Volume:6 Issues: 35 [September, 2021] pp. 26 - 41]
International Journal of Accounting, Finance and Business (IJAFB)
eISSN: 0128-1844
Journal website: www.ijafb.com

HEALTHCARE STOCKS. DEFENSIVE OR SPECULATIVE? EVIDENCE FROM DEVELOPED AND EMERGING MARKETS

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Article history
Received date : 1-7-2021
Revised date : 2-7-2021
Accepted date : 14-8-2021
Published date : 11-10-2021

To cite this document:
Yacob, Nathrah & Abdullah, Melissa (2021). Healthcare Stocks. Defensive or Speculative? Evidence from Developed and Emerging Markets. *International Journal of Accounting, Finance and Business (IJAFB)*, 6 (35), 26 - 41.

Abstract: *Sector rotation identifies the market condition and rebalances the portfolio according to the sustainability of the sectors. During the economy's slowdown, healthcare stocks have always been acknowledged as a component of a diversified portfolio as its features represent a defensive investment. However, is this still applicable during a major crisis like the Covid-19 pandemic? This study aims to examine whether the performance of healthcare stocks can sustain during the current pandemic. This study observed the performance of healthcare indices for the USA, France, Germany, China, India and Malaysia during the year 2020. Employing ARDL and non-linear ARDL, we found that the healthcare stocks of stock exchanges such as the USA, Germany, China and India are still the right candidates to diversify portfolio risk but not for France and Malaysia.*

Keywords: *Covid-19 pandemic, ARDL, NARDL, healthcare stocks, sector rotation strategy.*

Introduction

There were warnings by economic experts regarding possible global economic slowdown since 2018 as several unfortunate events occurred throughout the years, for instance, the trade disputes between the USA, China and Canada where Trump imposed tariffs on several imported products from those countries (dominicru, 2018) coupled with several protests (Rowen, 2016) in Hong Kong against an extradition bill the Chinese government. These events, one way or another, have impacted the global economy. In 2019, several countries had experienced mild recession when the shrinking of domestic growth product reported quarterly. Nevertheless, it was not the peak of the global economic slowdown until the unprecedented novel-coronavirus pandemic made its appearance. The outbreak of this virus, initially called SARS-Cov-2, was reported by Chinese officials in Wuhan City, China, in December 2019 (World Health Organization, 2020a). The WHO declared this outbreak as a pandemic in March 2020 as it had affected more than 114 countries worldwide and killed 4291 lives (World Health Organization, 2020b). As of January 2021, there were 86 million with 1.8 million deaths and the USA and India being at the top of the list with the highest total cases.

Volume:6 Issues: 35 [September, 2021] pp. 26 - 41]
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This pandemic has severely affected major economies' activities as the governments had to call for lockdowns or movement restrictions throughout the nations. These measures had caused businesses to shut down as most of them could not sustain themselves financially in business. The employment rate increased as these firms had to lay off their employees due to the inability to pay for the service rendered. The USA hit the highest unemployment rate in April 2020 at 14.7%, while India peaked at 23.5% in the same month. Hospitality, tourism, and aviation are the most hard-hit by the movement restriction orders, although several financial aids as stimulus packages introduced by the Governments to assist the affected (Nicola et al., 2020). Fortunately, several sectors are still able to sustain this unexpected harsh "economic weather", such as food and beverage, technology, and healthcare. These sectors outperformed other sectors, as evident on 1500 public listed firms in the USA stock exchange examined by Mazur, Dang and Vega (2020).

Regarding the comparison between developed and emerging economies on the impact of Covid-19 on the stock markets, the Asian emerging markets were observed to be badly impacted relatively to their European counterparts. Another study was also examined on China's Hang Seng Index and Shanghai Stock Exchange Composite Index, which observed the negative impact of cases and deaths due to Covid-19 on the stock returns. As to date, many studies have been examining the effect of the pandemic on different markets individually, none by far had observed a comparison between developed and emerging markets specifically on selected sectors in a single paper; hence this study will extend the findings from different studies and identify the magnitude of the impact throughout the year of 2020.

This study is crucial because the outperformance of health care stocks might have appeared to benefit only companies that are directly producing the product to mitigate the spread of the virus, such as the medical equipment or Personal Protective Equipment or the production of the much-awaited vaccines. In contrast, other companies in the same sector suffer like any other sector in the economy.

The main objective of the study includes proving or debunking the well-known sector rotation investment strategy that claims the healthcare sector as a defensive sector that should be included in portfolios to hedge against economic crisis as this sector can weather any business cycles or it is merely a speculation. If it is, does it affect every country? Should the investor be more specific on the nature of each firm when investing? This study investigates multiple pandemic waves that each country experienced in 2020, thus extended existing studies that had only observed for a short period in 2020. This is motivated by the studies done by Ashraf, 2020; Rahman, Amin and Al Mamun (2020) and Topcu and Serkan (2020) reported different momentum of impacts during different sub-period of study on stock market returns. Next, we examine the performance of the healthcare index from six different stock markets, which include the USA, France, Germany, China, Malaysia and India stock exchanges in search for specific nature of the business that outperformed other healthcare companies. These countries are chosen as they contributed to the most number of healthcare companies that are the components of Morgan Stanley Composite Index (MSCI) Healthcare, especially the USA and China. Specifically, in this study, the USA, France and Germany represent the performance of developed countries while China, India and Malaysia represent emerging countries. Finally, we examine the possible variables that influenced the performance of these healthcare sectors. The variables include Covid-19 cases and the macroeconomic data such as the oil price and the exchange rate in daily frequency. We will see whether the performance of the healthcare sectors

Volume:6 Issues: 35 [September, 2021] pp. 26 - 41]
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is driven by the fundamentals or are merely by the unexplained behaviour of the investors. As an antecedent to our analysis, the next section provides background information and empirical findings in the literature review section. Then, Section 3 outlines the data and methodologies in testing. Analysis of results is discussed in Section 4. Finally, Section 5 concludes with the main findings and some concluding remarks.

