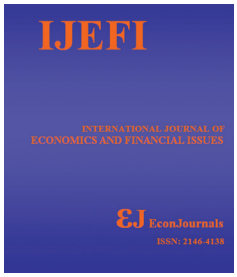

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International Evidence of COVID-19 and Stock Market Returns: An Event Study Analysis

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ABSTRACT

We study the effect of the first registered case of COVID-19 on stock market returns using event study analysis. Mean-adjusted returns and market model methods are used to estimate cumulative abnormal returns for 30 countries. The results show that stock market returns experience a downwards trend as well as significant negative returns following the COVID-19 outbreak.

Keywords: COVID-19, Event Study, Index Returns, Pandemics
JEL Classification: G14

1. INTRODUCTION

Research identifies a strong link between stock market returns and key events such as political events (Podgorski, 2020; Wong and Hooy, 2020); geopolitical events (Schiereck et al., 2016; Tielmann and Schiereck, 2017); terrorist incidents (Bash and Alsaifi, 2019); environmental events (Pham et al., 2019); and disease outbreaks such as animal diseases, Ebola, SARS, and COVID-19 (Park et al. 2008; Pendell and Cho, 2013; Chen et al., 2009; Chen et al., 2007; Ichev and Marinč, 2018; Al-Awadhi et al., 2020).

In December 2019, an infectious disease identified as coronavirus first appeared in Wuhan, the Capital of Hubei province in the People's Republic of China (PRC) and since then has spread rapidly across the globe. On 11 February 2020 the World Health Organization (WHO) announced that the new name for agent responsible for the coronavirus disease is COVID-19. (Centers for Disease Control & Prevention, 2020) On 11 March 2020 the WHO announced that COVID-19 is a global pandemic. As of 5 May 2020, the number of registered cases is around 3.6 million and the death toll is in the order of 252.8 thousand (Worldometer, 2020).

The emergence of the current COVID-19 pandemic caused financial markets to suffer historic losses in the first quarter of 2020 at a level not seen since 1987 (BBC, 31 March 2020). For example, the Dow Jones, S&P and NASDAQ declined 3.5%, 3.3% and 3.7%, respectively (BBC, 24 February 2020). This has led researchers to extensively investigate its effect on stock market returns. For example, Al-Awadhi et al. (2020) study the effect of COVID-19 on the Chinese stock market using panel data regression. They find that COVID-19 has a negative effect on all companies in that market. Baig et al. (2020) investigate the effect of COVID-19 on the United States (US) equity markets and find that it increases market illiquidity and volatility. Using wavelet coherence analysis, Demir et al. (2020) find a negative and positive relationship between COVID-19 and cryptocurrencies. In addition, Zhang et al. (2020) find that both financial market risk and uncertainty increase following the outbreak of COVID-19.

In this paper, we study the effect of the first registered case of COVID-19 for 30 stock market indices using an event study approach. The results show that there is a downwards trend in cumulative abnormal returns for all indices, indicating that there is a negative effect of COVID-19 on index returns. This paper contributes to the literature on the relationship between COVID-19 and stock market returns by covering 30 markets, as well as treating the first registered case in each country as the event day.

The remainder of this paper is organised as follows: in the next section we discuss the data and methodology. We analyse the results in Section 3 and in Section 4 we conclude the paper.

2. DATA AND METHODOLOGY

We obtain stock index daily data from EOD Historical Data and Morgan Stanley Capital International (MSCI).[1] The date of the first registered case and the number of the top 30 countries in terms of the number of registered cases of COVID-19 are obtained from the European Centre for Disease Prevention and Control. Table 1 shows the top 30 countries in terms of the number of registered cases (as of 24 April 2020), their stock index and their first registered case, which is treated as the event day. Countries whose first case was registered on a weekend are excluded from the study as stock market index data are not available for weekends.

We use simple arithmetic returns to calculate daily index return. In addition, we calculate abnormal returns ($ABR_{n,d}$) and cumulative abnormal returns ($CABR_{n,d}$) for each day in the event window for each index using the following methods: (1) mean-adjusted returns; and (2) the market model.

