Early effects of the Covid-19 on the Tourism industry: Evidence from the three major cruise companies

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Abstract:

The Covid-19 pandemic has shifted investors' preferences away from the cruise companies' stocks as the lockdown measures totally suspended the services of these companies. In this paper, we examine three of the biggest companies' stocks, namely the Carnival Corporation (CCL), the Royal Caribbean (RCL) and the Norwegian Cruise Line (NCLH) during the Covid-19 spread and the lockdown measures. Using relevant time series specifications, we establish a hypothesis regarding the effect of the Covid-19 pandemic on these three stocks. Based on our findings, the three stocks were affected by the Covid-19 spread and more precisely, the Covid-19 spread provides useful information for the predicting and forecasting of these stocks. Our findings are robust, since the out-of-sample forecasting accuracy of the alternative model employed, that explicitly incorporate the pandemic induced by the SARS-COV-2 virus, is superior to the baseline model.

Keywords: COVID-19; tourism; cruise; stocks

1. Purpose

The recent Covid-19 pandemic has spread from one country to another, having its origin in Wuhan-Hubei, China (Liu et al., 2020). The total cases globally amount to over 2 million people, showing the cruel face of this pandemic (WHO, 2020). In an attempt to minimize the spread of the virus, most economies and policy makers have taken extreme lockdown measures that adversely affect the overall microeconomic, macroeconomic and financial conditions in a global scale. Increased globalization and integration, of trade and financial relations, among the various economies and institutions, makes clear that the global cost of the pandemic will not be limited to the directly affected economies, since the indirect spillover effects are of great importance, as well (Lee and McKibbin, 2004).

Such cases are the Cruise companies that were affected both by the lockdown measures, due to the suspension of their proper function and by the economic recession followed by the Covid-19 spread. The lockdown measures had a very important and negative effect on the hospitality and tourism (Bakar and Rosbi, 2020), with damages ranging from billion to trillion dollars (Gössling et al., 2020), impacting many (if not all) of the touristic places of the world (Nicola et al., 2020).

Since international tourism is highly susceptible to external crisis events, it is very interesting to investigate and quantify the factors that seem to have a negative effect on tourism. Such a shock occurred in the cruise industry due to the Covid-19 spread. Fear has spread for the case of the Cruise companies as cruise stocks decreased their value by 15% approximately (Tenebruso, 2020). More analytically, some cruise stocks are expected to post quarterly loss of $1.78 per share in its upcoming report, which represents a year-over-year change of -369.7%. The revenues are expected to be $1.30 billion, down 73.1% from the year-ago quarter (Zacks, 2020).

In this paper, using relevant econometric techniques, we capture the impact of the COVID-19 spread on the three biggest Cruise companies and more precisely on the Carnival Corporation (CCL), the Royal Caribbean (RCL) and the Norwegian Cruise Line (NCLH) stocks. The present paper contributes to the literature in the following ways: (a) It is the first, to the best of our knowledge, that investigates the effect of the Covid-19 spread and the lockdown measures on the three major cruise companies; (b) It is the first, to the best of our knowledge, that accounts for the Covid-19 pandemic in a financial framework, using global data on the spread of the pandemic; (c) it proposes an alternative approach to the examination of the economic effect of disasters on the cruise companies, based on a financial framework; and (d) it provides a robustness analysis of the findings based on out-of-sample forecasting accuracy measures.

The paper is structured as follows: Section 2 describes the methodology used, Section 3 presents the empirical results and Section 4 concludes the paper.

2. Methodology

In order to econometrically investigate (non-)causality between the Covid-19 confirmed cases and the Cruise companies' stocks, we will make use of Granger (non-)causality tests and the state of the art step-by-step (non-) causality test, introduced by Dufour and Renault (1998) and extended by Dufour et al. (2006).

Additionally, in order to cross validate the fact that the Covid-19 confirmed cases are causal and thus have predictive ability on the major Cruise companies' stocks, we will also make use of forecasting strategies. In detail, using a vector autoregressive model as a baseline, we will investigate whether alternative specification that could also incorporate the information provided by Covid-19 confirmed cases as an exogenous variable in the same vector autoregressive model, outperforms the forecasting accuracy of the baseline model.

