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HOW COVID-19 AFFECTED MOROCCAN STOCK MARKET? AN EMPIRICAL INQUIRY

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ABSTRACT

In this study, we explored how COVID-19 influenced Morocco's stock market by employing an ARDL (Autoregressive Distributed Lag) model. We used daily series data collected from March 5, 2020, to June 30, 2021, as the dataset in this study. Results showed that, in the long run, an increase in new cases and deaths adversely affected the stock market. Furthermore, controlled variables such as the exchange rate had a negative influence on the Moroccan stock market, whereas Standard & Poor's had a positive impact. Our findings are important for policymakers, governmental authorities, and investors as they shed light on how emerging stock markets, such as Morocco's, responded during periods of uncertainty.

Keywords: Morocco, ARDL model, stock market, Covid-19, cointegration

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1. INTRODUCTION

Covid-19 was first detected in Wuhan, China, in December 2019. By March 2020, the World Health Organization (WHO) had officially designated it a global pandemic and the most significant crisis of the century. Its impact extended beyond health and public safety, deeply affecting various aspects of societies, economies, and financial markets worldwide (Al-alawnh et al., 2023; Yu et al., 2022). Numerous research findings indicate that stock markets demonstrate swift and substantial reactions to major occurrences (Onyeaka et al., 2021; Robinson, 2021). This paper focuses on exploring and analyzing the specific repercussions of the pandemic on the Moroccan stock market.

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The Casablanca Stock Exchange, like many other stock markets worldwide, is not isolated but interconnected with the global economy. This means that the state of the global economy significantly impacts how well it performs. Changes in global trade, geopolitical events, shifts in commodity prices, and international financial policies can all have an immediate impact on the Casablanca Stock Exchange (Al Janabi, 2006; Belcaid & El Ghini, 2021). Therefore, when attempting to contextualize the influence of the COVID-19 epidemic on the Moroccan stock market, it is essential to have a solid understanding of Morocco's financial environment as well as the country's position in the global economy. The Casablanca Stock Exchange is the most important venue in Morocco for trading various assets (Lahmiri & Bekiros, 2020). It is the most important stock market in the country; therefore, it plays a critical role in the process of raising cash, easing the way for investments, and encouraging the expansion of enterprises (Hassan et al., 2021). The Casablanca Stock Exchange lists companies from a wide variety of industries. Some of these industries include banking, telecommunications, energy, and consumer products (Bouhlal & Sedra, 2022). Its performance reflects the general health and sentiment of the Moroccan economy, and it has the potential to impact investors' confidence and decision-making.

Morocco, as one of the major emerging economies in North Africa, was not immune to the effects of the COVID-19 pandemic (Urom et al., 2023). The country faced a unique set of challenges as it grappled with the economic disruptions and uncertainties caused by the virus's spread. In particular, the measures implemented to contain the virus, such as lockdowns, travel restrictions, and social distancing guidelines, severely impacted business operations and consumer behavior (Mehdi et al., 2022). Due to these challenges, the Casablanca Stock Exchange, which represents the Moroccan stock market, experienced a substantial decline in stock prices (Bouzid Khalil, 2021). The disruption of investor confidence led to steep declines in stock prices across multiple industries. The uncertainty surrounding the pandemic's duration and economic consequences exacerbated the market's instability (Fadali & Bakir, 2021). Figure 1 depiction of the Moroccan stock index serves as an example of this situation because it shows a significant 32% decline in the index during the first quarter of 2020 and a subsequent gradual recovery. This decline is indicative of the immediate impact of the COVID-19 pandemic on the Moroccan stock market, highlighting how the market responded to the various challenges posed by the crisis.

This paper endeavors to explore and analyze the specific impact of the COVID-19 pandemic on the Moroccan stock market's performance, focusing on how it affected stock prices on the Casablanca Stock Exchange in both the short and long term. This study aims to provide valuable insights into the market's responsiveness within an emerging economy. Doing so contributes to a deeper understanding of the resilience and adaptability of the Moroccan economy when confronted with global shocks like the COVID-19 pandemic. Furthermore, this study can potentially inform policymakers and investors in their decision-making processes. The study adopts a comprehensive approach to examine the relationship between pandemic indicators and Casablanca Stock Exchange (CSE) performance. Specifically, it utilizes the Autoregressive Distributed Lag (ARDL) model, which is well-suited for analyzing both short-term and long-term dynamics between variables. The goal is to shed light on the lasting effects of the pandemic on the Moroccan stock market, providing insights that can be invaluable for navigating uncertainties and future crises.

The knowledge gained from this study may play a pivotal role in shaping policies to mitigate risks and strengthen resilience in emerging financial markets and economies. Policymakers, businesses, and investors can use the findings to develop more robust strategies and measures to manage risks, promote stability, and foster economic resilience in the face of unpredictable and challenging circumstances, drawing from the analysis of the COVID-19 pandemic's long-term and short-term impacts on the Moroccan stock market using the Autoregressive Distributed Lag (ARDL) model.