Literature review

The Covid-19 impact on the volatility of stock markets has been observed to be pervasive than any other health crisis, including the Spanish flu from 1917 to 1918 (Baker, Bloom, Davis, Kost, & Sammon, Marco C. Viratyosin, 2020a). Although in respect to cases, Spanish flu had infected five times more than the current cases of Covid-19, the impact on the stock market returns and volatility was not prevalent. According to Baker *et al.* (2020), one reason for the momentum of impact was the rapid dispersion of information with the high-technology of communication. Information regarding the disease disseminates at a speed of light, thus spills over to the capital markets of the affected countries, and markets have been negatively affected by it. Numerous studies have embarked on analyzing the impact of the pandemic on the stock markets globally; for example, Ashraf (2020) and Rahman, Amin and Al Mamun (2020) examined 64 countries and Australia, respectively. Ashraf (2020), in his study from January until April 2020, has found that all 64 stock markets' returns reacted negatively to the announcement regarding the number of cases; however, the impact declined after a few days of the initial announcement but re-appear stronger after one to two months onward. This observation seems consistent with the findings recorded by Topcu and Serkan (2020) on 26 emerging markets that also seen negative effects of covid-19, but the effect began to taper off in the middle of April 2020. Hence, the first hypothesis of this study tests whether there are different behaviours of the stock market returns during the announcement of new waves of the pandemic.

Hypothesis 1 tests whether the stock markets behave differently during different waves of the pandemic.

This study next will be focusing on the healthcare sector of all six markets. After observing 1500 firms listed on S&P1500 during the stock market crash, Mazur, Dang and Vega (2020) found that the effect did not enlarge, negatively impacting all sectors. The natural gas, food, healthcare, and software stocks have performed better than the rest of the listed firms in terms of stock returns. This observation conforms to the findings by He *et al.* (2020) that from the data extracted from the Shanghai and Shenzhen markets, they observed that healthcare is one of the sectors that are resilient to the crisis. On the other hand, the crude petroleum, real estate, entertainment and hospitality sectors tumble considerably, losing more than 70% of their market capitalizations. The stocks in these sectors appear to move asymmetrically, with extreme volatility observed in March 2020. The strength and weaknesses of the healthcare and pharmaceutical industry have been discussed by Nicola *et al.* (2020). The authors express their concern that the shortage of protective equipment (PPE) worldwide would impose risk to the healthcare workers, thus exposing them to the virus. Consequently, the pharmaceutical companies involved in developing the Covid-19 vaccine, such as Pfizer, Johnson and Johnson and AstraZeneca's revenues, may be affected if the production slowed down, although high demand for the vaccine required worldwide. As the healthcare sector has been reported to display co-movement and long-run relationships among countries of the large economies countries such as the US, UK and Germany (Chen, Chen and Tseng, 2017), it is noteworthy to

Volume:6 Issues: 35 [September, 2021] pp. 26 - 41]
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examine the behaviour and the performance of the healthcare sector during this pandemic to test whether there is a difference of strength of the effect in different Covid-19 pandemic waves.

Thus, for hypothesis 2, we examine whether there is a significant positive effect of the Covid-19 pandemic cases on the healthcare stocks returns.

By acknowledging the importance of including defensive stocks into one's portfolio to minimize portfolio risk, this study intends to search for the determinants that contribute to the sustainability of this sector. Numerous studies are exploring the determinant of the stock market returns in general; however, only scarce information is available that specifically identify the factors that influence the performance of healthcare stocks; hence, this motivates the authors to initiate a thorough analysis in this regard. One of the underpinning theories to support this study was introduced and formulated by Ross (1976) and Roll and Ross (1980), known as arbitrage pricing theory. It extends the capital asset pricing model (CAPM) by incorporating variables from macroeconomic fundamentals, and they were able to prove that these variables were risk-priced factors in generating asset returns. Based on this, more researchers attempted to link all classes of macroeconomic variables such as inflation rate, money supply, GDP growth rate, and industrial output to the pricing of an investment portfolio. However, the failure to observe any significant predictive value in macroeconomic variables to portfolio returns put the basic intuition of the APT at stake. The theory questions whether systematic variability or systematic beta alone affects expected returns – which is the central theme of modern asset pricing theory. Arbitrage pricing theory links specific macroeconomic fundamental variables in explaining the global stock market movement. If these fundamental links prove significant, the theory may well be relevant to modern asset pricing. We shall now discuss previous empirical research that sought to examine fundamental macroeconomic determinants of stock market returns in general and eventually explore others that research about the healthcare sector. Davis and Kutan (2003) examine the impact of inflation and real output on stock volatility in 13 developed and industrialized countries. The volatility measured by generalized autoregressive conditional heteroscedasticity [GARCH (1,1)] and exponential generalized autoregressive conditional heteroskedasticity [EGARCH (1,1)] models were consistent with Schwert (1989)'s findings that the predictive power of macroeconomic volatilities over stock market volatilities was marginal. However, output movement appeared to have predictive power over volatility in three among the sample countries.