1 Eodhistoricaldata.com and msci.com/end-of-day-data-search.

Table 1: Stock market indices and event days for the top 30 countries with the most registered cases as of 24 April 2020

	Country	Stock market index	First registered case (Event day)
1	United States	S&P500	21 January 2020
2	Spain	IBEX35	31 January 2020
3	Italy	FTSE Italia ALL	31 January 2020
4	France	CAC40	24 January 2020
5	Germany	DAX	27 January 2020
6	United Kingdom	FTSE100	31 January 2020
7	Turkey	FTSE Turkey	11 March 2020
8	China	FTSE China A50	31 December 2019
9	Russia	MOEX Russia	31 January 2020
10	Belgium	BEL20	4 February 2020
11	Canada	S&P TSX Composite	27 January 2020
12	Netherlands	AEX Amsterdam	27 February 2020
13	Switzerland	Swiss Market Index	25 February 2020
14	India	Nifty50	30 January 2020
15	Portugal	PSI20	2 March 2020
16	Peru	S&P BVL Peru General	6 March 2020
17	Ireland	ISEQ Overall	27 February 2020
18	Sweden	OMX30	31 January 2020
19	Austria	Austrian traded index	25 February 2020
20	Israel	Tel Aviv100	21 February 2020
21	Japan	Nikkei225	16 January 2020
22	Brazil	Bovespa	25 February 2020
23	Indonesia	JKSE Composite	2 March 2020
24	Denmark	OMX Copenhagen25	27 January 2020
25	Philippines	PESI	30 January 2020
26	Norway	Oslo All Shares	26 February 2020
27	Mexico	Mexico S&P BMV IPC	28 February 2020
28	South Korea	KOSPI	20 January 2020
29	Singapore	FTSE Straits time	23 January 2020
30	Poland	FTSE Poland	4 March 2020

1) Mean-adjusted returns

As in Brown and Warner (1985), we use standard mean-adjusted returns to calculate abnormal returns ($ABR_{n,d}$) for index n on day d:

$$ABR_{n,d} = R_{n,d} - \overline{R_n} \quad (1)$$

$$\overline{R_n} = \frac{1}{239} = \sum_{d=-250}^{-11} R_{n,d} \quad (2)$$

where $R_{n,d}$ is the return of index n on day d and is the average return of index n's daily returns during the estimation window (–250, –11).

2) Market model

In addition to the mean-adjusted returns, we calculate abnormal returns ($ABR_{n,d}$) using market model methodology as in Dodd and Warner (1983) and Brown and Warner (1985) as follows:

$$ABR_{n,d} = R_{n,d} - (\alpha_n + \beta_n R_{m,d}) \quad (3)$$

where $R_{n,d}$ is the return of index n on day d. $R_{m,d}$ is the return of the MSCI All-Country World Equity Index. α_n and β_n are regression coefficients for the estimation window (–250, –11) obtained by ordinary least squares estimation (OLS).

3. RESULTS

Figures 1 and 2 show $ABR_{n,d}$ and $CABR_{n,d}$ for all indices calculated using mean-adjusted returns and the market model,

Figure 1: $ABR_{n,d}$ and $CABR_{n,d}$ for all indices calculated using mean-adjusted returns

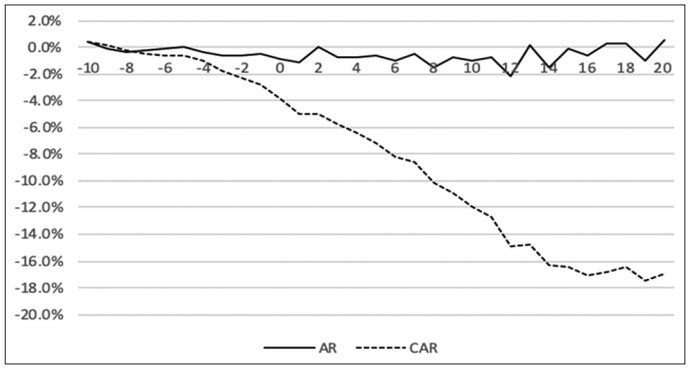

Figure 2: $ABR_{n,d}$ and $CABR_{n,d}$ for all indices calculated using the market model