2. LITERATURE REVIEW

Grasping the relationship between COVID-19 and stock markets is of paramount importance when it comes to making informed decisions in the realms of global finance, monetary policies, and investment strategies. This section reviews relevant studies concerning the correlation between COVID-19 and stock markets. To review the study on the impact of COVID-19 on the stock market, the study included a review of several relevant studies such as Mugiarni and Wulandari (2021); Singh et al. (2020); Topcu and Serkan (2020); Lee et al. (2020); Boumlik et al. (2023); Fakhfekh et al. (2020); Harabida and Radi (2020); Bouzid Khalil (2021).

Mugiarni and Wulandari (2021) investigation was to determine whether the COVID-19 epidemic had any impact on stock returns on the Indonesia Stock Exchange. The study utilized Indonesian stock return data from January 2 to December 31, 2020, incorporating daily data on confirmed COVID-19 cases and fatalities. The study's findings were derived using a panel-data regression model. The research findings indicate that stock returns on the Indonesia Stock Exchange responded unfavorably and significantly to the escalation of confirmed COVID-19 cases and the daily rise in mortality cases. Additionally, the analysis highlighted that the sectors most adversely affected by the COVID-19 pandemic were the consumer products and primary chemical industries in terms of stock returns.

A study by Singh et al. (2020) examines the impact of COVID-19 on stock markets in the G-20 countries. Using panel data regression, the authors conducted an event study to quantify abnormal returns and elucidate their underlying factors. The study sampled indexes from the G-20 nations, focusing on a 58-day period following the release of news about the COVID-19 outbreak, with a preceding estimation window of 150 days. Within this 58-day period, four sub-event windows exhibited statistically significant negative abnormal returns. These negative abnormal returns were observed across both developing and developed nations. Additionally, the panel data analysis affirms the stock market's subsequent recovery from the impact of COVID-19.

Furthermore, Topcu and Serkan (2020) examined the effects of COVID-19 on emerging stock markets from March 10 to April 30, 2020. By mid-April, the pandemic's adverse effects on emerging stock markets began to diminish. Furthermore, the research revealed that the timing of government responses and the magnitude of stimulus packages played a crucial role in shaping the consequences of the epidemic. Among the emerging markets, Asian developing markets experienced the most significant impact, while European emerging markets were relatively less affected by the pandemic. Additionally, Lee et al. (2020) aimed to investigate the impact of COVID-19 on Malaysia's stock market. The research used the KLCI (Kuala Lumpur Composite Index) and 13 sector-specific indexes as dependent variables. The study's data spanned from

December 2019 to April 2020. A study observed that an increase in COVID-19 cases in Malaysia had a detrimental effect on both the KLCI and all sector-specific indexes, except for the REIT (Real Estate Investment Trust) index. Additionally, the performance of the Malaysian stock market was influenced by the Brent oil price and the volatility index.

According to, Boumlik et al. (2023) examine the dividend policies of publicly-traded Moroccan companies listed on the Casablanca Stock Exchange, particularly in light of the COVID-19 pandemic. Utilizing panel data analysis spanning from 2015 to 2021 and focusing on non-financial corporations, it becomes evident that the prevalence of dividend reductions peaked during the initial phases of the crisis. Furthermore, results obtained from ordinary least squares (OLS) regressions reveal that the COVID-19 shock has had an adverse impact on the dividend payments of Moroccan-listed firms. This study suggests that during periods of economic turmoil, Moroccan businesses tend to adopt a risk-averse approach by prioritizing revenue preservation over dividend distributions. Consequently, they miss the opportunity to convey positive signals to investors and external stakeholders. The study's findings also indicate that various factors, including profitability, growth potential, leverage, and company size, influence corporate dividend policies.

Fakhfekh et al. (2020) examine the impact of COVID-19 on Moroccan sectoral stock indexes. To achieve this, the researchers employed two regression models, with a dummy variable representing the onset of COVID-19. The researchers collected data from the Casablanca stock market, spanning 22 different industries, from January 2017 to December 2021. Additionally, the study assessed performance metrics such as the Sharp ratio and the Treynor ratio, along with risk measures like CVaR and Beta, for each unique sector before and after the onset of COVID-19. Moreover, the study employed a GARCH model to emphasize conditional variance and the increased volatility in the selected stock indexes during this period. The findings enabled the categorization of industries into two samples: sample 1, adversely affected, and sample 2, benefiting from the COVID-19 pandemic. Conditional variance analysis revealed that COVID-19 substantially increased volatility across all sectors, albeit temporarily. However, the degree of this impact on volatility varied not only between the two samples but also among different sectors.