Meanwhile, inflation had significant predictive power over a three-month horizon in four of the sample countries. Beltratti and Morana (2002) opposed the widely applied GARCH (p,q) effect in modelling volatility. They contended that unrealistic high projections of future conditional volatility on high current volatility were due to the method of extrapolation that GARCH uses. Another study worthy of mentioning is the findings on the two major stock markets, the US and Japan, by Humpe and Macmillan (2009). By employing the cointegration, the study found long term relationships where both stock markets display positive cointegration with the industrial production index while negatively cointegrated with the money supply. A recent and more comprehensive sectorial study is done on energy, financials, real estate, industrial, healthcare, consumer discretionary, and consumer staples by Bhuiyan and Chowdhury (2020) for both the US and its neighbouring country, Canada. This study thus suggested that all of the macroeconomic variables employed could explain the returns in the US but only observed a single variable, that is, the interest rate, to have influenced the performance of Canadian stock returns. This is consistent with an earlier paper published by Anderson, Balli and Godber

Volume:6 Issues: 35 [September, 2021] pp. 26 - 41]
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(2018), which examined a wide range of economic variables, including balance of payments, unemployment, consumer confidence, consumer price index, consumer production, consumer spending, interest rates, gross domestic product, housing starts, industrial production, personal income, producer price index and retail sales for both the US and EU 22 sectoral- based portfolios. The study compared the economic announcement made in the US and EU on all sectoral-based portfolios thus found that the US economic announcements have a more significant effect on both markets than the economic announcement from the EU region. Therefore, based on all those empirical findings, the third hypothesis will test the impact of exchange rates, oil price and the Covid-19 daily cases on the returns of healthcare stocks.

Hypothesis 3 tests if the exchange rates, oil price, and the Covid-19 daily cases significantly affect the returns of healthcare stocks.

The next section discusses the data and research methodology employed in this study to test the hypotheses outlined in this section.

Data and research methodology

Daily data are extracted from six countries, namely the USA, France, Germany, China, Malaysia and India, for the period of study from January 2020 – December 2020. These countries are chosen as they contribute to the most number of healthcare companies that are the Morgan Stanley Composite World Healthcare index components. Specifically, the USA, France and Germany will represent the performance of developed countries while China, India and Malaysia represent emerging countries. Subsequently, we downloaded the healthcare index of all these countries, the Covid-19 daily cases, the daily real effective exchange rates from the Bank of International Settlement (BIS) website, which measure the relative value of each currency to a basket of 178 countries and the daily price of Brent crude oil being the most contracts traded globally.

According to the official reports, each country's daily Covid-19 cases are being carefully added to the data of the study. The first case reported to the officials in Wuhan City, China, was in December 2019 where it all began. It quickly spread to other parts of the world. While in the US, the first case was reported when a patient seeks medical attention in a hospital on January 20, 2020, with the Covid-19 symptom (ML et al., 2020). First, five cases officially reported in Germany and Europe were on January 24 2020, in Bordeaux, who had arrived from Wuhan, China, followed by Germany's first case on January 27 2020, in Munich. The first case in Malaysia was reported when travellers from China arrived from Singapore on January 25, 2020 (Elengoe, 2020; Shah et al., 2020). Finally, along the timeline, India only officially reported cases on January 30, 2020, when a student from Wuhan was tested positive for the deadly virus (Reid, 2020). Therefore, the data observation for each country in January starts when the case was officially reported, and missing observation is removed to further align with other variables for all countries. For example, although the covid-19 cases are reported daily, the healthcare index is unavailable due to national public holidays and the weekends; hence, the dates are removed from the total observation.

The return of the healthcare index is computed by natural logged the changes of price by using the formula below:

Volume:6 Issues: 35 [September, 2021] pp. 26 - 41]
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$$R_i = LN\left(\frac{P_1}{P_0}\right) \quad (1)$$

Other data such as the Covid-19 cases (Covid), the Brent crude oil price (COP) and the real effective exchange rate (REER) are log-transformed as well for consistency and as an effort to improve normality of the distribution of the data. A descriptive test is run to identify the data distribution and unit root distribution for all the data to determine the stationarity of each time series data following Im, Pesaran and Shin (2003). Next, the correlation of each variable is calculated to determine any co-movements between the variables and achieve confirmation with the eyeball analysis using the charts with regards to the movement of Covid-19 cases and the stock market returns for each country. The analysis resumes with the examination of the nexus between daily cases and the returns of healthcare stocks. For this test, the non-linear autoregressive distributed lags (NARDL) will be applied, given several advantages, as discussed in the following section. This model is selected due to reports found in empirical that had observed changes of momentum of effects from different sentiments of the investors towards the severity of the pandemic cases (Baker, Bloom, Davis, Kost and Sammon, Marco C. Viratyosin, 2020b; Delis, Savva and Theodossiou, 2021). Nevertheless, ARDL (p,q) findings will also be presented in the following section for robustness and comparison.

