Online Appendix

Stock Market Reactions to COVID-19 Lockdowns: A Global Analysis

Matthias Scherf[1] Xenia Matschke[2] Marc Oliver Rieger[3]

May 21, 2021

[1]Trier University, Trier, Germany, scherfm@uni-trier.de
[2]Trier University, Trier, Germany, matschke@uni-trier.de
[3]Trier University, Trier, Germany, mrieger@uni-trier.de

A.1. Detailed Methodology

This section describes the two-stage model used to measure the effects of government interventions. We follow an event-study approach and test the hypothesis that national COVID-19 numbers and government interventions with regard to COVID-19 have an effect on a country's stock market. All regressions in this study are run using heteroskedasticity and serial correlation robust estimators (Arellano et al. 1987).

The first stage regression aims at controlling for different confounding effects that are known to influence stock market returns in an event study environment:

$$R_{i,t} = \gamma_0 + \sum_{j=-1}^{1} \gamma_{1j} R^m_{i,t+j} + \gamma_2 M_t + \gamma_3 H_{i,t} + \sum_{j=1}^{4} \gamma_{4j} R_{i,t-j} + \epsilon_{i,t}; \tag{1}$$

where $R_{i,t}$ is the daily rate of return of country i at time t. Following Edmans, Garcia & Norli (2007), we control for the correlation of local stock indices across countries by including a world market portfolio R^m_t in the regression, namely the daily rate of return of the MSCI World index. Furthermore, we include the lead R^m_{t+1} and the lag R^m_{t-1} of the world market portfolio to control for time-varying correlations at the world level. To control for the Monday effect found in stock markets (Cho, Linton & Whang 2007), we include a dummy variable M_t. A similar effect often exists for the day after a non-weekend holiday (Edmans et al. 2007, Kaplanski & Levy 2010). Therefore, we also include a dummy variable $H_{i,t}$ to control for this effect, which takes the value 1 for days following a non-weekend holiday. Finally, we control for serial correlation in national stock market returns by including the j^{th} previous day rate of return of country i in our model. The adjusted R^2 for this regression is 36%.

From the above first stage of our model, we recover the estimated regression residuals $\hat{\epsilon}_{i,t}$ of the regression model. In the second stage of our model, we use these residuals as endogenous variable and now focus on the COVID-19 related determinants of the stock returns. The estimation equation is:

$$\begin{aligned} \hat{\epsilon}_{i,t} &= \beta_0 + \beta_1 C_{i,t} + \beta_2 C^w_t + \beta_3 F_{i,t} + \beta_4 G_{r,t} \\ &+ (\beta_5 \Delta S_{i,t-2} + \beta_6 \Delta S_{i,t-1} + \beta_7 \Delta S_{i,t} + \beta_8 \Delta c_{1,2} S_{i,t} + \beta_9 \Delta c_{3-7} S_{i,t})\, \chi_+(\Delta S_{i,t}) \\ &+ (\beta_{10} \Delta S_{i,t-2} + \beta_{11} \Delta S_{i,t-1} + \beta_{12} \Delta S_{i,t} + \beta_{13} \Delta c_{1,2} S_{i,t} + \beta_{14} \Delta c_{3-7} S_{i,t})\, \chi_-(\Delta S_{i,t}); \end{aligned} \tag{2}$$

where

$$\chi_+(x) := \begin{cases} 1, & \text{if } x \geq 0, \\ 0, & \text{otherwise;} \end{cases} \qquad \chi_-(x) := \begin{cases} 1, & \text{if } x < 0, \\ 0, & \text{otherwise.} \end{cases}$$

First, we control for the individual country's COVID-19 cases, since negative consequences of the pandemic on stock market returns are likely to occur (Döhrn 2020) because expected future cash flows decline, which should be reflected in asset prices. For this reason, we calculate the daily percentage change in total COVID-19 cases $C_{i,t}$ of country i. Because today's economies are connected globally, we additionally control for the percentage change in the world-wide number of cases C_t^w.