Moreover, Harabida and Radi (2020) examine the effect of the pandemic's spread on the Moroccan financial market during the period from February 24, 2020, to May 5, 2020, with the event date being March 16, 2020, which marks Morocco's declaration of a state of health emergency. The research employs the event study methodology to assess how the stock prices of companies listed on the Casablanca Stock Exchange reacted during this period. This methodology calculates the daily abnormal returns of each company and aggregates them over an event window to determine their statistical significance. The study's findings confirm the detrimental impact of the COVID-19 pandemic on the Moroccan financial industry. Study observed that market responses were more pronounced within shorter event windows, particularly in the days leading up to the event, and less significant in longer event windows. Khalil (2021) study delves into the response of the Casablanca Stock Exchange to the COVID-19 pandemic, with a specific focus on examining the spillover effects of COVID-19 cases and deaths in five selected countries, including Morocco. The analysis spans from June 13, 2019, to June 11, 2020. To investigate this, the study employs the "VAR-X model" (vector autoregression models with exogenous variables), which assesses how the returns of industry indices on the Casablanca Stock Exchange (considered endogenous variables) react to the presence of COVID-19 cases and fatalities (considered exogenous variables). The empirical

data show significant spillover effects on the returns of the majority of industry indices, demonstrating that the epidemiological conditions present in other countries are impacting on the Casablanca Stock Exchange.

Building upon previous research, it is widely acknowledged that the global financial markets experienced a negative impact due to the COVID-19 pandemic. While some studies have investigated the negative effects of COVID-19 on the Moroccan stock market, this study examines how COVID-19 has influenced Morocco's financial landscape. It examines the effects of COVID-19 on the Moroccan stock market by taking into account new cases and fatalities, thereby confirming and expanding upon earlier research findings. In summary, this study broadens the scope of the current literature by considering both the short-term and long-term dynamics of stock markets in Morocco during the COVID-19 pandemic. In doing so, it offers valuable insights that help us understand the multifaceted consequences of global crises on emerging markets, thereby enhancing our knowledge in this field.

3. DATA AND EMPIRICAL FRAMEWORK

3.1 Variables and Sample

This research utilizes a dataset of daily time series data collected from March 23, 2020, to June 30, 2021, sourced from eikon.refinitiv.com. We obtained two independent variables, namely new cases and new deaths, from ourworldindata.org. These variables represent the daily counts of new COVID-19 cases and deaths in Morocco. Additionally, several control variables were incorporated into the analysis, including the exchange rate from eikon.refinitiv.com, S&P 500 data sourced from Yahoo Finance, and Brent crude oil data obtained from eikon.refinitiv.com.

The exchange rate was included as a control variable in the model used for the impact of COVID-19 on the stock market. By incorporating the exchange rate as a control variable, we can better comprehend the specific effects of COVID-19 on the stock market's performance while also considering the influence of exchange rate fluctuations. Additionally, Mensi et al. (2021) indicated that Morocco is an importer of oil, which is significant to consider. Consequently, fluctuations in global oil prices have the potential to exert an influence on the Moroccan stock market. This is primarily because as global oil prices rise, Morocco's import expenses also increase, leading to an impact on the nation's trade balance and overall GDP. This, in turn, can result in diverse effects on energy-related companies and sectors listed on the Moroccan stock market. Including the S&P 500 index as a control variable in research can prove beneficial for a more comprehensive analysis of how external factors might influence the Moroccan stock market.

We utilized a predefined mathematical procedure that involves transforming the original variables into their logarithmic equivalents. Following the approach proposed by Busse and Hefeker (2007), $\log y_t = \log\left[y_t + \sqrt{(y_t^2 + 1)}\right]$. This transformation preserves the relative order of values and simulates the conventional logarithmic transformation for positive numbers. However, it behaves in a linear fashion near zero, enabling it to handle zero values effectively. Consequently, no data

points are excluded when applying this transformation (Akhtaruzzaman et al., 2018; Burbidge et al., 1988; Busse & Hefeker, 2007).

3.2 Unit Root Tests

The Autoregressive Distributed Lag (ARDL) approach offers several advantages when compared to alternative cointegration methods. ARDL is a statistical technique employed to estimate the parameters of a model. It proves particularly useful when the model comprises both stationary (I(0)) and non-stationary (I(1)) variables, signifying variables that either maintain a constant mean over time or do not. We test the variables included in the model using the ADF test. This refers to the data in its original form, without any transformations. Conversely, taking the first difference of a variable involves subtracting each observation from its preceding observation. The first difference is used to remove trends or non-stationarity in the data.

3.3. Correlation Matrix

We present the results of the correlation matrix as a preliminary step before employing the ARDL model to further investigate these interrelationships in our research. The correlation matrix results also show a linear relationship between the variables, with values ranging from 1 to -1. This gives a strong foundation for using the ARDL model.