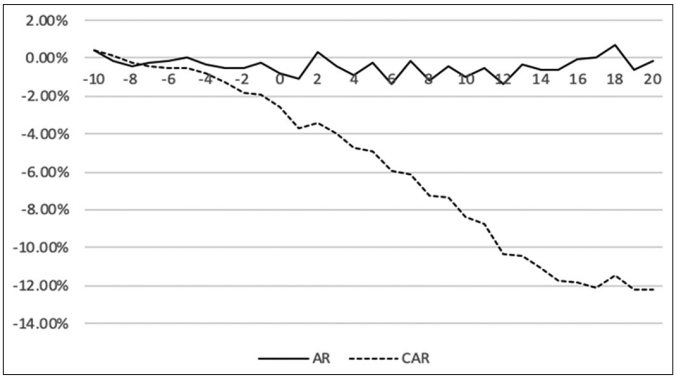

Table 2: Descriptive statistics for abnormal returns ($ABR_{n,d}$) using mean-adjusted returns and the market model before and after the event day

	Mean-adjusted returns $ABR_{n,d}$				Market model $ABR_{n,d}$			
	Mean	Median	Skewness	Kurtosis	Mean	Median	Skewness	Kurtosis
–10	0.0035	0.0016	0.8248	1.0077	0.0040	0.0020	0.5255	–0.0369
–9	–0.0018	–0.0012	–2.6062	9.5405	–0.0018	–0.0011	–1.8799	5.5265
–8	–0.0040	–0.0026	–1.6376	5.1077	–0.0040	–0.0024	–1.5067	4.3001
–7	–0.0026	–0.0014	–1.9949	7.1036	–0.0023	–0.0014	–1.1598	4.9073
–6	–0.0016	–0.0016	0.5351	2.3155	–0.0011	–0.0014	1.1040	4.1695
–5	–0.0004	0.0012	–1.0616	1.9382	–0.0001	0.0018	–1.0987	1.8343
–4	–0.0038	–0.0010	–0.8179	0.6601	–0.0038	–0.0013	–0.3640	–0.3660
–3	–0.0066	–0.0038	–0.9607	1.2312	–0.0056	–0.0037	–0.9626	0.8794
–2	–0.0061	–0.0058	–0.8099	1.2376	–0.0051	–0.0055	0.0465	1.9832
–1	–0.0054	–0.0033	0.3708	2.5902	–0.0020	–0.0032	1.0749	3.8065
0	–0.0095	–0.0079	0.0375	0.6112	–0.0082	–0.0079	0.2990	–0.0967
+1	–0.0114	–0.0021	–0.8089	0.0167	–0.0104	–0.0033	–1.0033	0.7455
+2	0.0000	0.0058	–0.9517	0.0494	0.0030	0.0065	–1.2553	1.8778
+3	–0.0077	–0.0017	–1.7918	3.4946	–0.0045	–0.0007	–1.0567	1.4938
+4	–0.0071	–0.0035	–1.8805	6.4822	–0.0088	–0.0044	–1.8831	6.4775
+5	–0.0068	–0.0020	–1.6026	3.7729	–0.0026	0.0026	–2.1219	6.2184
+6	–0.0103	–0.0019	–2.7420	9.4040	–0.0137	–0.0031	–2.7782	10.1231
+7	–0.0046	0.0008	–1.1062	1.3877	–0.0015	0.0070	–0.5300	2.3991
+8	–0.0151	–0.0039	–1.6349	2.3647	–0.0118	–0.0038	–1.5093	2.9531
+9	–0.0076	0.0011	–1.7665	5.3126	–0.0041	0.0032	–1.0662	3.5347
+10	–0.0107	–0.0055	–0.7301	4.0501	–0.0096	–0.0033	–1.4000	2.9829
+11	–0.0082	–0.0010	–1.3391	2.2891	–0.0056	–0.0024	–0.8947	2.5797
+12	–0.0212	–0.0057	–2.0242	4.2013	–0.0138	–0.0065	–1.6269	4.7253
+13	0.0011	–0.0007	2.8649	14.0119	–0.0031	–0.0006	–0.1763	4.7999
+14	–0.0155	–0.0013	–2.2035	5.3579	–0.0065	0.0011	–1.6070	3.2389
+15	–0.0015	–0.0024	0.3031	0.3220	–0.0062	–0.0045	0.1257	1.3870
+16	–0.0064	–0.0012	–0.6206	1.2979	–0.0010	–0.0009	0.0869	1.0811
+17	0.0031	–0.0015	1.3397	3.3004	–0.0001	–0.0043	1.5773	4.0255
+18	0.0030	0.0026	0.7656	1.7621	0.0065	–0.0001	0.9983	1.0249
+19	–0.0099	–0.0091	0.4044	0.7972	–0.0063	–0.0091	0.6008	0.8990
+20	0.0051	0.0000	1.2700	1.8749	–0.0013	–0.0053	0.7961	1.3912