In what follows, we offer a brief outline of the techniques and procedures used in this work.

2.1 Relevant tests

Phillips-Perron unit root test:
As a first step, we check for the potential existence of unit roots in our time series using relevant unit root tests. More analytically, we implement the Phillips-Perron unit root test. The null hypothesis of the test, is that the time-series contain a unit root.

Johansen co-integration test:

In case of I(1) variables, we test for cointegration among the time-series. If cointegrating relationships are present, Error Correction Terms (ECM) have to be included in the model. In this work, we implement the Johansen (1988) test. The trace test, tests the null hypothesis of $r < n$ cointegrating vectors, while the maximum eigenvalue test, similarly, tests the null hypothesis of $r < r + 1$ cointegrating vectors and the critical values are found in Johansen and Juselius (1990).

2.2 Causality testing between Covid-19 spread and Cruise companies' stocks

As a next step, we investigate (non-)causality between the Covid-19 confirmed cases and the Cruise companies' stocks, using the Granger (non-)causality tests.

Granger Non-causality

After examining the stationarity and cointegration properties of the data series, we use (non-)Granger causality to test the predictive ability of the variables that enter the model. More precisely, the hypothesis tested for Granger (non-)causality test is that the times series are not Granger causal, i.e. the logarithmic Covid-19 confirmed cases do not have predictive ability on the biggest cruise stocks. As Engle and Granger (1987) showed, if two variables are cointegrated, an Error Correction Model (ECM) should be employed in the model in order to capture the long-run relationship among the variables.

The ECM Granger non-causality test involves fitting the model:

$$\Delta y_t = a_0 + \sum_{i=1}^{m} a_{1i}\Delta y_{t-i} + \sum_{i=0}^{m} a_{2i}\Delta x_{t-i} + \lambda\mu_{t-1} + \varepsilon_t \quad \mathbf{(1)}$$

where Δ is the first difference operator, Δy_t and Δx_t are stationary time series and ε_t is the white noise error term with zero mean and constant variance. Also, μ_{t-1} is the lagged value of the error term of the cointegration regression.

Next, in order to study the exact timing pattern of the causality relationship, we make use of the state-of-the-art step-by-step causality introduced by Dufour and Renault (1998) and extended by Dufour et al. (2006).

Step-by-step causality

Based on recent advancement of the related literature of causality, Granger non-causality tests fail to unveil the potential timing pattern of a causal relationship. In this context, in a seminal paper in *Econometrica*, Dufour and Renault (1998) introduced the notion of *step-by-step* or *short-run* causality based on the idea that two time series X_t and Y_t could interact in a causal scheme via a third variable Z_t. More precisely, despite the fact that X_t could not cause Y_t one period ahead, it could cause Z_t one period ahead i.e. Z_{t+1}, and Zt could cause Yt two periods ahead i.e. Y_{t+2}. Therefore, $X_t \rightarrow Y_{t+2}$, even though $X_t \nrightarrow Y_{t+1}$.

For testing the step by-step causality, consider the following VAR (p) model:

$$Y_t = a + \sum_{k=1}^{p} \pi_\kappa Y_{t-k} + \sum_{q=0}^{Q} \beta_q X_{t-q} + u_t \quad \textbf{(3)}$$

where: Y_t is an (1xm) vector of variables, a is a (1xm) vector of constant terms; X_t is a vector of variables and u_t is a (1xm) vector of error terms such that $E(u_t u_s) = \sigma_{ii} I \ if \ t = s \ and \ E(u_t u_s) = \sigma_{ij} I \ \ if \ t \neq s,$ where I is the identity matrix. The lags in the baseline model are selected using the Schwartz-Bayes Information criterion (SBIC).

Following Dufour et *al.* (2006), the model described in (3) corresponds to horizon h=1. In order to test for the existence of non-causality in horizon h, the algorithm follows Konstantakis and Michaelides (2015).