3.4. Results of Lag Length

To estimate the ARDL (Autoregressive Distributed Lag) model, the study employed the vector autoregression (VAR) model to determine the appropriate lag length for the model. We accomplished this selection by applying three commonly used information criteria: the Akaike Information Criterion (AIC), the Schwartz Criterion (SC), and Hannan-Quinn (HQ). This analysis aimed to pinpoint the most suitable lag order that effectively captures the most accurate relationships and dynamics among the variables.

3.5. The Estimating Model

The purpose of this study is to examine the influence of COVID-19 on the stock market. A study estimated a simple modality for the effect of COVID-19 on the stock market based on several other studies (see Al-Alawnh et al., 2024; Dreger & Gros, 2021; Habibullah et al., 2021; Habibullah et al., 2022; Obiakor et al., 2022; Safuan et al., 2022).

$$sm_t = \upsilon_0 + \upsilon_1 new\ cases_t + \upsilon_2 new\ deaths_t + \upsilon_3 Z_t + \varepsilon_t \quad (1)$$

Whereby the variables are dependent variable (Casablanca Stock Exchange for Morocco), independent variables (new cases for Morroco, and new deaths for Morroco), and the control variables such as exchange rate, Brent crude oil, and S&P 500. Moreover, the study used the ARDL model to determine a long-term and short-term relationship. Pesaran et al. (2001) were the ones who initially introduced the idea of short-run and long-run. The study can derive this from the short-run ARDL based on Equation (1).

$$sm_t = \Theta_0 + \sum_{i=1}^{n} \Theta_{1i}\, sm_{t-i} + \sum_{i=0}^{n} \Theta_{2i}\, new\ cases_{t-i} + \sum_{i=0}^{n} \Theta_{3i}\, new\ deaths_{t-i} + \sum_{i=0}^{n} \Theta_{4i}\, Z_{t-i} + \omega_t \quad (2)$$

We can derive the following long-term model from Equation (1) to estimate the long-run model for ARDL, which can be deduced from Equation (2),

$$sm_t = \upsilon_0 + \upsilon_1\, new\ cases_t + \upsilon_2 new\ deaths_t + \upsilon_3 Z_t + \varepsilon_t \text{ with } \upsilon_0 = \frac{\Theta_0}{1-\sum \Theta_{1_i}},\ \upsilon_1 = \frac{\sum \Theta_{2_i}}{1-\sum \Theta_{1_i}},\ \upsilon_2 = \frac{\sum \Theta_{3_i}}{1-\sum \Theta_{1_i}} \text{ and } \upsilon_3 = \frac{\sum \Theta_{4_i}}{1-\sum \Theta_{1_i}}. \quad (3)$$

By utilizing the residuals obtained from the long-term model, the authors can also assess the presence of cointegration within the short-term ECM model,

$$\Delta\, sm_t = \gamma_0 + \sum_{i=1}^{m} \gamma_i \Delta\, sm_{t-i} + \sum_{i=0}^{m} \gamma_{2i} \Delta\, new\ cases_{t-i} + \sum_{i=0}^{m} \gamma_{3i} \Delta\, new\ deaths_{t-i} + \sum_{i=0}^{m} \gamma_{4i} \Delta\, Z_{t-i} + \lambda\, ECM_{t-} + \eta_t \quad (4)$$

Where the ECM_{t-1} is the residual from the long-term model with a one-period lag (i.e., Equations (1) or (3)), which is written as:

$$ECM_{t-1} = \varepsilon_{t-1} = sm_{t-1} - [\upsilon_0 + \upsilon_1\, new\ cases_{t-1} + \upsilon_2 new\ deaths_{t-1} + \upsilon_3 Z_{t-1}] \quad (5)$$

The parameter lambda (λ) in the error-correction term (ECM) at time $(t-1)$ quantifies the speed at which the variables adjust to attain long-term equilibrium. When it holds significance, it exhibits a negative value, and generally falls within the range of 0 to -2 (Samargandi et al., 2015). Additionally, the conditional error-correction model is employed to describe the long-term relationship between the variables under investigation, with specific emphasis on how COVID-19 impacted the Casablanca Stock Exchange for Morocco during the COVID-19 pandemic. The description of the conditional error-correction (ECM) model is as follows:

$$\Delta\, sm_t = \Theta_0 + \sum_{i=1}^{p} \Theta_i \Delta\, sm_{t-i} + \sum_{i=0}^{p} \Theta_{2i} \Delta\, new\ cases_{t-i} + \sum_{i=0}^{p} \Theta_{3i} \Delta\, new\ deaths_{t-i} + \sum_{i=0}^{p} \Theta_{4i} \Delta\, Z_{t-i} + \beta_1\, sm_{t-1} + \beta_2\, new\ cases_{t-1} + \beta_3\, new\ deaths_{t-1} + \beta_4\, Z_{t-1} + \mu_t \quad (6)$$

which is $H_0 : \beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$ in opposed to the alternative hypothesis $H_1 : \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq 0$.