This section begins with the traditional ARDL (p,q) for modelling the long-run relationships. It holds the advantage that it yields consistent results regardless of whether the underlying variables are integrated of order zero, one, or a mixture of both (Pesaran, Shin, and Smith, 2001; Pesaran and Shin, 1997). However, there is an advantage that ARDL does not consider the asymmetric effects that may exist. Therefore, to overcome the limitation, we apply the improved version of ARDL, which is the non-linear autoregressive distributed lags (NARDL), with our panel data as introduced by Shin, Yu, and Greenwood-Nimmo (2012). The NARDL model is the extension of the conventional ARDL model introduced by Pesaran and Shin (1997) that incorporates the elements of nonlinearity to capture the short and long-run dynamics in the variables of interest. It begins with the unit root test to check for stationarity and the integration level of the variables. Additionally, the appearance of auto-correlation in each variable is also tested. We then specify the following asymmetric long-run equation between the independent variables and the returns of healthcare stocks as following (Shin et al., 2012):

$$RHC_t = \alpha_0 + \alpha_1 \mathrm{cov}_t^+ + \alpha_2 \mathrm{cov}_t^- + \alpha_3 reer_t^+ + \alpha_4 reer_t^- + \alpha_5 oil_t^+ + \alpha_6 oil_t^- + \varepsilon_t \quad (2)$$

RHC is the return of healthcare stocks, *cov* is the Covid-19 cases, and *oil* is the widely used crude oil price, while *reer* is the real effective exchange rate. $\alpha = (\alpha_0, \alpha_1, \alpha_2, \alpha_3)$ is a cointegrating vector or a vector of long-run parameters to be estimated. The positive (+) and negative (–) signs are the partial sums of positive and negative components in the independent variables. This model captures the effects of the Covid-19 daily cases, the exchange rate and oil price in a more flexible structure. We expect that there will be positive relationships between Covid-19 cases and the performance of the healthcare stocks in the long run, which covers the main objective of the current study.

Additionally, as there are six countries with a total of 3 independent variables available in time series, panel data or longitudinal data, which typically refer to data containing time-series observations of several individuals, is the most suitable to be applied. It offers better accuracy in inferring the model's parameter as it contains more degree of freedom and volatility of the sample. Furthermore, it controls the effect of missing or unobserved variables (Hsiao, 2007).

Volume:6 Issues: 35 [September, 2021] pp. 26 - 41]
International Journal of Accounting, Finance and Business (IJAFB)
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Next, the discussion on the findings and their relevance to the previous empirical will be analysed in the following section.

Analysis and discussion

This section begins with the descriptive study on the stationarity of each variable of interest in this study; thus, we examine the existence of unit root using ADF-Fischer Chi-Square. The variables are logged transformed to enhance the normality of the distribution.

Table 1: The panel unit root test results for all variables.

Series	ADF-Fisher Chi-Sq
health	345.39***
Δlhealth	480.17***
lcovid	64.67***
Δ lcovid	220.55***
lreer	6.892
Δ lreer	598.10***
lco	-2.13
Δ lco	-13.92***

Note: Symbols ∗∗∗ significant at 1%, ∗∗ significant at 5% and ∗ significant at 10%. All the variables here are expressed in natural logs. The values in the parenthesis are the t-statistics of corresponding coefficients.

Table 1 examines the existence of unit root for each of the variables. It is shown that all variables at levels reject the hypothesis of the existence of unit root except for the exchange rate and the crude oil price. We calculate the variables at the first difference with this finding, thus removing unit root in all variables for further investigation in the following section. The next step involves observing the movement of the main stock market indices for all six countries and the daily cases of Covid-19.

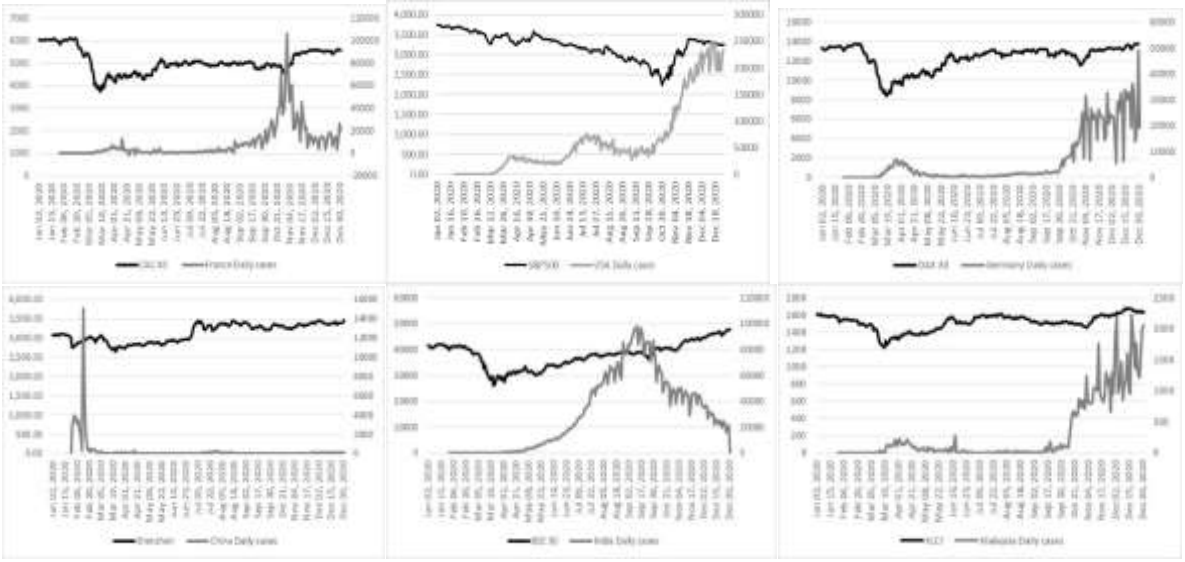

Figure 1: The movement of the stock market indices and daily cases of Covid-19 from January to December 2020

