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**SECTORAL IMPACT OF COVID-19 PANDEMIC ON INDIAN AUTOMOBILE AND HEALTHCARE SECTOR****DHANUSH.L****STUDENT****SCHOOL OF BUSINESS MANAGEMENT****CHRIST (DEEMED TO BE UNIVERSITY)****BANGALORE****RAMESH CHANDRA BABU****ASSOCIATE PROFESSOR****SCHOOL OF BUSINESS MANAGEMENT****CHRIST (DEEMED TO BE UNIVERSITY)****BANGALORE****ABSTRACT**

*The COVID-19 Pandemic which has caused a huge disruption in almost all the sectors of every economy across the globe has impacted largely the sectors of developing nations like India where the time taken to recover from this disaster is comparatively large when compared to the developed Nations. This research explores the way in which the two major sectors of the Indian economy have been impacted, namely the Healthcare sector and the Automobile sector. For this purpose the data of stock prices Pre-and Post Covid have been taken for both the Specific indexes related to these sectors and also the individual stock prices of the top 5 companies in each sector has been considered and compared with the index using various statistical analysis tools like the regression analysis, Johansen Cointegration test, Granger casualty test, Pairwise T-test and comparing the average returns pre and post Covid to obtain the actual difference in prices with time. Through the analysis we observe that the pandemic had indeed impacted both of the sectors initially and the Healthcare sector was found to recover soon than compared to the Automobile sector which is taking comparatively more time for its recovery, also it is found that there exists a long term relationship between the Sectoral indexes rather than short term impact. Therefore, this study largely aims to obtain the degree of impact of the pandemic on the Indian healthcare and the automobile sector which can be useful to other researchers who are willing to conduct their research with a similar objective*

**KEYWORDS**

Covid-19, automobile sector, health sector.

**JEL CODES**

L62, I10, I19.

**INTRODUCTION**

As the effect of the Covid-19 pandemic still continues to reverberate, different areas of the economy are facing an alternate sort of hazard. While antibodies for Covid are under the advancement stage and a portion of the underlying medicines are giving positive indications of achievement, the possible human effect of the Covid episode is enormous and a reason for worldwide concern.

The COVID 19 is making pulverization especially for the Indian economy. Due to the Covid actuated lockdown is debilitating the nation's GDP development since it is having significant unsettling influence across different areas. An exceptionally computerized creation framework will save energy and not just lower creation costs, yet in addition improve quality. The subsequent decrease in human working hours will assist us with looking after wellbeing, and will permit organizations to continue without interferences should an emergency hit once more. Expanded trust in innovation, specialized execution, and online instalment areas are causing an adjustment in purchaser conduct, away from customary techniques. This powers us to adjust to new patterns, for example, telecommuting, furthermore, move towards a future that could be liberated from physical workplaces on the loose. There will be a drawn out decline in business make a trip because of the rise of video-conferencing apparatuses, with High Net Worth Individuals wanting to travel through personal luxury plane rather than top of the line air travel. Governments, business pioneers, and organizations will dispense more spending plans for putting resources into medical services and medical services items subsequent to finding the holes in the worldwide framework while battling the Covid. More tech new companies will arise with imaginative applications. National Banks have infused enormous entreties for monetary foundations and offered extraordinary exceptions that were not gave previously. Therefore, the main aim of this paper is to find out the impact of Covid-19 on two important sectors of the Indian economy i.e., the healthcare sector and the automobile sector and also to figure out the degree of impact and their sector particular recovery pace.

**REVIEW OF LITERATURE**

Das (2020), in their paper have said that the current pandemic circumstance has antagonistic profound effect on Indian business. Locally, the effect of the Covid pandemic COVID-19 could prompt lull in home-grown interest. This will bring about disintegration of buying power due to work misfortunes or pay chops and hinder impact of conceded request will have a more drawn out enduring effect on various areas, particularly where request is optional in nature. India's genuine GDP exhausted to its base in more than six years during 4Q 2019-20. India's development for one year from now 2020-21 is anticipated in the middle of 5.3% to 5.7%. The COVID19, or Covid, pandemic has uncovered numerous shortcomings in the worldwide framework. Notwithstanding our collected involvement with emergency the executives, this infection has had the option to Segregate us all in our homes. Coronavirus has caused serious interruption for the Indian Economy. The current Covid pandemic could prompt a four percent lasting misfortune to genuine Indian total national output (GDP). It is assessed for India's Gross Home-grown Product (GDP) development rate to 1.9 percent for 2020-21. This will be the most minimal after India recorded development rate at 1.1 percent in 1991-92. The COVID 19 has upset significant areas, it's plainly apparent that different areas the travel industry and flying, telecom, auto area, transportation are most affected areas that are confronting negative repercussion of the current fiasco.

Sindhu (2020), Have elaborately stated the effect of COVID-19 pandemic on a wide range of businesses is incomprehensible, and it will ceaselessly disturb the world economy until its anticipation immunization comes on the lookout and given to in any event half of the populace. The pandemic outcomes deficiency of millions of occupations in all businesses and has a lot more extensive effect than the downturn in the year 2008. Most noticeably awful hit businesses are lodgings, travel, transport, oil, amusement, land, development and publicizing. Alone US, Hotel Industry projected to lose \$3.5 billion/week and around 6.5 million positions out of 8.3 million absolute lodging occupations and by taking a gander at the COVID-19 development as of now. Hence, future anticipated moving towards one of the most exceedingly terrible downturns ever. Coronavirus is ending up being the most exceedingly awful bad dream for people, and we can trust that a particular antibody should come out or some marvel could end up closure this pandemic and make our reality and economies more grounded once more.