Next we include a dummy variable $F_{i,t}$ for the first severe measures that are introduced in a country to stop the spread of the virus. The idea is that the first (partial) lockdown in a country signals the impact the virus will have on the country - not only for the health of the population, but also in economic terms (Reuters 2020). This should lead to an adjustment of asset prices. To determine when a government introduced its first severe measures, we look at the containment and closure policy data provided by the OxCGRT. We consider measures such as required school closing, workplace closing, cancellation of public events and stay at home orders as well as restrictions on gatherings of ten or less people as severe measures. If one of these measures is introduced for the first time on day t, the dummy variable $F_{i,t}$ of country i is set to one, otherwise it is set to zero. Similar to the dummy variable that controls for the first severe measure in a country, we also employ a dummy variable $G_{r,t}$ that controls for the first severe measures in the greater region r in which i is located. If these changes happen on a weekend, we move the dummy variable one for $F_{i,t}$ and $G_{r,t}$ to a Monday. To calculate $G_{r,t}$, we again look at the containment and closure policy data provided by the OxCGRT and consider the same measures as before. We split the data into the following regions r: Africa, North America, South America, South-East Asia, Europe and Western Pacific, using the definition for the different regions provided by the World Health Organisation (WHO). For North and South America, we employ the definition by Our World in Data.

To determine the effect of government interventions, we calculate the difference of the stringency index at time $t-1$ and time t to obtain the daily changes in government interventions $\Delta S_{i,t}$. Next we create separate variables for positive and negative changes in a country's stringency index, where $(\Delta S_{i,t})\chi_+$ represents restrictions and $(\Delta S_{i,t})\chi_-$ represents relaxations of government interventions. In the case of tightening of restrictions, we multiply $\Delta S_{i,t}$ with the dummy variable χ_+ and in the case of relaxations of government interventions, we multiply $\Delta S_{i,t}$ with χ_-. Because the information about a change in policies is released prior to the day of the event, we lag the variable $\Delta S_{i,t}$ by one and two days and include the variables $\Delta S_{i,t-2}$ and $\Delta S_{i,t-1}$ in our regression. For the day after the event day $t+1$ as well as the other six days following the event day (hence for dates $t+j$ with $j = \{1, ..., 7\}$), we decided to merge $\Delta S_{i,t+1}$ till $\Delta S_{i,t+7}$ into two separate variables. The first variable $\Delta c_{1,2} S_{i,t}$ cumulates $\Delta S_{i,t+1}$ and $\Delta S_{i,t+2}$ into one variable. The second variable $\Delta c_{3-7} S_{i,t}$ cumulates $\Delta S_{i,t+3}$ till $\Delta S_{i,t+7}$. Those cumulated stringency indices $\Delta c_{1,2} S_{i,t}$ and $\Delta c_{3-7} S_{i,t}$ are calculated by summing up the delta stringency indices $\Delta S_{i,t+j}$ from $j = 1$ till $j = 2$ and from $j = 3$ till $j = 7$, respectively.

As a final step, we split the whole sample into two different sub-samples on which we also conduct our analysis. The first sub-sample period starts January 22 and ends March 27, 2020, and the second starts March 28, 2020 and ends May 20, 2020. We chose the sample split at that date because by March 27, all countries within our sample had introduced their first severe measures. In the end, we are left with the following (sub-)samples: OECD&BRICS, OECD&BRICS-firsthalf, and OECD&BRICS-secondhalf.

A.2. Descriptive Statistics

Figure 1 shows the Italian and the U.S. index in Euros for January 22 till May 20. In addition to the indices, the figure shows the changes in a country's measures against the COVID-19 virus ($\Delta S_{i,t}$) as a vertical line. In the case of Italy and the U.S., we can clearly see that drops in the corresponding index happen around the time of further restrictive government interventions. The early changes in the stringency index ($\Delta S_{i,t}$) that we see for Italy and the U.S. around the end of January and the beginning of February show only a small impact on the countries' markets. The reason may be that those restrictions are travel restrictions set by the two countries. The U.S. on the other hand did not ban travel from some regions and only put quarantine requirements in place at the beginning of February. For details, we refer to the OxCGRT database. For both countries, the corresponding stringency index stays at a value below 20 at that time. If we look at the time around the first severe measures for Italy, we see the first big drop in the stock market.

[Figure 1 about here.]

Around the time of Italy's first severe measures, a drop in the U.S. index occurred. For the U.S., we see a big drop around the time of its first severe measure. If we look at the relaxations of restrictions, we see a positive reaction for the U.S. market and a mixed reaction for the Italian market.

Table 1 shows the descriptive statistics of abnormal returns for OECD and BRICS countries as well as for the three considered sample periods. We used both a parametric and a non-parametric test to test for differences in means. The corresponding tests are the Welch t-test and the Mann-Whitney U-test. On average, we see that the abnormal return is -0.0058%.[1] The difference between the first and second half of our study is significant for both OECD and BRICS countries. Here, the first half on average shows negative abnormal returns while the second half shows positive returns.

[Table 1 about here.]

[1] We did not find any difference between OECD and BRICS countries, neither in the first nor in the second half of the sample (results available upon request).

