influenza and other significant outbreaks has chronicled the historical behavior of stock markets. Similarly, scholars have investigated the effects of significant events on stock markets, such as SARS (18), natural disasters (19), corporate events (20), public news, and political events (21). Other research have found that SARS in 2003 affected the Taiwanese economy and regional stock markets (18).

To our knowledge, there is no previous work that reported the impact of the covid crisis on the physical therapy subsector of the stock market, so this work is aiming to fill the gap of knowledge in this area. The purpose of this work is to investigate the impact of the number and rate of COVID19 cases, deaths, and Telehealth stock prices on the physical therapy stock prices using data over the period between March 2020 (the time when WHO declared COVID 19 a pandemic) – and Jan 2022.

2. Materials and Methods:

As shown in **Figure (1)**, COVID 19 data were extracted from the CDC website (https://covid.cdc.gov/covid-data-tracker/#datatracker-home). Three aspects of data were collected: Cases, Deaths, and test volume.

Stock data were extracted from yahoo finance (https://finance.yahoo.com/). Both data of the price and volume of stocks were collected for both telehealth and physical therapy stocks.

Variables collected were physical therapy stock price and volume, telehealth stock price and volume, COVID19 new deaths, COVID19 new cases, and finally COVID19 test volumes over the period March 2020 (the time when WHO declared COVID 19 a pandemic) – to Jan 2022.

All analyses were conducted using Microsoft Office Excel 2022 and free R studio software using R language version 4.1.2.

Data were collected in a large data collection sheet in CSV format before starting the analysis, then the data was screened for outliers and abnormal data. After the first cleaning, a second one that includes seasonal and trend adjustment was conducted then a VAR model was conducted and Compute impulse response and finally determine error variance decomposition.
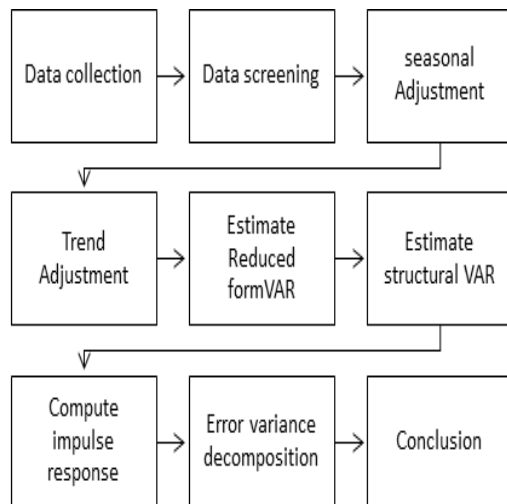

Figure (1): The flow of the statistical design
Of the current study

3.Results:

Data were collected in data collection table on excel and then plotted in R as shown in **figure (2)** and from the visual orientation we can see the trend in the data Before dealing with the trend we have to deal with seasonality of data but as the data is daily so there is no need to seasonally adjust the data. After that ADF stationarity test was conducted to all variables and showed that data need to be trend adjusted as shown in **table (1).**

The first difference of log of data is found to be extremely useful to make data stationery. Then this transformation is applied and then revisualization was conducted as in **figure (3)** and the ADF test was reconducted to ensure stationarity of data as shown in **table (1).**

The best lag number was investigated using many tests. AIC revealed that the first lag is the best lag to use in VAR model as shown in **table (2).** The VAR model was conducted using the first lag and revealed residual standard error of 0.0343 on 472 degrees of freedom with multiple R-Squared: 0.02949 while adjusted R-squared: 0.01305 with F-statistic equaled 1.793 on 8 and 472 DF and p-value equaled 0.0762 and correlation coefficient for physical therapy stocks are presented in **table (3).**
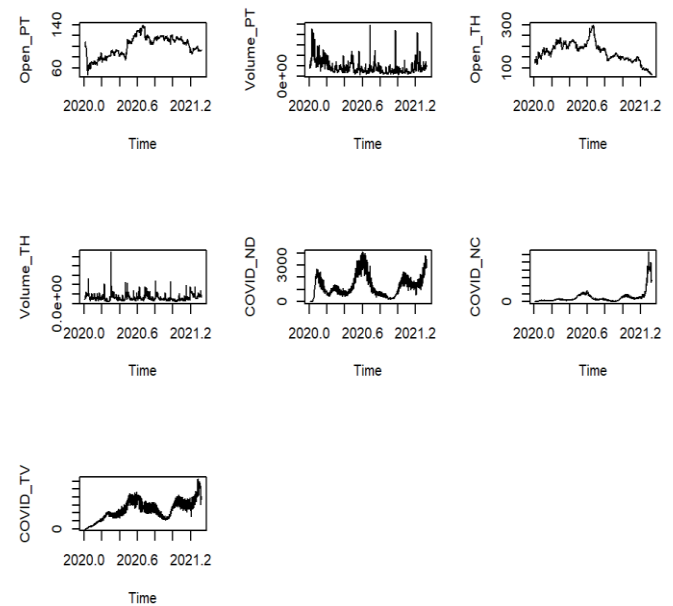