Rakshit (2020) have spoken about and thrown light on the likely impacts of Covid on the various areas and sectors of Indian economy and the explanations behind which India one of the arising economies on the planet can be profited in this emergency period. In addition, the investigation features the endurance procedures

that are basic for a business to adapt to the current circumstance. In any case, during this current pandemic situation, each undertaking should prepare for the vulnerabilities and difficulties that are springing up due to Covid. They should be proactive and should develop techniques to battle the impact of Covid to support during this difficult stretch. They need to capture plausible looming changes in business climate and ought to recognize the open doors to endeavour and flourish. Therefore, this paper wholly focused on the impacts of the pandemic on the Indian economy in particular and has suggested few Business revival strategies which can be considered as potential survival strategies during this tough situation pertaining in almost every economy around the globe.

Seetharaman (2020), In her paper has shared her opinion stating that No measure of precious stone ball Gazing may help us understand the full effect of the Covid-19 (C-19) emergency on business associations in an unmistakable way. Given the absence of priority, any such examinations appear to request routine modifications as we progress further up the "quantity of tainted" bend. Most nations of the world have forced limitations on social assemblies or even individuals working in closeness to one another. Enterprises that create and convey data items and administrations in this way, have kept on working while those that make actual items particularly work serious firms had to limit activities or briefly shut down.

In any case, in many nations, actual items which were fundamental in nature were hesitantly allowed to be made given the requirement for them in individuals' regular day to day existence. In this perspective, I draw upon three measurements – data power of item/administration, data force of cycle/esteem chain; alongside a third measurement – fundamental nature of the item/administration to help comprehend the prompt ramifications of C-19. I likewise present some recounted confirmations of endeavours to adjust plans of action in these conditions to address the difficulties that specific item qualities force yet at the equivalent profit by the business openings introduced by the centrality of the items.

Chaudary (2020), have stated that the flare-up of COVID-19 carried social and financial life to a stop. In this study the focus is on surveying the effect on influenced areas, for example, aviation sector, the travel industry, capital business sectors, retail, MSMEs, and oil. Worldwide and interior versatility is limited, and the incomes produced by movement and the travel industry, which contributes to 9.2% of the GDP, will negatively affect the GDP development rate. Flight incomes will descend by USD 1.56 billion. Oil has plunged to 18-year low of \$ 22 for every barrel in March, and Unfamiliar Portfolio Investors (FPIs) have removed enormous sums from India, about USD 571.4 million. While lower oil costs will recoil the current record deficiency, switch capital streams will grow it. Rupee is constantly deteriorating. MSMEs will go through an extreme money crunch. The emergency saw a shocking mass departure of such skimming populace of transients by walking, in the midst of countrywide lockdown. Their stresses basically were loss of work, every day proportion, and nonattendance of a federal retirement aide net. India should reconsider on her improvement worldview and make it more comprehensive. Coronavirus has likewise given some extraordinary occasions to India. There is a chance to take an interest in worldwide stockpile chains, multinationals are losing trust in China. To 'Make in India', a few changes are required, work changes being one of them.

## NEED FOR THE STUDY

The Covid-19 pandemic has indeed struck a huge blow to almost all the sectors especially in a developing economy like India therefore this study takes into consideration 2 major sectors of the economy i.e. Healthcare and the automobile sector and this research work is important since Covid-19 being a recent phenomenon and no much paper are published regarding the degree of impact on specific sectors therefore this study is an attempt to figure out the degree of impact and conclude upto what extent this pandemic has impacted these 2 major sectors of the Indian economy. This paper can also be useful for researchers doing further research with similar ideas.

## OBJECTIVES OF THE STUDY

- To analyse the long-term relationship between the selected stocks and its respective index using Johansen Cointegration test during Covid-19.
- To analyse the impact of Index on the selected stock prices during Covid-19
- To study Pre and post Covid impact on stock returns of the respective industry

## METHODOLOGY

### TYPE OF RESEARCH

This research paper is quantitative research. Quantitative analysis refers to the systematic empirical study of observable phenomena by mathematical, statistical, or computational techniques. The quantitative work desire is to establish and engage phenomena-related mathematical models, theories, and hypotheses. The measuring method is important to quantitative research because it provides the fundamental network to quantitative relationships between factual observation and mathematical expression.

### HYPOTHESIS

H0: COVID-19 Pandemic posed a great impact on healthcare and automobile sector

H1: COVID-19 Pandemic did not pose a great impact on healthcare and automobile sector

### PERIOD OF THE STUDY

The data was collected from reliable secondary sources

### NATURE OF DATA

Stock data and respective index prices of past 2 years is taken for the purpose of this research

### TOOLS FOR ANALYSIS

#### Stationarity Test

A Stationarity test allows us to verify whether a series is stationary or not. In this kind of approach there are two different approaches:

- 1) One being Stationarity tests such as the KPSS test that consider the null hypothesis as H0 that the series is stationary, and vice versa
- 2) Second one is the Unit root tests, such as the Dickey-Fuller test and its respective augmented version, which is called as the augmented Dickey-Fuller test (ADF), or it can also be the Phillips-Perron test (PP), for which the null hypothesis is on the contrary that the respective series has a unit root and hence it is not stationary. XLSTAT includes and contains as of today 4 major unit root tests: the Dickey-Fuller test, the PP test, the ADF test, and the final one being the KPSS stationarity test.

#### Granger Causality Test

Granger causality test is one among the statistical concept of causality that is mainly based on prediction. According to this test, if a signal says X1 Granger-causes (or "G-causes") and another signal X2, then the past values of the X1 data should be containing information that helps predict the X2 variables above and beyond information contained in the past values of X2 alone. Therefore, its mathematical formulation is based on the linear regression modelling of the stochastic processes (Granger 1969). Also more complex extensions to the nonlinear cases do exist, however these extensions are often more difficult to be applied in real practices.

#### Regression Analysis

Regression analysis contains a set of statistical methodologies which are used for the estimation of relationships between any particular dependent variable with one or more independent variables. It can therefore be utilized to assess and find out the degree of the strength of relationship between the variables and for modelling any of the future relationship between them.