2.3 Econometric models

A basic and classical econometric approach is the vector autoregressive model - VAR, or the vector error correction model – VECM in presence of co-integration relationship among the variables. In presence of co-integration relationship among the variables, we incorporate the error correction term.

Each variable in the model, has an equation explaining its evolution based on its own lagged values, the lagged values of the other model variables, the error correction, and an error term. A VECM model of order p, with exogenous variables is structured as follows:

$$\left\{\begin{array}{l} \Delta y_{1,t} = \ c_1 + \sum_j^n \sum_i^p \left(a_{j,i} \Delta y_{j,t-i}\right) + \sum_j^k \sum_i^q \left(b_{j,i} \Delta x_{j,t-i}\right) + v_{1,t} + e_{1,t} \\ \Delta y_{2,t} = \ c_2 + \sum_j^n \sum_i^p \left(a_{j,i} \Delta y_{j,t-i}\right) + \sum_j^k \sum_i^q \left(b_{j,i} \Delta x_{j,t-i}\right) + v_{2,t} + e_{2,t} \\ \qquad \qquad \qquad \qquad \qquad \qquad \ldots \\ \Delta y_{n,t} = \ c_n + \sum_j^n \sum_i^p \left(a_{j,i} \Delta y_{j,t-i}\right) + \sum_j^k \sum_i^q \left(b_{j,i} \Delta x_{j,t-i}\right) + v_{n,t} + e_{n,t} \end{array}\right\} \quad (4.7)$$

n is the number of the dependent variables ($y_{i,t}$) of the model, c_i is the fixed term, p is the lag order of the dependent variables, $e_{i,t}$ is the error term of each equation of the model, and $v_{i,t}$ is the error correction term, as before. In the case of exogenous variables, k is the number of the independent or exogenous variables ($x_{i,t}$) of the model and q is the lag order of the exogenous variables.

2.4 Information criterion

In this paper, we make use of the so-called Schwartz-Bayes Information criterion (SBIC) introduced by Schwarz (1978), because it is an optimal selection criterion when used in finite samples (Breiman and Freedman, 1983; Speed and Yu, 1992). The SBIC is derived:

$$\hat{k} = argmin_{k \leq n}\{-2\frac{\ln\big(LL(k)\big)}{n} + k\frac{\ln(n)}{n}\}$$

where LL(k) is the log-likelihood function of a VAR(k) model, n is the number of observations and k is the number of lags and $\hat{k}$ is the optimum lag length selected.

2.5 Forecasting accuracy

In the present paper, we make use of the forecasting accuracy measures: mean absolute error (MAE), the mean absolute percentage error (MAPE) and root mean square forecast error (RMSFE). In general, the smaller the values of each forecasting criterion, the better the forecasting value.

<u>MAE</u>

A model's MAE for forecast horizon H is given by the following:

$$MAE = \frac{1}{H}\sum_{t=0}^{H}|F_t - A_t| \text{ (4.17)}$$

where: h is the forecast horizon of the model, F_t are the out-of-sample forecasted values of the model, and A_t are the actual values. However, one of the main disadvantages of the MAE is the fact that is has no standard scale and it is not as comparable as a percentage. To overcome this problem we will also base our analysis on MAPE.

<u>MAPE</u>

A model's MAPE is given by the expression:

$$MAPE = \frac{100}{h}\sum_{t=0}^{h}\frac{|F_t - A_t|}{|A_t|}$$

<u>RMFSE</u>

The RMSFE is used to measure the forecasting error distribution. It is given by the expression:

$$RMSFE = \sqrt{E\left[(Y_{T+1} - \hat{Y}_{T+1|T})^2\right]} \text{ (4.19)}$$

2.6 Forecast accuracy comparison

In order to compare the forecasting accuracy of the baseline and alternative models, we use the Diebold - Mariano test. This test was established by Diebold and Mariano (1991), for the comparison of two forecast results.