Volume:6 Issues: 35 [September, 2021] pp. 26 - 41]
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Note that the primary Y-axis represents the price of the stock market index, and the secondary Y-axis represents the number of Covid-19 cases in units. S&P500, CAC 40, DAX 30 are the major stock market indices for NYSE, PSE and FSE, respectively. Shenzhen, BSE30 and KLCI represent the major stock market indices for China's SSE, India's Sensex and Bursa Malaysia, respectively.

Figure 1 displays the significant changes of all stock market indices that correlate with daily cases. It is observed that all indices except for the Shenzhen index display volatilities throughout the whole year of 2020, especially during the beginning of the first wave in March 2020. Mazur, Dang and Vega (2020) reported that DJIA plunged by 6400 points amid the fears of the financial implications of the pandemic globally, and this was not the only market that has been affected. A similar impact has been observed for all major stock markets as written by Campbell (2020) given the plunge of the MSCI World index over the same period in March 2020, specifically, post announcement of WHO on the Covid-19 as a global pandemic on March 11. Next, to seek confirmation on the charts displayed in Figure 1, we calculate the correlations between all indices and the daily Covid-19 cases for the six sample countries and present them in Table 2.

Table 2: correlations between all indices and the daily Covid-19 cases for USA, France, Germany, China, India and Malaysia.

	S&P500	CAC40	DAX 30	SHEN ZHEN	BSE 30	KLCI	USA CASES	FRA CASES	GERM CASES	CHI CASES	IND CASES
CAC40	0.289***	1									
(t-stat)	4.358	-----									
DAX30	-0.153**	0.852***	1								
(t-stat)	-2.233	23.45	-----								
SHENZHEN	-0.542***	0.364***	0.692***	1							
(t-stat)	-9.295	5.643	13.815	-----							
BSE30	-0.148**	0.807***	0.855***	0.744***	1						
(t-stat)	-2.16	19.686	23.759	16.051	-----						
KLCI	-0.074	0.781***	0.917***	0.741***	0.845***	1					
(t-stat)	-1.069	18.04	33.193	15.92	22.82	-----					
USA CASES	-0.58***	-0.505***	-0.113	0.429***	-0.085	0.013	1				
(t-stat)	-10.28	-8.427	-1.645	6.859	-1.227	0.189	-----				
FRAN CASES	-0.671***	-0.497***	-0.147**	0.424***	-0.018	-0.082	0.92***	1			
(t-stat)	-13.053	-8.265	-2.138	6.759	-0.265	-1.188	33.58	-----			
GERM CASES	-0.556***	-0.489***	-0.203***	0.393	-0.009	-0.087	0.92***	0.956***	1		
(t-stat)	-9.637	-8.093	-2.989	6.163	-0.125	-1.257	34.22	47.31	-----		
CHI CASES	0.076	0.152**	0.096	-0.009	0.159**	0.064	-0.08	-0.061	-0.008	1	
(t-stat)	1.094	2.216	1.393	-0.138	2.319	0.931	-1.16	-0.883	-0.122	-----	
IND CASES	-0.706***	-0.300***	0.186***	0.622***	0.112	0.25***	0.93***	0.836***	0.782***	-0.11	1
(t-stat)	-14.384	-4.539	2.726	11.468	1.633	3.703	35.22	21.98	18.105	-1.599	-----
MALAY CASES	-0.394***	-0.232***	-0.072	0.304***	0.157**	0.029	0.73***	0.782***	0.842***	-0.025	0.599***
(t-stat)	-6.176	-3.442	-1.036	4.61	2.294	0.413	15.414	18.08	22.48	-0.367	10.807

Note: Symbols ∗∗∗ significant at 1%, ∗∗ significant at 5% and ∗ significant at 10%. All the variables here are expressed in natural logs. The values in the parenthesis are the t-statistics of corresponding coefficients.

Volume:6 Issues: 35 [September, 2021] pp. 26 - 41]
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An interesting finding is observed from Table 2, where the growth of Covid-19 cases has significantly affected the stock market returns for developed countries such as the USA, France and Germany with negative relationships, as reported by Ashraf (2020) and Mazur et al. (2020). However, the contrary is evident from emerging countries where the movement of cases showed no significant impact on the stock market returns, which contradicts the findings by other researchers such as Topcu & Serkan (2020). Hence, we analyze further and discuss in the following section to find the possible reasons for this inconsistency. Due to the asymmetric effects of daily cases reported on the performance of healthcare returns, the non-linear ARDL is employed on the data, and as a comparison, the linear ARDL is displayed in Table 3. The analysis will be discussed in the following section.