#### Johansen's Co-integration Test

There are generally two types of Johansen's co-integration tests: one of this uses trace (from linear algebra) and the other being a maximum eigenvalue approach (an eigenvalue is called a special scalar; When you multiply a given matrix by a particular vector and get the same vector as the final answer, along with a new scalar, then the scalar is said to be an eigenvalue). Therefore, both the forms of the test will help us determine whether if Co-integration is present or not. The Null hypothesis for both the forms of test is that there are no Co-Integrating equations. The difference therefore lies in the alternate hypothesis: the trace test alternate

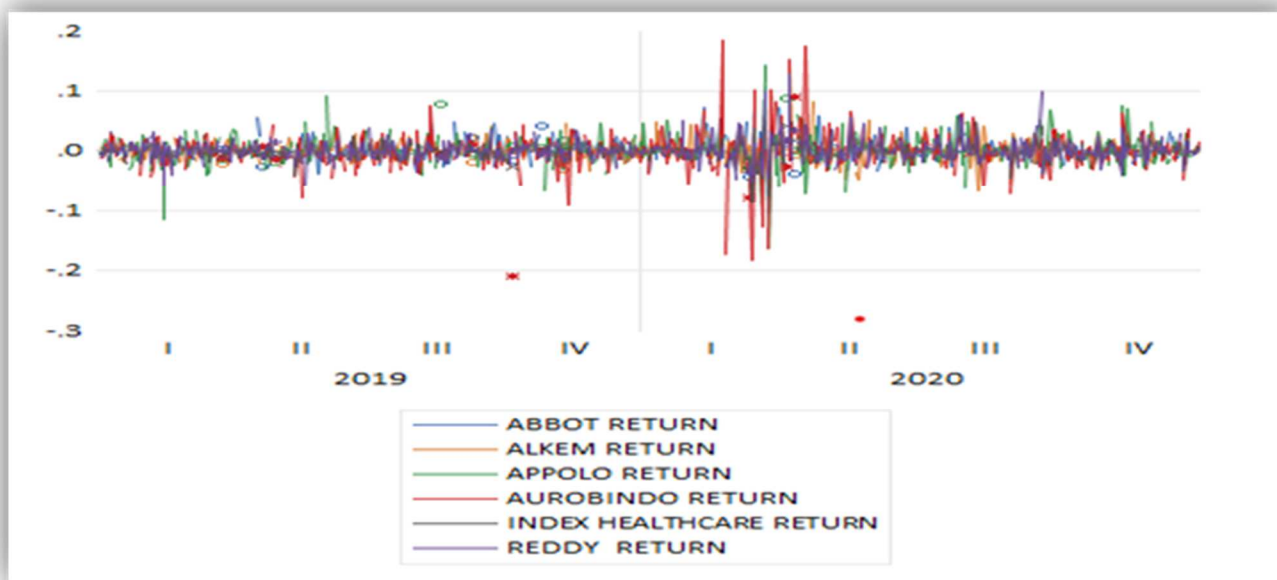
hypothesis is simply such that the numbers of Cointegrating relationships are atleast one (projected by the number of linear combinations). The maximum eigenvalue test therefore has an alternate hypothesis in the form of  $K_0 + 1$  (instead of  $K > K_0$ ). Rejecting of the null hypothesis in this situation is basically saying that there is only one combination of the non-stationary variables that will give us a stationary process.

**Paired T-Test**

A paired t-test is generally used when we are interested in knowing the difference between two variables for the same particular given subject. Often these two variables are seen to be generally separated by time. For example, we may have data regarding diabetes levels in 1952 and diabetes levels in 1962 for each included subject. Therefore, we may be interested in the difference in the diabetes levels between these two different given time points.

**RESULTS AND DISCUSSION  
HEALTHCARE SECTOR**

**GRAPH 1: STATIONARITY TESTS OF NIFTY HEALTHCARE INDEX AND 5 MAJOR COMPANIES**



The above graph shows that the data is stationary when put through the stationarity test.

**AUGMENTED DICKEY FULLER TEST**

H0: The Data is Non-stationary and has a unit root.

H1: The Data is stationary and does not have a unit root.

**TABLE 1: THE AUGMENTED DICKEY FULLER TEST DATA FOR THE HEALTHCARE SECTOR**

AUGMENTED DICKEY FULLER TEST (ADF TEST)		
VARIABLES	T-STATISTIC	PROBABILITY VALUES
NIFTY HEALTHCARE RETURNS	-11.50684	0.0000
ABBOT RETURNS	-12.00314	0.0000
ALKEM RETURNS	-14.5559	0.0000
APPOLO RETURNS	-12.58769	0.0000
DR REDDYS RETURNS	-12.47254	0.0000
AUROBINDO	-12.81649	0.0000

Through the above table we can see that the probability values are less than ( $P=0.05$ ) which shows and suggests to reject the Null hypothesis and accept the alternative hypothesis and we can therefore say that the data is stationary and does not have a unit root.

**GRANGER CAUSALITY TEST FOR SHORT RUN**

H0: The Index has return does not Granger cause individual companies return

H1: The individual companies does not Granger cause the Healthcare index returns

**TABLE 2: GRANGER CAUSALITY TEST OF HEALTHCARE INDEX RETURN AND ALKEM RETURN**

Pairwise Granger Causality Tests

Date: 01/13/21 Time: 21:00

Sample: 1/01/2019 12/31/2020

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
INDEX_HEALTHCARE_RETURN does not Granger Cause ALKEM_RETURN	494	5.55653	0.0041
ALKEM_RETURN does not Granger Cause INDEX_HEALTHCARE_RETURN		0.60283	0.5477

The above table demonstrates the Granger Causality Test results for Short Run. Since we know that this test requires stationary data, hence we have taken the returns or first difference of the variables i.e., Nifty healthcare index and Alkem Returns. The results here showcase that the first null hypothesis which is having a probability of 0.041 which is less than 0.05 which means that this null hypothesis gets rejected. This in turn tells that the Nifty healthcare index does impact or granger the Alkem Returns. Similarly, the second null hypothesis also proves the same result since there the probability value is 0.5477 which is greater than 0.05, which tells that Returns of Alkem does not impact the Nifty healthcare index returns but it is vice versa.