Banerjee et al. (1998) proposed the bound t-test, a related cointegration test, based on earlier contributions by Banerjee et al. (1986) and Kremers et al. (1992). Their test is based on the t-statistic associated with the coefficient of the lagged dependent variable in a conditional. It supports the conclusion that there is a long-term relationship between the variables obtained by the F joint significance test.

4. ESTIMATION RESULTS

4.1 Graphical Display and Summary Statistics

Table 1 summarizes the study variables. It gives a full overview of the dependent and independent variables being studied and the control variables. Additionally, Figure 1 illustrates the dependent variable, showing a significant 32% decline in the index during the first quarter of 2020.

Figure 1: Trend in Stock Market Index in Morocco Pre-Covid19 and During A Pandemic.

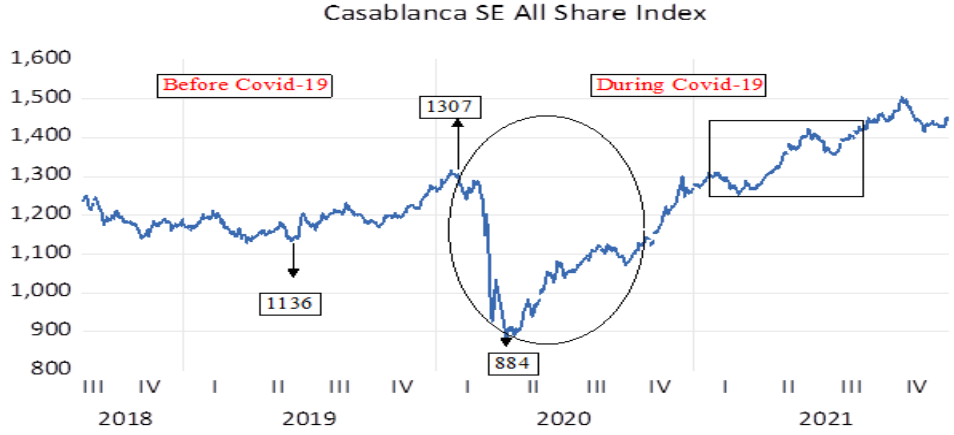

Table 1: Descriptions of Variables

No	Variable	Data source	Measurements of variables	Role
1	Casablanca stock market (CSM)	eikon.refinitiv.com	Close price	Dependent
2	New cases (NC)	ourworldindata.org	New cases on a daily basis	Independent
3	New deaths (ND)	ourworldindata.org	New deaths on a daily basis	Independent
4	Exchange rate (EX-RATE)	eikon.refinitiv.com	Exchange rate daily	Control
5	Brent Crude Oil (B.C.O)	eikon.refinitiv.com	Close price	Control
6	S&P 500	Yahoo Finance	Close price	Control

As observed in Table 2, our findings align with those of Agarwalla et al. (2021), Banerjee (2021), Malik et al. (2022), and Youssef et al. (2021) in terms of certain variables displaying a negative skewness. Similar to their studies, we noticed that some variables exhibited a left-skewed distribution, indicating a longer tail on the negative side of the distribution. This skewness indicates that the data tends to have lower values, with a few extreme observations on the negative end. The presence of negative skewness in these variables is consistent with the patterns identified in the mentioned research papers, which further supports the validity and coherence of our study's results in relation to the broader body of literature on the subject. According to the findings of our study,

the kurtosis of new cases in the variable was higher than 3, which is consistent with previous research by Banerjee (2021), Bourghelle et al. (2021), Fakhfekh et al. (2021), and Ftiti et al. (2021).

Furthermore, the Jarque-Bera test evaluates the distribution of the variable. As shown in Table 2, the test results indicate a test probability of 0%, indicating that the empirical data's distribution significantly deviates from a normal distribution. This finding aligns with studies conducted by Curto and Serrasqueiro (2022), Malik et al. (2022), and Youssef et al. (2021).

Table 2: Descriptive Statistics of The Variables

	CSE	NC	ND	EX-RATE	B.C.O	S&P_500
Mean	7.7531	6.6789	2.727	2.9197	8.7373	8.8511
Median	7.7478	6.809	2.6441	2.9097	8.6801	8.8634
Max	7.9535	9.4246	5.2983	3.0275	9.1844	9.0589
Min	7.4774	0	0	2.8693	8.0372	8.4062
Std. Dev.	0.125	1.6385	1.5231	0.0412	0.2624	0.1448
Skewness	-0.3408	-0.976	-0.2496	0.8366	-0.1596	-0.5698
Kurtosis	2.1222	5.0385	2.0155	2.5611	2.4119	2.6821
Jarque-Bera	15.7998	101.8943	15.5839	38.2798	5.7279	17.9046
Probability	0.0004	0	0.0004	0	0.057	0.0001

Note: All variables are in logarithms.