A.3. Coefficients from the abnormal return construction

Table 2 shows the regression results for the first stage of our model, where we calculated the residuals $\hat{\epsilon}_{it}$, which we use as the dependent variable in the second stage. R_{t-2} and R_{t-3} have been dropped to improve the model's adjusted R^2, which is 36%. The Breusch-Godfrey test was used to test for serial correlation, because it allows for the inclusion of lagged variables, which could potentially cause problems in more general tests for autoregressive processes (Godfrey 1978). The corresponding p-value is 0.52 which means our model is not subject to serial correlation. The variables for the international stock market (MSCI World) are highly significant and confirm that international markets are integrated with one another. Similar to other studies, we find a highly significant negative return on Mondays (Cho et al. 2007, Kuria & Riro 2013, Ülkü & Rogers 2018) and positive returns after a non-weekend holiday (Tsiakas 2008, Tsiakas 2010).

[Table 2 about here.]

A.5. Robustness Checks

To check if our results are robust, we modify the second stage of our model. Instead of using the cumulated stringency index $\Delta cS_{i,t}$ in our analysis, we include the full range of stringency indices $\sum_{j=-7}^{7} \Delta S_{i,t+j}$ in our model. The results are reported in Tables 3, 4, and 5.

The regression results for the full sample (3) confirm the results of our first regression. The negative impact for first measure in a region and first measure in a country are almost identical compared to our main results. If we again look at the sequential impact, we see that negative returns again start one day before the implementation of restrictions and extend to two days after the implementation, followed by a correction between day $t3$ and $t5$. Furthermore, we find negative returns seven to four days before the government interventions are imposed, which provides further evidence for an existing announcement effect. Another explanation may be that discussions about lockdowns take place around that time, which is priced in by the market. This time, however, we find no significant effects for the easing of government restrictions.

[Table 3 about here.]

Table 4 shows the results for the first half of our sample period (January 22 - March 27, 2020). The results confirm the main results for our first sub-sample. The returns are again negative and bigger when the first severe measures are implemented - whether regional or national - compared to the implementation of further restrictions. The pattern of returns for further restrictions is also similar to the whole sample. Negative returns can be seen again seven to five days and one day before further restrictions as well as on the day restrictions are imposed. This time, however, we do not find negative returns for day $t1$ and $t2$. The negative returns are again partially corrected after the implementation, which is a sign of an overreaction before the implementation. Similarly to our main results, we find a negative return on the day restrictions are eased. (Because of the negative delta stringency indices, results have to be multiplied by -1). However, we additionally find negative returns 7 to 5 days before the relaxation of government interventions. This is further evidence that the market interprets the easing of restrictions as coming too early in the period January to March. Furthermore, we find further evidence for an announcement effect.

[Table 4 about here.]

In Table 5, the results for the second half of our study can be found (March 28 - May 20, 2020). Our main results for the second sub-sample are again confirmed in our robustness check. While the negative effect of further restrictions seems to have weakened one day before the implementation of restrictions, this effect is still strong on day 5 before the restrictions are implemented. In addition to the positive returns two days before the rollback of restrictions, we find a correction at the day of the relaxation. Overall, the robustness check confirms our findings in Section 3 in the main text.

[Table 5 about here.]

A.4. Graphical Presentation of Results

The results of the overall sample are summarised in Figure (1) in the main text. We see an initial price drift, i.e. an underreaction to the stringency measures followed by an overreaction, which can be seen from the partial recovery starting a few days after the stringency event. The patterns for restrictions and their rollbacks are mostly symmetric.

Figure 2 shows the pattern of restrictions and relaxations for the first half of the studied period. We again see the negative impact of restrictions with a correction and the negative impact of relaxation during the studied period up to the end of March.

[Figure 2 about here.]

Figure 3 shows the same pattern of restrictions and relaxations for the second half of our studied period – starting March 28 till May 20, 2020. For restrictions, we see negative returns, as we have observed before, and positive returns before relaxations, which are corrected afterwards.

[Figure 3 about here.]

References

Arellano, M. et al. (1987), 'Computing robust standard errors for within-groups estimators', *Oxford Bulletin of Economics and Statistics* **49**(4), 431–434.

Cho, Y.-H., Linton, O. & Whang, Y.-J. (2007), 'Are there Monday effects in stock returns: A stochastic dominance approach', *Journal of Empirical Finance* **14**(5), 736–755.

Döhrn, R. (2020), Auswirkungen der COVID-19-Epidemie auf die chinesische Wirtschaft - eine erste Abschätzung, Technical report, RWI Materialien.