TABLE 3: GRANGER CAUSALITY TEST OF HEALTHCARE INDEX RETURN AND ABBOT RETURN

## Pairwise Granger Causality Tests

Date: 01/13/21 Time: 20:56

Sample: 1/01/2019 12/31/2020

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
ABBOT_RETURN does not Granger Cause INDEX_HEALTHCARE_RETURN	494	2.11943	0.1212
INDEX_HEALTHCARE_RETURN does not Granger Cause ABBOT_RETURN		0.67866	0.5078

The above table demonstrates the Granger Causality Test results for Short Run. Since we know that this test requires stationary data, hence we have taken the returns or first difference of the variables i.e., Nifty healthcare index returns and Abbot Returns. The results here showcase that the first null hypothesis which is having a probability of 0.1212 which is more than 0.05 which means that this null hypothesis gets accepted. This in turn tells that the abbot returns do not impact or granger the Nifty Healthcare Returns. Similarly, the second null hypothesis also proves the same result since there the probability value is 0.5078 which is greater than 0.05, which tells that Returns of Nifty healthcare does not impact the Abbot returns and vice versa.

TABLE 4: GRANGER CAUSALITY TEST OF HEALTHCARE INDEX RETURN AND APOLLO RETURN

## Pairwise Granger Causality Tests

Date: 01/13/21 Time: 21:01

Sample: 1/01/2019 12/31/2020

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
INDEX_HEALTHCARE_RETURN does not Granger Cause APPOLO_RETURN	494	0.92724	0.3963
APPOLO_RETURN does not Granger Cause INDEX_HEALTHCARE_RETURN		0.08071	0.9225

The above table demonstrates the Granger Causality Test results for Short Run. Since we know that this test requires stationary data, hence we have taken the returns or first difference of the variables i.e., Nifty healthcare index returns and Apollo returns. The results here showcase that the first null hypothesis which is having a probability of 0.3963 which is greater than 0.05 which means that this null hypothesis is accepted. This in turn tells that Nifty healthcare index does not impact or granger the Apollo Returns. Similarly, the second null hypothesis also proves the same result since there the probability value is 0.9225 which is greater than 0.05, which tells that Returns of Apollo does not impact the Nifty healthcare index returns in the short run.

TABLE 5: GRANGER CAUSALITY TEST OF HEALTHCARE INDEX RETURN AND AUROBINDO RETURN

## Pairwise Granger Causality Tests

Date: 01/13/21 Time: 21:02

Sample: 1/01/2019 12/31/2020

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
INDEX_HEALTHCARE_RETURN does not Granger Cause AUROBINDO_RETURN	494	2.49178	0.0838
AUROBINDO_RETURN does not Granger Cause INDEX_HEALTHCARE_RETURN		1.04450	0.3527

The above table demonstrates the Granger Causality Test results for Short Run. Since we know that this test requires stationary data, hence we have taken the returns or first difference of the variables i.e., Nifty healthcare index returns and Aurobindo returns. The results here showcase that the first null hypothesis which is having a probability of 0.0838 which is greater than 0.05 which means that this null hypothesis is accepted. This in turn tells that Nifty healthcare index does not impact or granger the Aurobindo Returns. Similarly, the second null hypothesis also proves the same result since there the probability value is 0.3527 which is greater than 0.05, which tells that Returns of Aurobindo does not impact the Nifty healthcare index returns in the short run.

TABLE 6: GRANGER CAUSALITY TEST OF HEALTHCARE INDEX RETURN AND DR.REDDYS RETURN

## Pairwise Granger Causality Tests

Date: 01/13/21 Time: 21:02

Sample: 1/01/2019 12/31/2020

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
INDEX_HEALTHCARE_RETURN does not Granger Cause REDDY__RETURN	494	0.51164	0.5998
REDDY__RETURN does not Granger Cause INDEX_HEALTHCARE_RETURN		0.00123	0.9988

The above table demonstrates the Granger Causality Test results for Short Run. Since we know that this test requires stationary data, hence we have taken the returns or first difference of the variables i.e., Nifty healthcare index returns and Dr Reddys returns. The results here showcase that the first null hypothesis which is having a probability of 0.5998 which is greater than 0.05 which means that this null hypothesis is accepted. This in turn tells that Nifty healthcare index does not impact or granger the Dr Reddys Returns. Similarly, the second null hypothesis also proves the same result since there the probability value is 0.9988 which is greater than 0.05, which tells that Returns of Dr Reddys does not impact the Nifty HealthCare index returns in the short run.

REGRESSION ANALYSIS

TABLE 7: REGRESSION ANALYSIS OF NIFTY HEALTHCARE INDEX AND 5 COMPANIES

Dependent Variable: INDEX\_HEALTHCARE\_RETURN  
 Method: Least Squares  
 Date: 01/13/21 Time: 13:48  
 Sample (adjusted): 1/02/2019 12/31/2020  
 Included observations: 496 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.000107	0.000314	-0.340910	0.7333
ABBOT_RETURN	0.082907	0.018304	4.529354	0.0000
ALKEM_RETURN	0.089463	0.018202	4.914979	0.0000
APPOLO_RETURN	0.119647	0.013765	8.692088	0.0000
AUROBINDO_RETURN	0.176870	0.011062	15.98881	0.0000
REDDY_RETURN	0.311562	0.020024	15.55907	0.0000
R-squared	0.761137	Mean dependent var		0.000761
Adjusted R-squared	0.758700	S.D. dependent var		0.014162
S.E. of regression	0.006957	Akaike info criterion		-7.086237
Sum squared resid	0.023713	Schwarz criterion		-7.035351
Log likelihood	1763.387	Hannan-Quinn criter.		-7.066262
F-statistic	312.2774	Durbin-Watson stat		2.006232
Prob(F-statistic)	0.000000			

Upon applying the multiple Linear Regression analysis on Nifty healthcare index returns and 5 major companies in that index it was discovered that importance of Regression from the above table, that comes out to be 0.000 (< 0.05) which implies that regression model can be legitimately settled. Referring to the above table we get the coefficients of Regression Model which clearly shows a negative value on the individual company's return which is contradicting or in general is providing an inverse relation with the dependent variable i.e. the nifty healthcare index during the Covid pandemic duration.