First, we define the actual values: $\{y_t, t = 1, \dots, T\}$ and two forecast values: $\{\hat{y}_{1t}, t = 1, \dots, T\}$ and $\{\hat{y}_{2t}, t = 1, \dots, T\}$.

Next, we define the forecast errors as:

$$e_{it} = \hat{y}_{it} - y_t, i = 1,2 \quad (2.29)$$

And,

$$g(e_{it}) = \exp\{le_{it}\} - 1 - le_{it} \quad (2.30)$$

Function g is a loss function and l is a positive constant.

The loss differential between the two forecasts is:

$$d_t = g(e_{1t}) - g(e_{2t}) \quad (2.31)$$

The null hypothesis of the Diebold – Mariano test is the following:

$$H_0: E(d_t) = 0$$

And the respective alternative hypothesis:

$$H_0: E(d_t) \neq 0$$

3.Result Analysis

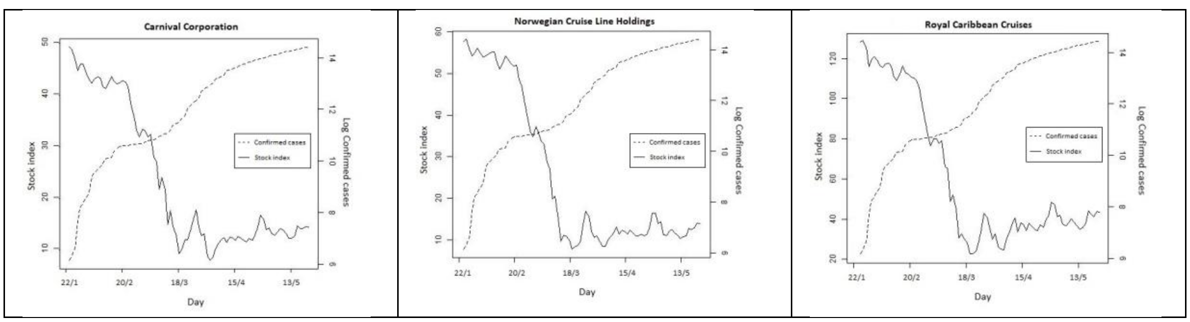
3.1Data and variables

The data used in the present paper are the global Confirmed cases of the Covid-19 in daily format and were downloaded by the John Hopkins University database and span the period 22 January 2020 until 22 May 2020. Moreover, in the present paper we used financial stocks of the three biggest Cruise companies, namely the the Carnival Corporation (CCL), the Royal Caribbean (RCL) and the Norwegian Cruise Line (NCLH) as derived from finance.yahoo, and span also the period 22 January 2020 until 22 May 2020. The confirmed cases were transformed into logarithmic scale. The descriptive statistics of the timeseries are depicted in Table 1. Furthermore, the plots of the logarithmic confirmed Covid-19 cases and the three CCL stock index are depicted on Figures 1-3.

Table 1: Descriptive statistics of the timeseries.

Variable	Mean	Standard Deviation	Min	Max
Log Confirmed Covid-19 cases	12.67	2.31	6.32	15.47
CCL	23.46	13.72	7.97	49.30
NCLH	25.35	18.38	7.77	58.22
RCL	61.41	35.30	22.33	128.32

Figures 1-3: Log Confirmed Covid-19 cases and CCL, NCLH and RCL stock index, respectively.



Figures 1-3 indicate that the logarithmic confirmed Covid-19 cases seem to have a lagged effect on the three stocks. This fact provide a graphical evidence about the impact of the Covid-19 spread on the Cruise companies' stocks, a fact that needs to be investigated thoroughly using econometric methodology.

3.2Results

In the present work, we make use of the granger and step-by-step causalities in order to identify whether the Covid-19 spread causes the three major Cruise companies, as captured by the stocks of these companies. As a next step, we test the contribution of the information derived by the Covid-19 confirmed cases on the forecasting of the aforementioned stocks. To do so, we make use of two econometric models in the form of vector autoregressive model (since there is connection among the three stocks). The first model, declared as he baseline, will be a vector autoregressive model only with endogenous variables (the three stocks) and an alternative model being the same with the baseline, augmented with one exogenous variable, the Covid-19 global confirmed cases. The comparison of these two models, in terms of forecasting ability, will unveil a possible contribution of the exogenous variable on the forecasting of the three stocks.