Figure (2): Original data visualization

The Impulse response function was conducted and presented for the effect of all variables on physical therapy stocks in **table (4).** And finally, the Error variance decomposition values were presented for other variables for the next 20th day and presented in **table (4)**

The R code and related statistics were presented in the GitHub file at https://github.com/DrAhmedTorad/Prediction-of-physical-therapy-stoks.

Discussion:

Our findings matched those of Sansa (2020), who explained the link between COVID-19 reported incidents and the financial markets systems of the SSE and DJIA in March 2020. Furthermore, our findings are comparable with those of Czech et al. (2020), who employed the TGARCH model to find that COVID-19 had a negative influence on Visegrad stock market indices.

When the disease's nature was modified from epidemic to pandemic, they noticed that stock markets were severely impacted. Zhang et al. (2020) have looked at the impact of COVID-19 on stock markets in ten different countries.

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Corbeta et al. (2020) provided some intriguing information. They demonstrated that the pandemic affect businesses with names connected to the virus, even if the businesses were unrelated to the virus.

Our findings, on the other hand, were in partial disagreement with Ashraf (2020), who discovered that confirmed cases have a stronger impact on the stock market than deaths.

Table (1): ADF test before and after transformation

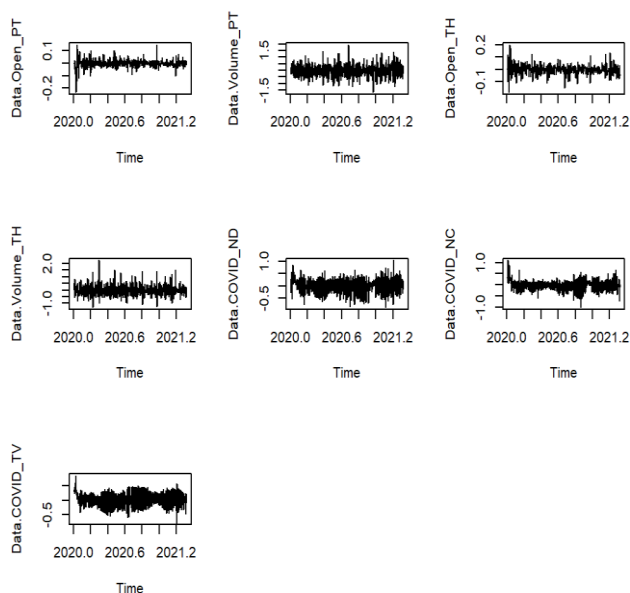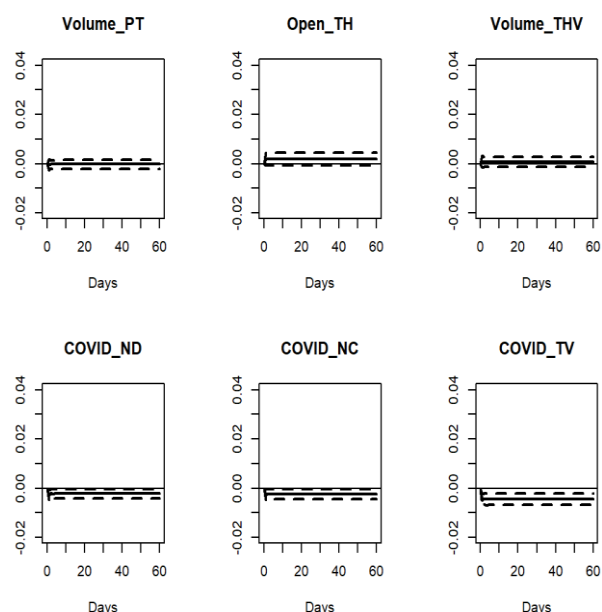| ADF	Before Transformation	After transformation
Open PT	-2.228	-13.534
Volume PT	-8.387	-21.602
Open TH	-2.446	-17.776
Volume TH	-9.904	-22.258
COVID ND	-3.534	-22.558
COVID NC	-1.936	-18.203
COVID TV	-5.647	-20.732

Figure (4): Impulse response function

Figure (3): Transformed data visualization

European stock markets were shown to be connected during the outbreak, while US markets were unable to play a significant role before and during the pandemic. Furthermore, during the pandemic, (Okorie & Lin, 2020) observed the prevalence of financial contagion. Furthermore, investors may create portfolios and risk management techniques. Furthermore, in order to minimize losses during a pandemic, investors must focus on diversification.