CO-INTEGRATION TEST

H0: There is no Co-integration between the index and selected companies

H1: There is Co-integration between the index and selected companies

TABLE 8: JOHANSEN COINTEGRATION TEST (TRACE) OF THE HEALTHCARE SECTOR

Date: 01/13/21 Time: 13:24  
 Sample (adjusted): 1/09/2019 12/31/2020  
 Included observations: 491 after adjustments  
 Trend assumption: Linear deterministic trend  
 Series: REDDY\_RETURN AUROBINDO\_RETURN APPOLO\_RETURN ALKEM\_RETURN ABBOT\_RETURN INDE...  
 Lags interval (in first differences): 1 to 4

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.252961	590.8490	95.75366	0.0000
At most 1 *	0.209944	447.6548	69.81889	0.0000
At most 2 *	0.190808	331.9500	47.85613	0.0000
At most 3 *	0.173452	227.9959	29.79707	0.0000
At most 4 *	0.148320	134.4617	15.49471	0.0000
At most 5 *	0.107124	55.63424	3.841465	0.0000

Trace test indicates 6 cointegrating eqn(s) at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

\*\*MacKinnon-Haug-Michelis (1999) p-values

TABLE 9: JOHANSEN CO-INTEGRATION TEST (MAXIMUM EIGENVALUE) OF THE HEALTHCARE SECTOR

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

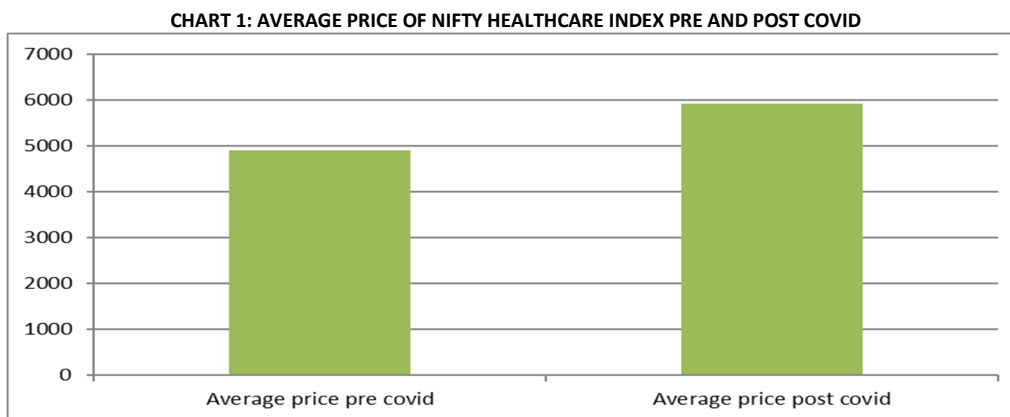
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.252961	143.1943	40.07757	0.0000
At most 1 *	0.209944	115.7048	33.87687	0.0000
At most 2 *	0.190808	103.9540	27.58434	0.0000
At most 3 *	0.173452	93.53425	21.13162	0.0000
At most 4 *	0.148320	78.82746	14.26460	0.0000
At most 5 *	0.107124	55.63424	3.841465	0.0000

Max-eigenvalue test indicates 6 cointegrating eqn(s) at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

\*\*MacKinnon-Haug-Michelis (1999) p-values

The above table demonstrates the Johansen Cointegration test results. It assures the long-term relationship among the selected variables. The result shows that the series is cointegrated, as both the trace and the maximum eigenvalue tests reject the null hypothesis of no Cointegration, suggesting that there are 6 significant co-integrating vectors in the model. This implies that there are six common stochastic trends, indicating a degree of market integration. Therefore, it may conclude that there exists a stationary, long-run relationship among the variables.



In the above chart the average price of Nifty Healthcare index for the period (01-01-2019-31-12-2019) i.e. pre covid is taken and it is compared with the average price of Post Covid starting from (01-01-2020-31-12-2020), we can see from the above table that the average price has increased from 4900 to around Rs.6000 this in turn tells us that the healthcare sector was initially affected in the early stages of Covid-19 but it slowly got back on track and became a sector with rapid recovery rate after being hit from the pandemic