A first step in every econometric modeling is the unit root test. In the present paper, we make use of the Phillips – Perron unit root test. The results are depicted in Table 2.

Table 2: Phillips – Perron unit root test results.

Variable	PP-test P-value	Order of Integration
Log_Confirmed Covid-19 cases	0.01	I(0)
CCL	0.96	I(1)
NCLH	0.98	I(1)
RCL	0.96	I(1)

Since the results in Table 2 show that the Covid-19 has no unit root, meaning that the timeseries is stationary, this specific timeseries cannot be cointegrated and thus, it is excluded from the cointegration test.

Table 3: Johansen Cointegration test results.

Rank of co-integration	Test	10pct	5pct	1pct
r<=2	2.23	6.50	8.18	11.65
r<=1	13.93	12.91	14.9	19.19
r=0	23.83	18.9	21.07	25.75

The results of the co-integration test are depicted in Table 3, indicate that there are 2 cointegration relationships among the stocks. In such case, an error correction term must be included in the econometric models.

The next step is the use of the causality tests, namely the Granger causality and the step-by-step causality. To start with, we give the results of the Granger causality (Table 4).

Table 4: Granger causality results for the case of the CCL, NCLH and RCL stock.

Stock	P-value	Order
CCL	0.027, 0.070	2, 3
NCLH	0.007, 0.016, 0.045, 0.097, 0.062, 0.034	2, 3, 4, 5, 7, 10
RCL	0.006, 0.009, 0.031, 0.068, 0.066, 0.088	2, 3, 4, 5, 6, 7

The results in Table 4 indicate that the Covid-19 causes the three stocks. In order to identify the specific order, we make use of the step-by-step causality. The results are depicted in Table 5.

Table 5: Step-by-step causality results for the case of the CCL stock.

Stock	P-value	Order
CCL	0.01, 0.013, 0.058, 0.062, 0.022, 0.015, 0.033, 0.086,	2, 3, 4, 6, 7, 8, 9, 10, 11, 12,

	0.062, 0.013, 0.009, 0.024	13, 14
NCLH	0.002, 0.001, 0.007, 0.04, 0.016, 0.007, 0.009, 0.017, 0.066, 0.075, 0.014, 0.007, 0.031	2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
RCL	0.001, 0.001, 0.011, 0.038, 0.024, 0.009, 0.009, 0.026, 0.075, 0.052, 0.008, 0.004, 0.018	2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14

The results in Table 5 indicate that the Covid-19 causes the three stocks in multiple orders. These orders are 2-14, except for the order 5 for the case of the CCL. For the case of the NCLH and the RCL, the order of step-by-step causality is statistical significant for 2-14 lags.

Since we have shown that the Covid-19 spread causes the three stocks, and therefore it provides useful information for their interpretation and their modeling, we will test if the Covid-19 spread contributes to the forecasting of these stocks. To do so, we first decide for the lag order of the econometric models (baseline and alternative), based on the SBIC criterion. The results are depicted in Table 6.

Table 6: Results of the SBIC criterion for the case of the Baseline and Alternative models.

Order	SBIC for the Baseline	SBIC for the Alternative
1	2.273	-3.409
2	2.570	-2.779
3	2.932	-2.137
4	3.294	-1.439
5	3.692	-0.826
6	4.045	-0.540
7	4.271	-0.036
8	4.679	0.605
9	5.003	0.884
10	5.352	-3.409

Based on Table 6, the SBIC criterion indicate the lag order 1 as the most appropriate for both models. In this case, the order of the baseline and alternative order will be selected to be equal to 1.