Table 3 presents the results of unit root testing. Show that new cases and deaths are at their original levels. On the other hand, variables such as the Moroccan stock market, exchange rate, Brent oil price, and S&P 500 are in the first difference. This combination of level and first difference data allows the ARDL model to capture the interactions and relationships between variables over time, accounting for both their long-term and short-term dynamics.

Table 3: Results of Unit Root Test (ADF)

	Level			First Difference	
variables	With Constant	With Constant & Trend	variables	With Constant	With Constant & Trend
	t-Statistic	t-Statistic		t-Statistic	t-Statistic
CSE	-233.3952	-2.8240	Δ (CSE)	-4.3981***	-4.2697***
NC	-3.4812***	-3.8811**	Δ (NC)	-	-
ND	-4.3409***	-4.4277***	Δ (ND)	-	-
EX -RATE	-1.6756	-2.559	Δ (EX-RATE)	-5.1696***	-5.1759***
B.C.O	-0.3675	-2.8311	Δ (B.C.O)	-5.7137***	-5.7035***
S&P 500	-2.3209	-3.8439	Δ (S&P500)	-7.0688***	-7.3599***

Note: Asterisk *** denotes statistically significant at the 1% level.

The findings from the correlation matrix, as presented in Table 4, reveal significant relationships among the study variables. Notably, there is a positive correlation observed between the Moroccan stock market, new cases, deaths, the Brent Index, and the US S&P 500. In contrast, the exchange rate exhibited a negative impact on Morocco's stock market, and this effect was found to be statistically significant at 1% and 10% levels.

Table 4: Correlation Matrix.

	CSE	N C	N D	EX_RATE	B.C.O	S&P 500
CASABLANCA	1.0000					
N C	0.2542***	1.0000				
N D	0.2736***	0.8390***	1.0000			
EX_RATE	-0.9426***	-0.4731***	-0.4922***	1.000000		
B.C.O	0.9312***	0.1115*	0.1026*	-0.8335***	1.000000	
S&P 500	0.9260***	0.4263***	0.3585***	-0.9201***	0.8954***	1.000000

Note: Asterisks ***, ** and * denote statistically significant at the 1%, 5% and 10% level, respectively.

After applying the Vector Autoregression (VAR) model, we determined the optimal lag lengths for our variables using the Akaike Information Criterion (AIC). Specifically, for the relationship between the Moroccan stock index and the number of new COVID-19 cases, the AIC indicated that a lag length of 3 was most appropriate. For the Moroccan stock index and the number of new COVID-19 deaths, the AIC has a lag length of 3 (see Table 5).

Table 5: VAR Lag Order Selection Criteria.

VAR lag order selection criteria Casablanca SE All Share Index and new cases (Morrocco)				
Lag	0	1	2	3
LogL	1176.263	3131.803	3235.977	3286.978
LR	NA	3821.021	199.4391	95.62683*
FPE	1.83E-11	5.98E-17	3.82E-17	3.47e-17*
AIC	-7.6991	-20.3277	-20.7762	**-20.8748***
SC	-7.6257	-19.8141	**-19.8224***	-19.481
HQ	-7.6698	-20.1222	**-20.39466***	-20.3173
VAR lag order selection criteria Casablanca SE All Share Index and new deaths (Morrocco)				
Lag	0	1	2	3
LogL	1033.755	2691.615	2786.436	2837.771
LR	NA	3227.803	180.3037	95.28110*
FPE	1.67E-11	7.72E-17	4.95E-17	4.41e-17*
AIC	-7.786023	-20.07284	-20.51845	**-20.63463***
SC	-7.704752	**-19.50394***	-19.46192	-19.09047
HQ	-7.753366	-19.84424	**-20.09391***	-20.01414

Note: Table outlines the criteria used for selecting the lag order. '*' indicates the lag order selected by the criterion these criteria, including Log Likelihood (LogL), Likelihood Ratio (LR), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Information Criterion (SC), and Hannan-Quinn Information Criterion (HQ), provide different measures to evaluate the optimal lag orders.

4.2 Cointegration Analysis

Table 6 shows a cointegration relationship between the Casablanca SE All Share Index and COVID-19 cases and deaths. For both cases and deaths, the F-statistics (7.7693 for cases and 5.6333 for deaths) exceed the upper bound critical values at the 1%, 5%, and 10% significance levels. This indicates a significant long-run relationship between the stock index and COVID-19 variables. In other words, changes in COVID-19 cases and deaths have a long-term impact on the Casablanca SE All Share Index. Additionally, the T-statistics for the error correction terms (-6.2752 for cases and -5.3493 for deaths) are significantly lower than the critical values at all significance levels, suggesting that the error correction terms are highly significant. These results confirm the robustness of the ARDL model in capturing both the long-term equilibrium and short-term dynamics in the relationship between the Casablanca SE All Share Index and COVID-19 cases and deaths.