Table 3: ARDL (p,q) and NARDL (p,q) models for developed and emerging countries

Variables	USA	France	Germany	China	India	Malaysia
Panel A:						
ARDL (p,q)						
Short-run estimates						
$d(lcovid_t)$	-0.01***		-0.006***		-0.01**	0.003
	(-2.767)		(-2.944)		(-2.522)	(1.024)
$d(lcovid_{t-1})$	-0.007*		-0.007***		-0.012***	-0.002
	(-1.961)		(-2.894)		(-2.638)	(-0.605)
$d(lcovid_{t-2})$	-0.001		-0.004		-0.008*	0.005*
	(-0.357)		(-1.649)		(-1.677)	(1.783)
$d(lcovid_{t-3})$	-0.008**		-0.006***		-0.013***	
	(-2.113)		(-2.946)		(-2.799)	
$d(lcovid_{t-4})$	0.003				-0.007**	
	(0.831)				(-2.036)	
$d(lcovid_{t-5})$	-0.005					
	(-1.236)					
$d(lcovid_{t-6})$	0.009**					
	(2.324)					
$d(loil_t)$		0.032	0.0344	0.087***	0.068***	0.051
		(1.352)	(1.338)	(3.231)	(2.703)	(1.304)
$d(loil_{t-1})$				-0.0187	0.0485*	0.026
				(-0.679)	(1.924)	(0.690)
$d(loil_{t-2})$				0.051**		0.028
				(1.921)		(0.722)
$d(loil_{t-3})$				0.047*		0.117***
				(1.782)		(3.018)
$d(lreer_t)$	0.381	-0.726	-0.262	-1.016**	-1.381***	
	(1.019)	(-1.018)	(-0.2959)	(-2.042)	(-3.706)	
$d(lreer_{t-1})$	-1.119***	-2.116***	-1.973**	0.91*		
	(-3.004)	(-3.122)	(-2.299)	(1.813)		
$d(lreer_{t-2})$	0.054	-2.189***	-2.376***			
	(0.153)	(-3.179)	(-2.777)			
$d(lreer_{t-3})$	0.188	-0.959				
	(0.567)	(-1.428)				
$d(lreer_{t-4})$	-0.202					
	(-0.621)					
$d(lreer_{t-5})$	1.04***					
	(3.229)					

Volume:6 Issues: 35 [September, 2021] pp. 26 - 41]
International Journal of Accounting, Finance and Business (IJAFB)
eISSN: 0128-1844
Journal website: www.ijafb.com

Panel B:						
Long-run estimates						
$lcovid_{t-1}$	0.001	1.00E-04	0.0006	0.0012	-0.001	-0.002*
	(1.437)	(0.046)	(0.599)	(1.553)	(-1.534)	(-1.957)
$loil_{t-1}$	0.0057	-0.011**	-0.005	-0.006	-0.017**	-0.012
	(0.558)	(-2.468)	(-0.687)	(-1.089)	(-2.762)	(-1.219)
$lreer_{t-1}$	0.102	0.04	-0.082	-0.044	-0.103	(-0.239)
	(1.338)	(0.353)	(-0.284)	(-0.433)	(-0.908)	(-0.986)
Bound test	18.47***	65.07***	65.08***	21.04***	17.32***	37.58***
Cointegrated equation	-1.249***	-1.161***	-1.116***	-1.027***	-0.869***	-0.839***
Panel C:						
Non-Linear ARDL (p,q)						
Short-run estimates						
$d(lcovid)_{+}$	-0.009		-0.0074*		0.002	0.001
	(-1.397)		(-1.886)		(0.485)	(0.219)
$d(lcovid)^{+}_{t-1}$	-0.009		-0.008*		-0.028***	-0.014***
	(-1.149)		(-1.867)		(-4.065)	(-3.079)
$d(lcovid)^{+}_{t-2}$	0.0001		-0.008*		-0.0118*	0.011**
	(0.0146)		(-1.875)		(-1.833)	(2.461)
$d(lcovid)^{+}_{t-3}$	-0.015***		-0.004		-0.0321***	
	(-2.058)		(-1.195)		(-4.987)	
$d(lcovid)^{+}_{t-4}$	-0.0124		-0.005*		-0.0067	
	(-1.653)		(-1.763)		(-1.5152)	
$d(lcovid)^{+}_{t-5}$	-0.018**					
	(-2.423)					
d(lcovid)-			-0.003	0.003	-0.024***	0.01
			(-0.806)	(1.250)	(-3.351)	(1.817)
$d(lcovid)^{-}_{t-1}$			-0.013***	0.001	-0.017**	0.014**
			(-2.766)	(0.355)	(-2.405)	(2.363)
$d(lcovid)^{-}_{t-2}$			-0.005	0.002	-0.038***	
			(-0.974)	(0.882)	(-4.485)	
$d(lcovid)^{-}_{t-3}$			-0.012**	0.007***	-0.016**	
			(-2.438)	(3.041)	(-2.331)	
$d(lcovid)^{-}_{t-4}$					-0.027***	
					(-4.488)	
$d(leer)^{+}$	0.5188	-2.672**	-1.417		-2.897***	-0.809
	(0.762)	(-2.288)	(-0.912)		(-4.688)	(-1.387)
$d(leer)^{+}_{t-1}$	-3.66***	0.3081	-1.003			
	(-5.69)	(0.259)	(-0.657)			
$d(leer)^{+}_{t-2}$	-1.906***	-2.836***	-3.753**			
	(-2.917)	(-2.666)	(-2.473)			
$d(leer)^{+}_{t-3}$	-1.212*	-1.492				
	(-1.862)	(-1.440)				
$d(leer)^{+}_{t-4}$	0.829					
	(1.327)					
$d(leer)^{+}_{t-5}$	0.826					
	(1.421)					
$d(leer)^{-}$	0.895	0.677	0.439	-1.373*		0.208