The baseline model incorporated one lag order for each endogenous variables (CCL, NCLH and RCL). Using out of sample forecast with fixed window, for horizon H=1,2,…,20, we forecast for approximately two months. Then, we employ the same model incorporating as exogenous variable the logarithmic global confirmed Covid-19 cases and test again the forecasting ability of this alternative model. We then compare the two models in terms of forecasting ability, based on the MAE, MAPE, RMSFE and estimate the statistical significance of the comparison based on Diebold-Mariano test. The results are depicted in Tables 7-9.

Table 7: MAE, MAPE and RSMFE forecasting accuracy of the VEC and VECX models for the case of CCL.

Horizon	MAE_VEC	MAPE_VEC	RMSFE_VEC	MAE_VECX	MAPE_VECX	RMSFE_VECX
1	0.933	0.072	0.933	0.745	0.057	0.745
2	1.631	0.116	1.774	1.361	0.097	1.494
3	2.601	0.168	2.996	2.234	0.144	2.602
4	2.890	0.185	3.203	2.417	0.155	2.698
5	2.680	0.175	2.981	2.092	0.135	2.439
6	2.622	0.173	2.883	1.910	0.124	2.263
7	2.418	0.161	2.707	1.700	0.111	2.102
8	2.250	0.151	2.560	1.598	0.106	1.991
9	2.217	0.151	2.500	1.460	0.097	1.881
10	2.279	0.156	2.536	1.330	0.089	1.785
11	2.317	0.159	2.551	1.242	0.083	1.706
12	2.313	0.160	2.529	1.238	0.084	1.669
13	2.259	0.158	2.470	1.318	0.091	1.723
14	2.234	0.158	2.434	1.397	0.099	1.783
15	2.265	0.161	2.453	1.442	0.103	1.803
16	2.434	0.172	2.679	1.370	0.098	1.748
17	2.566	0.182	2.836	1.352	0.097	1.715
18	2.704	0.191	3.003	1.342	0.096	1.690
19	2.870	0.202	3.217	1.319	0.094	1.657
20	3.031	0.213	3.418	1.313	0.094	1.637

Table 8: MAE, MAPE and RSMFE forecasting accuracy of the VEC and VECX models for the case of NCLH.

Horizon	MAE_VEC	MAPE_VEC	RMSFE_VEC	MAE_VECX	MAPE_VECX	RMSFE_VECX
1	0.737	0.064	0.737	0.510	0.045	0.510
2	1.644	0.130	1.877	1.302	0.102	1.524
3	3.123	0.210	3.832	2.655	0.177	3.336
4	3.919	0.254	4.578	3.315	0.214	3.918
5	3.940	0.261	4.472	3.190	0.210	3.706
6	4.103	0.274	4.550	3.201	0.212	3.634
7	3.802	0.261	4.280	2.749	0.182	3.365
8	3.613	0.254	4.084	2.420	0.161	3.148
9	3.607	0.259	4.029	2.234	0.150	2.978
10	3.685	0.268	4.067	2.126	0.144	2.849

11	3.724	0.276	4.071	1.972	0.135	2.719
12	3.741	0.282	4.059	1.826	0.125	2.604
13	3.730	0.287	4.026	1.763	0.123	2.518
14	3.787	0.297	4.064	1.678	0.118	2.431
15	3.881	0.309	4.148	1.595	0.113	2.351
16	4.116	0.327	4.449	1.590	0.113	2.308
17	4.329	0.344	4.705	1.558	0.111	2.253
18	4.566	0.362	5.002	1.547	0.111	2.213
19	4.873	0.382	5.422	1.603	0.115	2.235
20	5.171	0.402	5.813	1.644	0.118	2.246