Edmans, A., Garcia, D. & Norli, Ø. (2007), 'Sports sentiment and stock returns', *The Journal of Finance* **62**(4), 1967–1998.

Godfrey, L. G. (1978), 'Testing against general autoregressive and moving average error models when the regressors include lagged dependent variables', *Econometrica* pp. 1293–1301.

Kaplanski, G. & Levy, H. (2010), 'Sentiment and stock prices: The case of aviation disasters', *Journal of Financial Economics* **95**(2), 174–201.

Kuria, A. M. & Riro, G. K. (2013), 'Stock market anomalies: A study of seasonal effects on average returns of Nairobi securities exchange', *Research Journal of Finance and Accounting* **4**(7), 207–215.

Reuters (2020), 'Italy March industry output plunges 28% month-on-month on coronavirus lockdown, steepest drop on record', *Reuters* .

Tsiakas, I. (2008), 'Overnight information and stochastic volatility: A study of European and US stock exchanges', *Journal of Banking & Finance* **32**(2), 251–268.

Tsiakas, I. (2010), 'The economic gains of trading stocks around holidays', *Journal of Financial Research* **33**(1), 1–26.

Ülkü, N. & Rogers, M. (2018), 'Who drives the Monday effect?', *Journal of Economic Behavior & Organization* **148**, 46–65.

Table 1

Distribution of abnormal returns for OECD and BRICS countries

	Full Sample Period			First Half			Second Half		
	Full Sample	OECD	BRICS	Full Sample	OECD	BRICS	Full Sample	OECD	BRICS
Mean	-5.8E-04	-4.4E-04	-1.4E-03	-2.4E-03	-2.2E-03	-3.3E-03	2.1E-03	2.3E-03	2.5E-03
Median	1.0E-04	1.4E-04	-7.2E-04	-1.0E-03	-9.2E-04	-2.1E-03	2.1E-03	2.2E-03	2.3E-03
Sd	2.1E-02	2.0E-02	2.8E-02	2.3E-02	2.2E-02	3.1E-02	1.7E-02	1.6E-02	2.0E-02
Min	-0.12	-0.11	-0.12	-0.12	-0.11	-0.12	-5.9E-02	-5.1E-02	-5.9E-02
Max	0.12	0.11	0.12	0.12	0.12	0.12	6.9E-02	6.9E-02	6.9E-02
N	2666	2300	366	1591	1374	217	1075	926	149
	OECD- BRICS	diff.	p-value	First - Second Half (OECD)	diff.	p-value	First - Second Half (BRICS)	diff.	p-value
Welch's t-test		9.8E-05	0.52		-4.6E-03	0.00**		-5.8E-03	0.03**
Mann-Whitney-U-test		9.8E-05	0.65		-4.6E-03	0.00**		-5.8E-03	0.03**

This table reports the abnormal returns for OECD and BRICS countries. Additionally, the table distinguishes between the full sample period (January 22 - May 20), the first half (January 22 - March 27), and the second half (March 28 - May 20); and reports on the T-test and U-test p-value for the differences between the first and second half.$^{*}p \leq 0.1$,$^{**}p \leq 0.05$

Table 2

Model for the calculation of abnormal stock market returns

variable	coefficient	p-value
Intercept	0.00	0.36
MSCI World t-1 (R^m_{t-1})	0.28	0.00**
MSCI World t0 (R^m_t)	0.57	0.00**
MSCI World t+1 (R^m_{t+1})	-0.08	0.00**
Monday M_t	-6E-03	0.00**
Holiday $H_{i,t}$	4E-03	0.00**
$R_{i,t-1}$	0.07	0.32
$R_{i,t-4}$	0.07	0.52
adjusted R^2		0.36
Breusch Godfrey	LM test 0.4	0.52
N		3440

This table reports the regression results of the first-stage model for the full sample from January 22 - May 20.
The estimation equation is:

$$R_{i,t} = \gamma_0 + \sum_{j=-1}^{1} \gamma_{1j} R^m_{t+j} + \gamma_2 M_t + \gamma_3 H_{i,t} + \sum_{j=1}^{4} \gamma_{4j} R_{i,t-j} + \epsilon_{i,t};$$

where $R_{i,t}$ is the daily rate of return of country i at time t. A further explanation is provided in the text.