Managers are significant players in financial markets; they are familiar with the dangerous

Current research is important for market players and policymakers, including investors, managers, businesses, and governments. Investors must have market knowledge in order to spend their resources in advantageous avenues even amid volatile market conditions such as those seen during COVID-19. In this sense, investors might seek advice from management and policymakers. As a result, investors may make sensible judgments about their investments. Furthermore, nature of equities during the pandemic and can take precautionary actions accordingly. Managers can boost investors' confidence, encouraging them to make long-term investments.

Table (2): Best lag results

	1	2	3	4	5	6	7	8	9	10

AIC(n)	-19.840	-20.129	-20.266	-20.401	-20.943	-21.119	-21.150	-21.182	-21.106	-21.100
HQ(n)	-19.591	-19.657	-19.573	-19.487	-19.807	-19.761	-19.570	-19.381	-19.082	-18.855
SC(n)	-19.206	-18.931	-18.505	-18.076	-18.055	-17.667	-17.134	-16.602	-15.962	-15.393
FPE(n)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

	Volume PT	Open TH	Volume TH	COVID ND	COVID NC	COVID TV
1	0	0	0	0	0	0
2	0.009474	0.289501	0.069073	0.7095	0.655229	2.103829
3	0.010505	0.289522	0.073145	0.783635	0.676955	2.148904
4	0.010667	0.289522	0.073515	0.79533	0.678805	2.151917
5	0.010692	0.289522	0.073546	0.797054	0.678922	2.152051
6	0.010695	0.289522	0.073548	0.797311	0.67893	2.152058
7	0.010696	0.289522	0.073549	0.797349	0.67893	2.152058
8	0.010696	0.289522	0.073549	0.797355	0.67893	2.152058
9	0.010696	0.289522	0.073549	0.797355	0.67893	2.152058
10	0.010696	0.289522	0.073549	0.797355	0.67893	2.152058
11	0.010696	0.289522	0.073549	0.797356	0.67893	2.152058
12	0.010696	0.289522	0.073549	0.797356	0.67893	2.152058
13	0.010696	0.289522	0.073549	0.797356	0.67893	2.152058
14	0.010696	0.289522	0.073549	0.797356	0.67893	2.152058
15	0.010696	0.289522	0.073549	0.797356	0.67893	2.152058
16	0.010696	0.289522	0.073549	0.797356	0.67893	2.152058
17	0.010696	0.289522	0.073549	0.797356	0.67893	2.152058
18	0.010696	0.289522	0.073549	0.797356	0.67893	2.152058
19	0.010696	0.289522	0.073549	0.797356	0.67893	2.152058
20	0.010696	0.289522	0.073549	0.797356	0.67893	2.152058

Table (3): VAR model

	Estimate	Std. Error	Value t	(>|t|) Pr
Open PT	0.044	0.046	0.961	0.337
Volume PT	0.001	0.003	0.179	0.858
Open TH	0.042	0.039	1.087	0.278
Volume TH	2.33E-03	3.78E-03	0.615	0.5389
COVID ND	3.69E-03	7.66E-03	0.482	0.63
COVID NC	-1.32E-03	8.65E-03	-0.153	0.8786
COVID TV	-2.57E-02	1.04E-02	-2.473	0.0138 *
const	-1.24E-03	3.15E-03	-0.394	0.694

Governments may also play a key role in facilitating the spread of tax breaks and interest-free loans. Governments can even help national markets by loosening lending restrictions and granting short-term loans on more favorable conditions. Governments can undertake surveys to help investors reduce their uncertainties.

Table (4): Error variance decomposition values

Policymakers can devise effective methods for balancing financial investments during an outbreak. To do so, they might concentrate on understanding the dynamics of stock markets to devise efficient methods. Furthermore, policymakers can combine strategies to deal with the financial and economic consequences of the COVID-19 pandemic. The emphasis must be on increasing stock market stability.

Conclusion:

Only covid test volume from investigated variables can predict to a small extent physical therapy stock and should be combined with other variables to increase the predictability of the model.

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