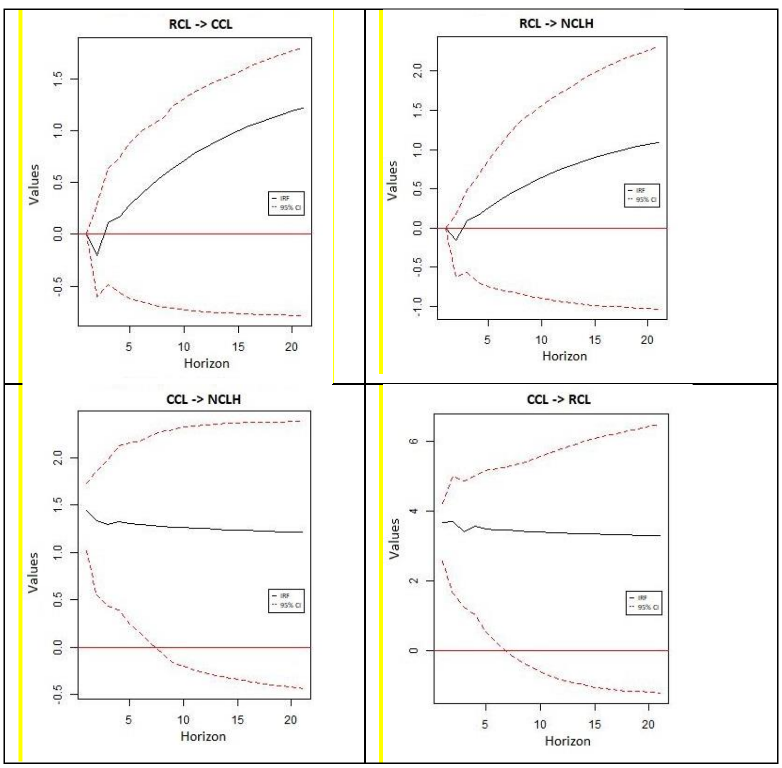
Table 9: MAE, MAPE and RSMFE forecasting accuracy of the VEC and VECX models for the case of RCL.

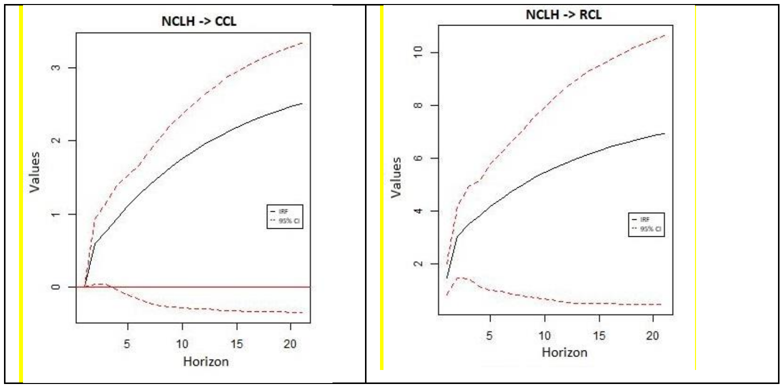
Horizon	MAE_VEC	MAPE_VEC	RMSFE_VEC	MAE_VECX	MAPE_VECX	RMSFE_VECX
1	4.027	0.102	4.027	3.349	0.085	3.349
2	5.155	0.127	5.277	4.167	0.102	4.246
3	7.792	0.175	8.687	6.463	0.145	7.263
4	8.872	0.196	9.658	7.180	0.159	7.832
5	8.406	0.189	9.120	6.332	0.141	7.127
6	8.276	0.188	8.889	5.801	0.130	6.632
7	7.668	0.177	8.369	5.173	0.117	6.163
8	7.151	0.167	7.927	4.884	0.112	5.853
9	7.037	0.166	7.748	4.486	0.104	5.535
10	7.206	0.171	7.851	4.061	0.094	5.252
11	7.246	0.174	7.832	3.871	0.090	5.043
12	7.201	0.175	7.745	3.887	0.092	4.968
13	7.089	0.174	7.610	4.067	0.099	5.076
14	7.100	0.177	7.584	4.203	0.104	5.145
15	7.324	0.183	7.808	4.191	0.104	5.078
16	7.969	0.197	8.753	4.044	0.100	4.938
17	8.503	0.209	9.446	3.811	0.094	4.791
18	8.955	0.220	9.982	3.705	0.092	4.677
19	9.551	0.233	10.772	3.527	0.087	4.553
20	10.128	0.246	11.511	3.365	0.083	4.438

The results in Tables 7-9 show that the alternative model is better in terms of forecasting ability than the baseline, for the three stocks (CCL, NCLH, RCL). All results, based on the Diebold-Mariano test are statistical significant. This implies that the Covid-19 augments the forecasting ability of the stocks of the three major cruise companies.