Table 6: ARDL Bound Test Results (F-Bounds Test) And (T-Bounds Test)

Variables	Casablanca SE All Share Index and COVID-19 (Cases)		Casablanca SE All Share Index and COVID-19 (Deaths)
k		4	
F-Statistic	7.7693***		5.6333***
Critical Values	1%	5%	10%
Upper Bound	5.06	4.01	3.52
Lower Bound	3.74	2.86	2.45
Variables	Casablanca SE All Share Index and COVID-19 (Cases)		Casablanca SE All Share Index and COVID-19 (Deaths)
T-Statistic	-6.2752***		-5.3493***
Critical Values	1%	5%	10%
Upper Bound	-4.60	-3.99	-3.66
Lower Bound	-3.43	-2.86	-2.57

Note: Asterisks (***) indicate statistically significant levels of 1%. Cointegration is evaluated using the Bounds F-test, and a related Bound T-test, as proposed by Banerjee et al. (1998), focuses on long-term relationships based on lagged dependent variables.

4.3. Long-Run and Short-Run Relationship

Table 7 displays the results of an autoregressive distributed lag (ARDL) model that used the Akaike Information Criterion (AIC) to choose the model. It focuses on the Casablanca SE All Share Index and how it is linked to COVID-19 cases and deaths, exchange rates, Brent crude oil prices, and the S&P 500 index. The chosen models used ARDL (3, 0, 1, 2, 1) for new cases and ARDL (3, 1, 1, 2, 1) for new deaths. Both models have strong R^2 and adjusted R^2, indicating that they explain the variance in the stock index.

In the long-run analysis, the coefficient for new cases is -0.0176 with a t-statistic of -4.891, significant at the 1% level. This implies a negative long-run impact of new COVID-19 cases on the stock market. For new deaths, the coefficient is -0.0110 with a t-statistic of -2.5497, significant at the 5% level, suggesting a negative long-run impact of new COVID-19 deaths on the stock market. The exchange rate has a strong negative long-term relationship with the stock market, with coefficients of -2.0609 for new cases and -1.9365 for new deaths, both of which are significant at the 1% level. Brent crude oil prices do not show a significant long-run impact, with coefficients of -0.0206 and 0.0188, respectively. The S&P 500 index shows a positive long-run relationship with the stock market, with coefficients of 0.39284 for new cases and 0.3384 for new deaths, significant at the 1% and 5% levels, respectively. The Moroccan stock market has experienced negative long-term effects due to the rising number of new cases and deaths. This suggests that the increasing number of new cases and deaths has adversely influenced the market's performance and dynamics over an extended period of time. Investors and analysts may attribute this decline to a variety of

factors, such as decreased consumer confidence, economic uncertainty, or shifts in investor sentiment driven by the health crisis.

Additionally, the exchange rate has negatively impacted the Moroccan stock market. During the COVID-19 pandemic, the Moroccan stock market faced challenges, primarily due to adverse changes in the exchange rate with the US dollar. Various factors, such as the pandemic's economic repercussions, increased economic uncertainty, reduced investor confidence, and shifts in market sentiment, could have contributed to these negative effects. This underscores the significance of understanding the interplay between exchange rates and stock market performance, especially during major global disruptions like the COVID-19 crisis.

In contrast, the S&P 500 index had a positive impact on the Moroccan stock market. Movements in the S&P 500, which represents US companies' performance, were associated with positive outcomes for the Moroccan stock market. Positive changes in the S&P 500 may be interpreted as indicators of global economic health or potential investment opportunities, which could have contributed to the rise in the Moroccan stock market. This finding highlights the interconnectedness of global financial markets and how international factors can influence the performance of regional stock markets. In summary, while COVID-19 has had a detrimental impact on the Moroccan stock market, other factors like the S&P 500 demonstrate the complex and interdependent nature of financial markets during periods of economic disruption.

In the short-run dynamics, the error correction term (ECM) coefficients are -0.14523 for new cases and -0.1184 for new deaths, indicating a significant movement towards equilibrium at 1%. For new cases, the regression standard error is 0.0101, and for new deaths, it is 0.0102. The low standard errors imply that the model provides accurate predictions, reflecting the actual behavior of the Moroccan stock market in response to changes in new COVID-19 cases and deaths. This demonstrates the model's effectiveness in capturing both the short-term dynamics and long-term equilibrium relationships of the stock market amid the pandemic.