Table 3: Descriptive statistics for cumulative abnormal returns ($CABR_{n,d}$) calculated using mean-adjusted returns and the market model before and after the event day

	Mean-adjusted returns $CABR_{n,d}$				Market model $CABR_{n,d}$			
	Mean	Median	Skewness	Kurtosis	Mean	Median	Skewness	Kurtosis
–10	0.0035	0.0016	0.8248	1.0077	0.0040	0.0020	0.5255	–0.0369
–9	0.0017	0.0005	–0.2737	2.8140	0.0017	0.0004	0.0215	3.7048
–8	–0.0023	–0.0012	–1.8494	5.7161	–0.0022	–0.0007	–1.3243	2.9777
–7	–0.0049	–0.0034	–1.1963	1.7095	–0.0047	–0.0034	–0.6913	0.8378
–6	–0.0065	–0.0039	–1.4192	3.4359	–0.0057	–0.0037	–1.3074	2.6892
–5	–0.0069	–0.0046	–1.8055	4.3570	–0.0056	–0.0045	–1.4318	2.8749
–4	–0.0107	–0.0081	–1.9988	6.4472	–0.0082	–0.0084	–1.0307	1.8337
–3	–0.0173	–0.0072	–2.4549	9.0317	–0.0130	–0.0062	–1.6481	4.0157
–2	–0.0234	–0.0156	–1.2919	2.4248	–0.0183	–0.0154	–0.4377	–0.3907
–1	–0.0288	–0.0236	–0.5627	–0.2345	–0.0193	–0.0195	–0.1591	–0.3463
0	–0.0383	–0.0323	–0.4300	–0.7466	–0.0262	–0.0302	–0.1901	0.4113
+1	–0.0498	–0.0407	–0.6457	–0.2662	–0.0370	–0.0349	–0.8218	0.1060
+2	–0.0497	–0.0309	–0.4860	–0.6939	–0.0345	–0.0231	–0.6777	–0.4617
+3	–0.0574	–0.0336	–1.1669	1.0217	–0.0396	–0.0218	–0.8662	–0.1908
+4	–0.0646	–0.0392	–1.3565	1.3574	–0.0477	–0.0348	–1.2036	0.8532
+5	–0.0713	–0.0409	–1.3350	1.5321	–0.0491	–0.0296	–0.7303	–0.4252
+6	–0.0816	–0.0439	–1.7812	4.0059	–0.0599	–0.0255	–1.6131	2.8314
+7	–0.0862	–0.0324	–1.0948	0.8216	–0.0612	–0.0295	–1.0779	0.1746
+8	–0.1013	–0.0327	–0.8342	–0.3056	–0.0729	–0.0301	–0.7959	–0.6598
+9	–0.1089	–0.0325	–0.5403	–1.2765	–0.0737	–0.0297	–0.8117	–0.8611
+10	–0.1196	–0.0360	–0.5924	–1.2227	–0.0836	–0.0313	–1.1098	0.0721
+11	–0.1278	–0.0385	–0.4132	–1.6217	–0.0878	–0.0317	–0.9926	–0.3820
+12	–0.1489	–0.0437	–0.5481	–1.2510	–0.1032	–0.0427	–1.1125	0.0329
+13	–0.1478	–0.0382	–0.3984	–1.6817	–0.1045	–0.0327	–1.0162	–0.4657
+14	–0.1633	–0.0383	–0.5813	–1.2360	–0.1107	–0.0356	–1.2592	0.4316
+15	–0.1649	–0.0380	–0.5200	–1.3650	–0.1177	–0.0316	–1.1685	0.0542
+16	–0.1712	–0.0652	–0.7609	–0.5248	–0.1179	–0.0528	–1.2877	1.1118
+17	–0.1681	–0.0799	–0.7836	–0.3550	–0.1208	–0.0657	–1.2629	1.0989
+18	–0.1651	–0.1007	–0.6558	–0.6106	–0.1149	–0.0842	–0.9178	0.0593
+19	–0.1750	–0.1363	–0.7919	0.3772	–0.1218	–0.0963	–0.8533	0.0181
+20	–0.1699	–0.1418	–0.5662	–0.3097	–0.1226	–0.1104	–0.5768	–0.7488

respectively. They show that $CABR_{n,d}$ experiences a downwards trend following the event day. Tables 2 and 3 present descriptive statistics for all indices, whose distribution is negatively skewed following the event day, indicating the existence of extreme negative values. Moreover, the kurtosis values demonstrate that the distribution is leptokurtic, suggesting the presence of extreme outlier values.