Volume:6 Issues: 35 [September, 2021] pp. 26 - 41]
International Journal of Accounting, Finance and Business (IJAFB)
eISSN: 0128-1844
Journal website: www.ijafb.com

	(1.546)	(0.478)	(0.239)	(-1.655)		(0.496)
$d(leer)^{-}_{t-1}$	-0.552	-4.534**	-3.799**			
	(-0.937)	(-3.202)	(-2.116)			
$d(leer)^{-}_{t-2}$	-0.864		0.382			
	(-1.499)		0.2179			
$d(leer)^{-}_{t-3}$	-0.429		-0.888			
	(-0.747)		(-0.542)			
$d(leer)^{-}_{t-4}$	-1.971***		1.695			
	(-3.525)		(1.057)			
$d(leer)^{-}_{t-5}$			-1.611			
			(-1.009)			
$d(leer)^{-}_{t-6}$			-4.465***			
			(-2.878)			
$d(loil)^{+}_{t}$	0.11**		0.121	0.139***	0.0824*	0.049***
	(2.398)		2.554**	(2.989)	(1.666)	(2.364)
$d(loil)^{+}_{t-1}$	0.08*		-0.113	-0.076*		
	(1.929)		-2.396**	(-1.670)		
$d(loil)^{+}_{t-2}$	-0.068		(0.016)	0.041		-0.01
	(-1.541)		0.3524	(0.887)		(-0.739)
$d(loil)^{-}_{t-3}$				0.085*		
				(1.857)		
$d(loil)^{-}_{t}$					0.089**	
					(2.113)	
$d(loil)^{-}_{t-1}$	-0.009		0.092	`	0.069*	
	(-0.190)		(2.132)		(1.802)	
$d(loil)^{-}_{t-2}$	-0.115**		-0.023			
	(-2.544)		(-0.525)			
$d(loil)^{-}_{t-3}$	-0.051		-0.062			
	(-1.153)		(-1.479)			
$d(loil)^{-}_{t-4}$	-0.054		-0.078*			
	(-1.281)		(-1.842)			
$d(loil)^{-}_{t-5}$	-0.163***		-0.091**			
	(-3.886)		(-2.192)			
Panel D						
Model: NARDL (p,q) - Long run						
$lcovid^{+}_{t}$	-0.003*	0.0012				
	(-1.936)	(0.8196)				
$lcovid^{+}_{t-1}$			0.003**	0.002*	0.006*	0.0017
			(2.015)	(1.809)	(3.461)	(0.813)
$lcovid^{-}_{t}$		0.002				
		(1.277)				
$lcovid^{-}_{t-1}$	0.006***		0.004**	0.003**	0.003	0.002
	(3.016)		(2.279)	(2.566)	(1.157)	(0.946)
$loil^{+}_{t}$						0.049**
						(2.364)
$loil^{+}_{t-1}$	0.038**	-0.004	0.042**	0.028**	-0.025**	

Volume:6 Issues: 35 [September, 2021] pp. 26 - 41]
International Journal of Accounting, Finance and Business (IJAFB)
eISSN: 0128-1844
Journal website: www.ijafb.com

	(2.469)	(-0.371)	(2.009)	(2.189)	(-2.474)	
$loil^{-}_{t}$				-0.001		-0.011
				(-0.074)		(-0.739)
$loil^{-}_{t-1}$	0.092***	-0.014**	0.019		0.036*	
	(4.571)	(-2.229)	(1.543)		(1.863)	
$lreer^{+}_{t}$						-0.808
						(-1.387)
$lreer^{+}_{t-1}$	2.029***	0.033	0.1244	0.064	-0.276*	
	(6.398)	(0.132)	(0.301)	(0.392)	(-1.779)	
$lreer-_{t}$					-0.414**	0.2079
					(-2.395)	(0.496)
$lreer-_{t-1}$	0.771***	0.118	0.7154			
	(4.703)	(0.257)	(1.565)			
Bound test	17.98***	36.75	36.42***	11.68***	48.962***	21.36***
Co-integration	-1.889***	-1.150***	-1.165***	-1.170***	-1.235***	-0.844***
Heteroskedasticity	47.388*	20.584	45.91*	21.52	30.17*	110.06**
Autocorrelation	0.133	1.808	0.493	2.046	0.158	0.033

Note: Symbols ∗∗∗ significant at 1%, ∗∗ significant at 5% and ∗ significant at 10%. The values in the parenthesis are the t-statistics of corresponding coefficients. The superscript "+" and "-" indicate positive and negative changes, respectively.