**PAIRED T-TEST**

**H0:** There is no impact of Covid on the Index returns with respect to time

**H1:** There is an impact of Covid on the Index returns with respect to time

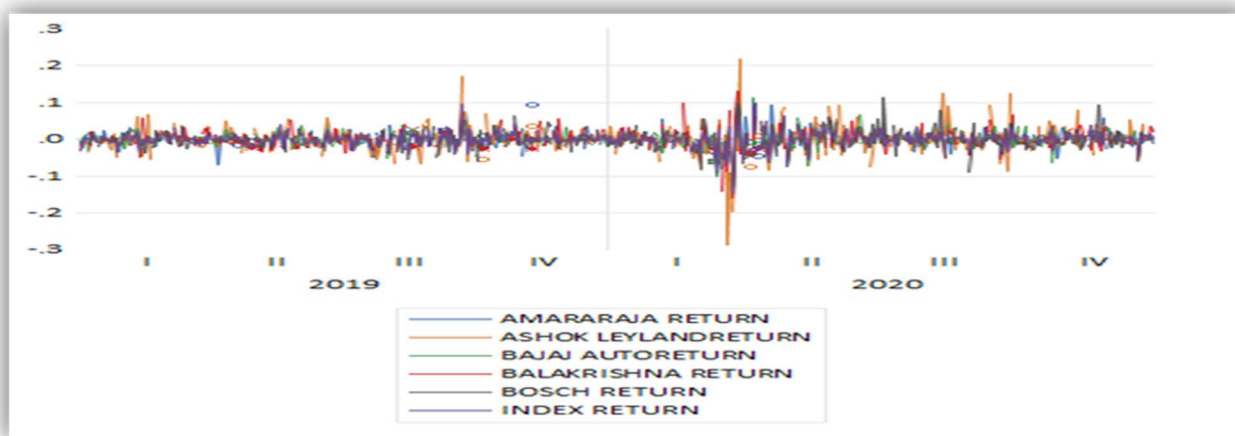
**TABLE 10: PAIRED T-TEST OF NIFTY HEALTHCARE INDEX PRE AND POST COVID**

PAIRED T-STATISTIC	
T STATISTIC ON PRICE	0.000000000000000000092733
T STATISTIC ON RETURNS	0.107491598

In the above table we can see that initially a Paired T-statistic was conducted with respect to the prices and we can say that the test proved to be significant i.e. (probability value of less than 0.05) was obtained which further showed that the pandemic had definitely impacted the prices of the Healthcare sector index, later the Paired T-test was conducted with respect to the returns where it was found that the Returns post covid pandemic were not much affected post the Covid pandemic as the Probability value is greater than 0.05.

**AUTOMOBILE SECTOR**

**GRAPH 2: STATIONARITY TESTS OF NIFTY AUTOMOBILE INDEX AND 5 MAJOR COMPANIES**



The above graph shows that the data is stationary when put through the stationarity test.

**AUGMENTED DICKEY FULLER TEST**

**H0:** The Data is Non-stationary and has a unit root

**H1:** The Data is stationary and does not have a unit root

**TABLE 11: THE AUGMENTED DICKEY FULLER TEST DATA FOR THE AUTOMOBILE SECTOR**

AUGMENTED DICKEY FULLER TEST (ADF TEST)		
VARIABLES	T-STATISTIC	PROBABILITY VALUES
NIFTY AUTOMOBILE RETIURNS	-12.4107	0.0000
ASHOK LEYLAND RETURNS	-12.82258	0.0000
BAJAJ AUTO RETURNS	-13.05073	0.0000
BALAKRISHNA LIMITED RETURNS	-12.56745	0.0000
BOSCH LTD RETURNS	-12.74202	0.0000
AMARARAJA RETURNS	-11.29307	0.0000

Through the above table we can see that the probability values are less than (P=0.05) which shows and suggests to reject the Null hypothesis and accept the alternative hypothesis and we can therefore say that the data is stationary and does not have a unit root.

**GRANGER CASUALTY TESTS**

**H0:** The Index has return does not Granger cause individual companies return

**H1:** The individual companies do not Granger cause the Automobile index returns

TABLE 12: GRANGER CAUSALITY TEST OF AUTOMOBILE INDEX RETURN AND AMARA RAJA RETURN

## Pairwise Granger Causality Tests

Date: 01/13/21 Time: 21:22

Sample: 1/01/2019 12/31/2020

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
INDEX_RETURN does not Granger Cause AMARARAJA_RETURN	494	0.61316	0.5421
AMARARAJA_RETURN does not Granger Cause INDEX_RETURN		1.12677	0.3249

The above table demonstrates the Granger Causality Test results for Short Run. Since we know that this test requires stationary data, hence we have taken the returns or first difference of the variables i.e., Nifty Automobile index returns and Amara raja returns. The results here showcase that the first null hypothesis which is having a probability of 0.5421 which is greater than 0.05 which means that this null hypothesis is accepted. This in turn tells that Nifty Automobile index does not impact or granger the Amara raja Returns. Similarly, the second null hypothesis also proves the same result since there the probability value is 0.3249 which is greater than 0.05, which tells that Returns of Amara Raja does not impact the Nifty Automobile index returns in the short run.

TABLE 13: GRANGER CAUSALITY TEST OF AUTOMOBILE INDEX RETURN AND ASHOK LEYLAND RETURN

## Pairwise Granger Causality Tests

Date: 01/13/21 Time: 21:23

Sample: 1/01/2019 12/31/2020

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
INDEX_RETURN does not Granger Cause ASHOK_LEYLANDRETURN	494	4.50889	0.0115
ASHOK_LEYLANDRETURN does not Granger Cause INDEX_RETURN		0.10837	0.8973

The above table demonstrates the Granger Causality Test results for Short Run. Since we know that this test requires stationary data, hence we have taken the returns or first difference of the variables i.e., Nifty Automobile index returns and Amara raja returns. The results here showcase that the first null hypothesis which is having a probability of 0.0115 which is less than 0.05 which means that this null hypothesis is Rejected. This in turn tells that Nifty Automobile index does impact or granger the Ashok Leyland Returns. Similarly, the second null hypothesis also proves the same result since there the probability value is 0.8973 which is greater than 0.05, which tells that Returns of Amara Raja does not impact the Nifty Automobile index returns in the short run but it is vice versa.

TABLE 14: GRANGER CAUSALITY TEST OF AUTOMOBILE INDEX RETURN AND BAJAJ AUTO RETURN

## Pairwise Granger Causality Tests

Date: 01/13/21 Time: 21:24

Sample: 1/01/2019 12/31/2020

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
INDEX_RETURN does not Granger Cause BAJAJ_AUTORETURN	494	1.37724	0.2532
BAJAJ_AUTORETURN does not Granger Cause INDEX_RETURN		0.37368	0.6884

The above table demonstrates the Granger Causality Test results for Short Run. Since we know that this test requires stationary data, hence we have taken the returns or first difference of the variables i.e., Nifty Automobile index returns and Bajaj auto returns. The results here showcase that the first null hypothesis which is having a probability of 0.2532 which is greater than 0.05 which means that this null hypothesis is accepted. This in turn tells that Nifty Automobile index does not impact or granger the Bajaj auto Returns. Similarly, the second null hypothesis also proves the same result since there the probability value is 0.6884 which is greater than 0.05, which tells that Returns of Bajaj auto does not impact the Nifty Automobile index returns in the short run.