Tables 4 and 5 show mean and median equality tests for all indices calculated using the two methods (mean-adjusted returns and the market model). The event windows we use are [–1, 1], [–3, 3], [–5, 5], [–10, 10], [–10, 15] and [–10, 20]. Table 4 shows that using mean-adjusted returns, market responses following the event day are negative and highly significant during all event windows

Table 4: Mean and median equality tests for cumulative abnormal returns ($CABR_{n,d}$) calculated by mean-adjusted returns

Panel A: Mean equality tests				
Event window	**Before**	**After**	**After–Before**	**t-test**
[–1,1]	–0.0288	–0.0498	–0.0209	–1.7468*
[–3,3]	–0.0173	–0.0574	–0.0401	–2.7469***
[–5,5]	–0.0069	–0.0713	–0.0644	–3.9584***
[–10,10]	0.0035	–0.1196	–0.1231	–4.6628***
[–10,15]	0.0035	–0.1649	–0.1684	4.7177***
[–10,20]	0.0035	–0.1699	–0.1734	6.4518***
Panel B: Median equality tests				
Event window	**Before**	**After**	**After–Before**	**W/M**
[–1,1]	–0.0236	–0.0407	–0.0171	1.6337
[–3,3]	–0.0072	–0.0336	–0.0265	2.1807**
[–5,5]	–0.0046	–0.0409	–0.0363	3.5113***
[–10,10]	0.0016	–0.0360	–0.0375	3.5557***
[–10,15]	0.0016	–0.0380	–0.0396	3.4226***
[–10,20]	0.0016	–0.1418	–0.1434	5.1228***

The t-test represents a standard test for equality of the Satterthwaite–Welch test. The W/M represents the Wilcoxon–Mann–Whitney signed rank median test. *, **, *** imply statistical significance at the 10%, 5% and 1% level, respectively

Table 5: Mean and median equality tests for cumulative abnormal returns ($CABR_{n,d}$) calculated using the market model

Panel A: Mean equality tests				
Event window	**Before**	**After**	**After–Before**	**t-test**
[–1,1]	–0.0193	–0.0370	–0.0177	–1.6912*
[–3,3]	–0.0130	–0.0396	–0.0266	2.2329**
[–5,5]	–0.0056	–0.0491	–0.0435	3.4766***
[–10,10]	0.0040	–0.0836	–0.0876	3.9926***
[–10,15]	0.0040	–0.1177	–0.1217	3.8934***
[–10,20]	0.0040	–0.1226	–0.1265	5.9632***
Panel B: Median equality tests				
Event window	**Before**	**After**	**After–Before**	**W/M**
[–1,1]	–0.0195	–0.0349	–0.0154	1.2049
[–3,3]	–0.0062	–0.0218	–0.0156	1.5006
[–5,5]	–0.0045	–0.0296	–0.0251	2.4912**
[–10,10]	0.0020	–0.0313	–0.0334	3.6444***
[–10,15]	0.0020	–0.0316	–0.0337	3.3782***
[–10,20]	0.0020	–0.1104	–0.1124	4.6793***

The t-test represents a standard test for equality of the Satterthwaite–Welch test. The W/M represents the Wilcoxon–Mann–Whitney signed rank median test. *, **, *** imply statistical significance at the 10%, 5% and 1% level, respectively

with the exception of [–1,1], which is insignificant according to the Wilcoxon–Mann–Whitney signed rank median test.[2] Table 5 shows that using the market model, market reactions following the event day are negative and highly significant during all event windows but [–1,1] and [–3, 3], which are insignificant according to the Wilcoxon–Mann–Whitney signed rank median test. Taken together, the results indicate that indices are negatively affected by the COVID-19 outbreak.[3]

4. CONCLUSION

After analysing the returns of 30 stock market indices following the outbreak of COVID-19, we conclude that stock market returns reaction is significantly negative. This result is obtained using mean-adjusted returns and the market model methods for different event windows.

2 This median test is nonparametric and used to address small sample size and thinly traded stocks (see Bartholdy et al., 2011; Harris and Hardin, 2013; Maynes and Rumsey, 1993).

3 Figures and results for and calculated using both methods for every stock index are available from the author upon request.

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