Panel A of Table 3 displays the dynamic effects of the daily Covid-19 cases on the movement of the healthcare returns. It is noteworthy that three out of five sample countries show significant negative impacts, in contemporaneous and with lagged effects. The countries are the USA, Germany and India, with India having the power to forecast the healthcare returns up to 4 days in advance. This support the findings by Mishra, Rath and Dash (2020) that concluded all indices traded on the Bombay Stock Exchange show severe negative impact and high volatility of the main stock market index relative to other significant economic events in India. However, the result of this study contradicts their findings whereby a positive impact with lower volatility of healthcare stock returns was found due to improved demands of healthcare products during the pandemic in the year 2020. This could be because of a shorter period of studies that covers up to April 2020, where it was the peak of the first wave of the pandemic and the panic sentiment was intense. Being on the top of the rank in terms of a total number of cases, the USA has shown significant negative effects from the daily cases as well; however, not as strong as the effects in India and eventually dissipates with lagged effects. Over the long run (Panel B), it seems that the effects have disappeared for all countries except for Malaysia, although there are suggestions that all of these countries' variables may co-integrated in the long run as suggested by the cointegration's coefficients.

A detailed study is then employed to identify any dynamic asymmetric effects and the findings illustrated in Panel C table 3. It is quite obvious that after the effect of asymmetrical have been taken into account, we see the significant difference of daily cases movement to the healthcare returns. Thus, this explains why several countries have not shown any significant association between the variables with the notion of symmetric effect. Germany and India both display significant effects of the association between daily cases and healthcare stocks in two different cases; therefore, we can conclude there are asymmetric effects between them for these countries. Additionally, countries except France and Malaysia have shown an overall effect during the decline of daily cases to the healthcare returns than during the increase of daily cases

Volume:6 Issues: 35 [September, 2021] pp. 26 - 41]
International Journal of Accounting, Finance and Business (IJAFB)
eISSN: 0128-1844
Journal website: www.ijafb.com

with positive impact. These results completely have reversed from the findings in Panel C, where negative effects are observed, thus have contradicted previous studies on selected countries such as India and China (Mishra et al., 2020; Schell, Wang, & Huynh, 2020; Sun, Bao, & Lu, 2021). The final models are tested with bound test, autocorrelation, and heteroscedasticity to achieve a parsimonious model, obtaining the results' accuracy. This section continues with the insights of the three healthcare sectors from the major stock exchanges of the largest economies in the world as issued by the MSCI.

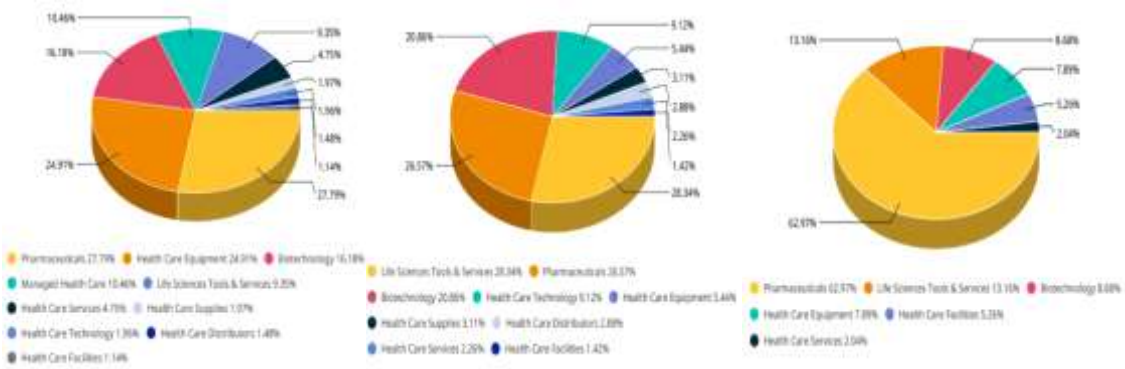

Figure 2: The sub-industry weights of MSCI Healthcare USA, China and India portfolios. Source: MSCI.com

Referring to figure 2, there seems to be a consistent component of sub-sectors included in the index with the largest contributes by the pharmaceutical sub-sector for the USA and India; however, it falls as the second-largest contributor for MSCI healthcare China. These sub-sectors are also impacted during the pandemic. The issues, which include the high demand for drugs and supply shortage of active pharmaceutical ingredients (API) due to a slowdown in production, have positively boosted the companies' revenues. Hence, it may explain the positive performance of these sectors in those countries.

Conclusion

Conventionally, the sector rotation strategy across the business cycle is a well-known investment "mantra" among investors. Following this strategy, when the economy contracts, the healthcare, food and beverage sectors should be included in a portfolio to reach diversification. The findings from this study suggest that for several stock markets such as the USA and Germany from developed economies, China and India, the two of the largest emerging economies, demonstrate positive effects of the Covid-19 pandemic on the healthcare stocks returns. During the economic contraction, healthcare sectors may prove to be the defensive sector that could weather any kind of economic conditions; hence should remain to be one of the candidates to diversity ones' portfolios. These findings are significant to international portfolio managers or personal investors with the aim to minimize the risk of their investments while possibly try to reach optimize returns. However, this study has limitations which more specific answers can be obtained in the future for each market, especially for stock markets such as France and Malaysia, where we have observed an insignificant pandemic to the sectors in those markets, which contradict the famous investment strategy. Therefore, we suggest that more studies should be done to identify the causes of differences in the performance of the healthcare stocks between the sample countries. Moreover, windows of event studies should be introduced to identify differences of effects during different phases of the pandemic throughout the year 2020 until the most recent 2021.

Acknowledgement
We would like to extend gratitude to MSCI, Inc. for providing us with the data on MSCI Healthcare index China, which contributed significantly to the completion of this research.

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