TABLE 15: GRANGER CAUSALITY TEST OF AUTOMOBILE INDEX RETURN AND BALAKRISHNA LTD RETURN

## Pairwise Granger Causality Tests

Date: 01/13/21 Time: 21:24

Sample: 1/01/2019 12/31/2020

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
INDEX_RETURN does not Granger Cause BALAKRISHNA_RETURN	494	0.88280	0.4143
BALAKRISHNA_RETURN does not Granger Cause INDEX_RETURN		2.12998	0.1199

The above table demonstrates the Granger Causality Test results for Short Run. Since we know that this test requires stationary data, hence we have taken the returns or first difference of the variables i.e., Nifty Automobile index returns and Balakrishna returns. The results here showcase that the first null hypothesis which is having a probability of 0.4143 which is greater than 0.05 which means that this null hypothesis is accepted. This in turn tells that Nifty Automobile index does not impact or granger the Balakrishna Returns. Similarly, the second null hypothesis also proves the same result since there the probability value is 0.1199 which is greater than 0.05, which tells that Returns of Balakrishna does not impact the Nifty Automobile index returns in the short run.

TABLE 16: GRANGER CAUSALITY TEST OF AUTOMOBILE INDEX RETURN AND BOSCH RETURN

Pairwise Granger Causality Tests  
 Date: 01/13/21 Time: 21:25  
 Sample: 1/01/2019 12/31/2020  
 Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
INDEX_RETURN does not Granger Cause BOSCH_RETURN	494	4.32423	0.0138
BOSCH_RETURN does not Granger Cause INDEX_RETURN		0.86049	0.4236

The above table demonstrates the Granger Causality Test results for Short Run. Since we know that this test requires stationary data, hence we have taken the returns or first difference of the variables i.e., Nifty Automobile index returns and Bosch returns. The results here showcase that the first null hypothesis which is having a probability of 0.0138 which is lesser than 0.05 which means that this null hypothesis is rejected. This in turn tells that Nifty Automobile index does impact or granger the Bosch Returns. Similarly, the second null hypothesis also proves the same result since there the probability value is 0.4236 which is greater than 0.05, which tells that Returns of Bosch does not impact the Nifty Automobile index returns in the short run but it is vice versa.

REGRESSION ANALYSIS

TABLE 17: REGRESSION ANALYSIS OF NIFTY AUTOMOBILE INDEX AND 5 COMPANIES

Dependent Variable: INDEX\_RETURN  
 Method: Least Squares  
 Date: 01/13/21 Time: 15:10  
 Sample (adjusted): 1/02/2019 12/31/2020  
 Included observations: 496 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.000289	0.000379	-0.763548	0.4455
BOSCH_RETURN	0.191757	0.019794	9.687863	0.0000
BALAKRISHNA_RETURN	0.210758	0.018777	11.22417	0.0000
BAJAJ_AUTORETURN	0.392245	0.023141	16.95055	0.0000
ASHOK_LEYLANDRETURN	0.107990	0.013233	8.160390	0.0000
AMARARAJA_RETURN	0.097370	0.022280	4.370374	0.0000
R-squared	0.818648	Mean dependent var		2.42E-06
Adjusted R-squared	0.816797	S.D. dependent var		0.019633
S.E. of regression	0.008403	Akaike info criterion		-6.708399
Sum squared resid	0.034600	Schwarz criterion		-6.657513
Log likelihood	1669.683	Hannan-Quinn criter.		-6.688424
F-statistic	442.3847	Durbin-Watson stat		1.989383
Prob(F-statistic)	0.000000			

Upon applying the multiple Linear Regression analysis on Nifty Automobile index returns and 5 major companies in that index it was discovered that importance of Regression from the above table, that comes out to be 0.000 (< 0.05) which implies that regression model can be legitimately settled. Referring to the above table we get the coefficients of Regression Model which clearly shows a negative value on the individual company's return which is contradicting or in general is providing an inverse relation with the dependent variable i.e. the nifty Automobile index during the Covid pandemic duration.

CO-INTEGRATION TEST

H0: There is no Co-integration between the index and selected companies  
 H1: There is Co-integration between the index and selected companies

TABLE 18: JOHANSEN COINTEGRATION TEST (TRACE) OF THE AUTOMOBILE SECTOR

Date: 01/13/21 Time: 15:07  
 Sample (adjusted): 1/09/2019 12/31/2020  
 Included observations: 491 after adjustments  
 Trend assumption: Linear deterministic trend  
 Series: AMARARAJA\_RETURN ASHOK\_LEYLANDRETURN BAJAJ\_AUTORETURN BALAKRISHNA\_RETURN BOS...  
 Lags interval (in first differences): 1 to 4

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.267618	629.6564	95.75366	0.0000
At most 1 *	0.225310	476.7333	69.81889	0.0000
At most 2 *	0.213034	351.3845	47.85613	0.0000
At most 3 *	0.164852	233.7555	29.79707	0.0000
At most 4 *	0.155103	145.3033	15.49471	0.0000
At most 5 *	0.119612	62.54971	3.841465	0.0000

Trace test indicates 6 cointegrating eqn(s) at the 0.05 level  
 \* denotes rejection of the hypothesis at the 0.05 level  
 \*\*MacKinnon-Haug-Michelis (1999) p-values