The residual diagnostics indicate that the models do not exhibit significant serial correlation or heteroskedasticity. Specifically, the LM test for serial correlation has values of 0.7186 for new cases and 0.2244 for new deaths, while the ARCH test for heteroskedasticity shows values of 0.0581 for new cases and 0.0923 for new deaths, all of which are greater than 5%. These results validate the robustness of the models. In summary, the ARDL models effectively capture both the long-term equilibrium and short-term dynamics in the relationships between the Casablanca SE All Share Index and COVID-19 cases and deaths, as well as other factors like exchange rates, Brent crude oil prices, and the S&P 500 index.

Table 7: COVID's Impact on The Short-Term and Long-Term Performance of Morocco's Stock Market

Model selection method: Akaike info criterion (AIC)				
Part-A.	Selected model: ARDL (3, 0, 1, 2,1)		Selected model: ARDL (3, 1, 1, 2,1)	
R^2 and Adj. R^2	[0.9922]	[0.9919]	[0.9920]	[0.9916]
Part-B.	Long-run cointegration models for new cases and stock market		Long-run cointegration models for new deaths and stock market	
Variables	Coefficient	t-Statistic	Coefficient	t-Statistic
NEW CASES	-0.0176***	-4.8910	-	-
NEW DEATHS	-	-	-0.0110**	-2.5497
EXCHANGE RATE	-2.0609***	-12.6264	-1.9365***	-8.5791
BRENT CRUDE OIL	-0.0206	-0.4327	0.0188	0.4180
S&P 500	0.39284***	3.6421	0.3384**	2.5162
Part-C.	Short-run ECM regression models for new cases and stock market		Short-run ECM regression models for new deaths and stock market	
ECM*	-0.14523***		-0.1184***	
R-squared	0.4826		0.4647	
Adjusted R-squared	0.4684		0.4479	
S.E. of regression	0.0101		0.0102	
Part-D.	Residual Diagnostic		Residual Diagnostic	
LM χ^2 Serial (1)	0.7186		0.2244	
LM χ^2 ARCH (1)	0.0581		0.0923	

Asterisks (***, ***) indicate statistically significant levels of 1% and 5%. R^2 and Adjusted R^2 measure model fit, while LM χ^2 (1) and ARCH test for serial correlation and Heteroskedasticity of order one in the ARDL equations. SER denotes the standard error of regression. Variable descriptions are detailed in Table 1.

5. CONCLUSION

This study examined the impact of COVID-19 on the Moroccan stock market, specifically the Casablanca SE All Share Index, using an autoregressive distributed lag (ARDL) model. By employing the Akaike Information Criterion (AIC) for model selection, we identified significant long-term and short-term relationships between the stock market index and several key variables: new COVID-19 cases and deaths, exchange rates, Brent crude oil prices, and the S&P 500 index. In the short-run dynamics, the error correction term (ECM) coefficients for new cases and deaths models indicate a significant movement towards equilibrium, suggesting that the market adjusts back to its long-term equilibrium after short-term deviations.

In the long-run, regarding the impact of COVID-19 influencing the Moroccan stock market during the COVID-19 pandemic, Firstly, an increase in new COVID-19-related cases and deaths had a detrimental impact on the Moroccan stock market, indicating the market's susceptibility to pandemic-related uncertainties and disruptions. Furthermore, the controlled variables associated

with the exchange rate negatively influenced the stock market. Intriguingly, the Standard and Poor's (S&P 500) index demonstrated a positive effect on the Moroccan stock market, suggesting the influence of broader international financial trends on local market dynamics. These findings underscore the multifaceted nature of factors shaping the Moroccan stock market during the pandemic, encompassing both negative and positive drivers of market performance.

The results of this study substantial significance for a range of stakeholders, including investors, governments, and decision-makers, particularly understanding Morocco's stock market during periods of uncertainty and for future crisis preparedness. Investors can utilize the insights gleaned from this research to make more informed investment decisions, better assess risks, and devise strategies to improve the often-volatile stock market and decline during periods of uncertainty. For governments, this study offers a valuable resource for shaping economic policies and crisis management strategies. Whether in the public or private sector, decision-makers can leverage these findings to inform their choices in times of economic uncertainty. This includes devising resilient business strategies, crafting fiscal policies, and making investment decisions grounded in a deeper understanding of how various internal and external factors influence stock market dynamics. Furthermore, the broader implications extend to future crisis preparedness, highlighting the importance of robust risk management and contingency planning. By analyzing the intricate relationships between variables during the COVID-19 pandemic, decision-makers can draw valuable lessons about building resilience, adapting to changing circumstances, and the necessity of proactive measures to safeguard economic stability in the face of unforeseen challenges. In terms of future research, it is advisable to explore the consequences of COVID-19 on the Moroccan exchange rate. Additionally, expanding the investigation into the fluctuations of the Moroccan stock market would be a valuable avenue for further study.

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