Finally, using the impulse – response function, and more precisely, the orthogonalized impulse responses, the results indicate that the effect of the RCL on the CCL stock, is not statistically significant, as depicted in Figure 4 - a. In the same context, the effect of the RCL on the NCLH stock, is not statistically significant (Figure 4 – b). Moreover, the effect of the CCL on the NCLH stock, is statistically significant and positive (Figure 4 – c). This means that a unit shock in the CCL stocks, will lead to a positive effect in the NCLH stocks. The effect of the CCL on the RCL stock, is statistically significant and positive, as depicted in Figure 4 – d. This means that a unit shock in the CCL stocks, will lead to a positive effect in the RCL stocks. Furthermore, the effect of the NCLH on the CCL stock, is statistically significant and positive (Figure 4 – e). This in turn, means that a unit shock in the NCLH stocks, will lead to a positive effect in the CCL stocks. Finally, the effect of the NCLH on the RCL stock, is statistically significant and positive, as depicted in Figure 4 - f. This means that a unit shock in the NCLH stocks, will lead to a positive effect in the RCL stocks.

Figure 4: Impulse response function for the endogenous variables.





4. Conclusion

In the present paper, we examine three major cruise companies' stocks, namely the Carnival Corporation (CCL), the Royal Caribbean (RCL) and the Norwegian Cruise Line (NCLH) during the Covid-19 spread and lockdown measures. Using relevant time series specifications, we establish a hypothesis regarding the effect of the Covid-19 on these three stocks. The hypothesis is proved, as, based on our findings, the Covid-19 spread, Granger causes and also step-by-step causes the CCL, NCLH and RCL stocks. These results indicate that the Covid-19 spread provide useful information for the modeling of these stocks as it affects them, econometrically speaking.

Furthermore, the Covid-19 spread provides useful information for the forecasting of these stocks, as shown by the forecasting comparison of the baseline and alternative models, indicated by the forecasting criteria MAE, MAPE and RMSFE, with statistical significance of the comparison, as shown by the Diebold-Mariano test. Our findings are robust, since the out-of-sample forecasting accuracy of the alternative model employed, that explicitly incorporate the pandemic induced by the SARS-COV-2 virus, are superior to the baseline model.

The present paper findings show that the Covid-19 spread not only contributes with statistically significant information in the modeling of the three major cruise companies' stocks, but also increase the forecasting ability of these stocks in the 22/10 – 22/05 time period of the year 2020. The results give credit to the impact of the Covid-19 spread on the Cruise Companies, decreasing their revenues and impacting their stocks. This fact unveils the great impact of the Covid-19 on the tourism industries worldwide.

Finally, the effect of the CCL stock on the NCLH and the RCL stocks, is statistically significant and positive, which means that CCL affects the other two stocks in a positive way. The same case is for the NCLH stock, as it affects the CCL and RCL stocks with statistical significant and positive shock. On the other hand, The effect of the RCL on the NCLH stock, and also on the CCL stock, is not statistically significant. This means that the RCL cruise company does not affect the other two major cruise companies with statistical significance. Shedding light to the case, a fact is that the cruise companies, during the lockdown measures lost big portion (if not all) of their profits, leading them to severe economic damage. This occurrence, made the traders to swap from these stocks to other commodities, regarded as more stable.

Summing up, the economic measures that decreased and during some period of time totally suspended the Cruise companies' function, and simultaneously the abandon of the Cruise trades had an extremely negative impact on these companies, as depicted by the modeling and forecasting, employed in the present paper. We anticipate our work to be a starting point for more sophisticated models, testing for other factors that could play a significant role in forecasting the various touristic industries. Clearly, future and more extended research on the subject would be of great interest.

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