TABLE 19: JOHANSEN COINTEGRATION TEST (MAXIMUM EIGENVALUE) OF THE AUTOMOBILE SECTOR

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

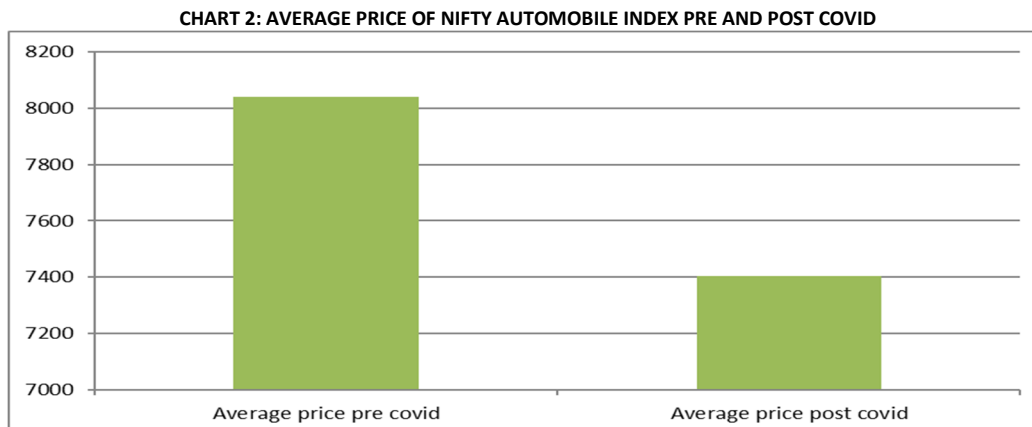
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.267618	152.9231	40.07757	0.0000
At most 1 *	0.225310	125.3488	33.87687	0.0000
At most 2 *	0.213034	117.6290	27.58434	0.0000
At most 3 *	0.164852	88.45213	21.13162	0.0000
At most 4 *	0.155103	82.75364	14.26460	0.0000
At most 5 *	0.119612	62.54971	3.841465	0.0000

Max-eigenvalue test indicates 6 cointegrating eqn(s) at the 0.05 level  
 \* denotes rejection of the hypothesis at the 0.05 level  
 \*\*MacKinnon-Haug-Michelis (1999) p-values



The above table demonstrates the Johansen Cointegration test results. It assures the long-term relationship among the selected variables. The result shows that the series is cointegrated, as both the trace and the maximum eigenvalue tests reject the null hypothesis of no Cointegration, suggesting that there are 6 significant co-integrating vectors in the model. This implies that there are six common stochastic trends, indicating a degree of market integration. Therefore, it may conclude that there exists a stationary, long-run relationship among the variables.

**AVERAGE PRICE PRE AND POST COVID OF NIFTY AUTOMOBILE INDEX**



In the above table the average price of Nifty Automobile index for the period starting from (01-01-2019-31-12-2019) i.e. Pre-Covid is taken and it is compared with the average price of Post Covid starting from (01-01-2020-31-12-2020), we can see from the above table that the average price has decreased drastically from 8000 to around Rs.7400 this in turn tells us that the Automobile sector which was already suffering was affected badly by the Covid-19 pandemic and it is slowly getting back on track and trying to recover as fast as possible after being hit from the pandemic

**PAIRED T-TEST**

**H0:** There is no impact of Covid on the Index returns with respect to time

**H1:** There is an impact of Covid on the Index returns with respect to time

**TABLE 20: PAIRED T-TEST OF NIFTY AUTOMOBILE INDEX PRE AND POST COVID**

PAIRED T-STATISTIC	
T STATISTIC ON PRICE	0.00000010457
T STATISTIC ON RETURNS	0.634973281

In the above table we can see that initially a Paired T-statistic was conducted with respect to the prices and we can say that the test proved to be significant i.e. (probability value of less than 0.05) was obtained which further showed that the pandemic had definitely impacted the prices of the Automobile sector index, later the Paired T-test was conducted with respect to the returns where it was found that the Returns post covid pandemic were not much affected post the Covid pandemic as the Probability value is greater than 0.05.

**SUMMARY OF FINDINGS**

- It is found that there exists a long-term relationship between the Stocks selected namely the Abbot, Alkem, Apollo, Aurobindo and Dr Reddys returns and its respective Nifty Healthcare index returns which was found using Johansen Cointegration test.
- It is also found that there exists a long-term relationship between the Stocks selected namely the Bosch, Amara Raja, Ashok Leyland, Bajaj auto and Bala-krishna returns Apollo, Aurobindo and Dr Reddys and its respective Nifty Automobile index returns which is also found using Johansen Cointegration test.
- There is a differential impact Covid-19 on the average returns of both the Nifty Automobile index and the Nifty Healthcare index.
- The health care sector showed a great recovery rate when compared to the automobile sector which is still in the verge of recovery.

**CONCLUSIONS AND SUGGESTIONS**

In this study, we compared the impact of covid-19 pandemic on two major sectors of the Indian economy namely healthcare and the automobile sector. We further collected the data of the respective industry indexes and individual stock prices of the top five companies in each index this was done to compare the impact of individual stock prices on the respective industry indexes and from reliable secondary sources. The methodology included running various statistical tests like stationarity test, granger casualty test, regression analysis and Johaneson Cointegration test and also the paired t-test. These tests helped to analyse the problem statement and achieve the objectives of the study. Where it was found that the pandemic had a short term impact on the healthcare sector and long term impact on the automotive sector also the paired t-test suggests that there is indeed an impact of the pandemic on the prices of both the sectors but the degree of impact varies independently.

It is understood from the analysis that there exists a minimal relationship between the sectors respective indexes and selected companies since there are other factors and many other companies which are a part of the index and have not been considered for the study, therefore the investors and other stake holders must consider all the possible factors before making any investment decisions especially in these sectors.

The government in any developing economy like India should take effective measures during these tough situations like the on-going pandemic crisis to soothe the situation and help these sectors by providing financial stimulus and other policies which help these sectors recover swiftly from their current situation and also be prepared to face such calamities in future.

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