Table 3

Robustness Check OECD and BRICS Countries (January 22 - May 20, 2020)

variable	coefficient	p-value
intercept	1.15E-03	0.04**
new cases (country i)	-3.30E-04	0.77
new cases (global)	3.70E-03	0.38
first severe measures (country i)	-1.47E-02	0.01**
first severe measures (region)	-1.89E-02	0.00**
positive stringency index t-7	-5.90E-04	0.00**
positive stringency index t-6	-7.50E-05	0.67
positive stringency index t-5	-4.59E-04	0.01**
positive stringency index t-4	-3.61E-04	0.05**
positive stringency index t-3	-3.15E-04	0.15
positive stringency index t-2	1.37E-04	0.60
positive stringency index t-1	-4.82E-04	0.01**
positive stringency index t0	-4.85E-04	0.03**
positive stringency index t+1	-1.90E-04	0.37
positive stringency index t+2	-4.85E-04	0.07*
positive stringency index t+3	4.91E-04	0.03**
positive stringency index t+4	2.46E-04	0.28
positive stringency index t+5	3.54E-04	0.08*
positive stringency index t+6	-9.11E-05	0.68
positive stringency index t+7	2.05E-04	0.20
negative stringency index t-7	-1.86E-04	0.40
negative stringency index t-6	-1.91E-04	0.26
negative stringency index t-5	3.28E-04	0.23
negative stringency index t-4	-3.33E-04	0.31
negative stringency index t-3	-5.56E-04	0.13
negative stringency index t-2	-1.50E-03	0.11
negative stringency index t-1	8.14E-05	0.84
negative stringency index t0	8.12E-04	0.13
negative stringency index t+1	3.31E-05	0.76
negative stringency index t+2	2.54E-05	0.81
negative stringency index t+3	-5.84E-05	0.73
negative stringency index t+4	2.39E-04	0.28
negative stringency index t+5	-4.67E-05	0.61
negative stringency index t+6	1.39E-07	1.00
negative stringency index t+7	7.71E-05	0.56
adjusted R^2		0.09
N		2666

This table reports the regression results for OECD and BRICS countries for the full sample from January 22 - May 20, 2020. For the independent variable, we use the abnormal returns from the first-stage model reported in Table 2. The above table shows the results for the variables: daily changes in total COVID-19 cases in percent of country i, daily global changes in total COVID-19 cases in percent, the dummy variable for the first severe measures of country i and the dummy variable for the first severe measure in the greater region r and the changes in the stringency index of country i at time t (separately for restrictions (positive) and relaxations of restrictions (negative)). $^{*}p \leq 0.1, ^{**}p \leq 0.05$

Table 4

Robustness Check OECD and BRICS Countries (January 22 - March 27, 2020)

variable	coefficients	p-value
intercept	-3.20E-06	1.00
new cases (country i)	-2.02E-04	0.86
new cases (global)	7.18E-03	0.12
first severe measures (country i)	-1.35E-02	0.02**
first severe measures (region)	-1.82E-02	0.00**
positive stringency index t-7	-5.71E-04	0.00**
positive stringency index t-6	-5.52E-05	0.76
positive stringency index t-5	-4.02E-04	0.02**
positive stringency index t-4	-2.97E-04	0.12
positive stringency index t-3	-3.01E-04	0.20
positive stringency index t-2	1.80E-04	0.51
positive stringency index t-1	-4.84E-04	0.01**
positive stringency index t0	-5.41E-04	0.02**
positive stringency index t+1	-1.57E-04	0.49
positive stringency index t+2	-4.49E-04	0.13
positive stringency index t+3	5.02E-04	0.05**
positive stringency index t+4	2.97E-04	0.25
positive stringency index t+5	4.71E-04	0.05**
positive stringency index t+6	-1.85E-04	0.48
positive stringency index t+7	2.97E-04	0.14
negative stringency index t-7	1.37E-03	0.02**
negative stringency index t-6	1.66E-03	0.02**
negative stringency index t-5	3.12E-03	0.04**
negative stringency index t-4	-8.62E-04	0.48
negative stringency index t-3	-1.65E-03	0.50
negative stringency index t-2	1.62E-04	0.97
negative stringency index t-1	-4.32E-04	0.69
negative stringency index t0	6.70E-03	0.00**
negative stringency index t+1	-5.00E-05	0.68
negative stringency index t+2	6.23E-05	0.82
negative stringency index t+3	-6.19E-04	0.59
negative stringency index t+4	1.71E-03	0.29
negative stringency index t+5	3.94E-06	0.91
negative stringency index t+6	2.97E-05	0.71
negative stringency index t+7	9.00E-05	0.20
adjusted R^2		0.11
N		1591

This table reports the regression results for OECD; BRICS countries; January 22 - March 27. $^{*}p \leq 0.1, ^{**}p \leq 0.05$

Table 5

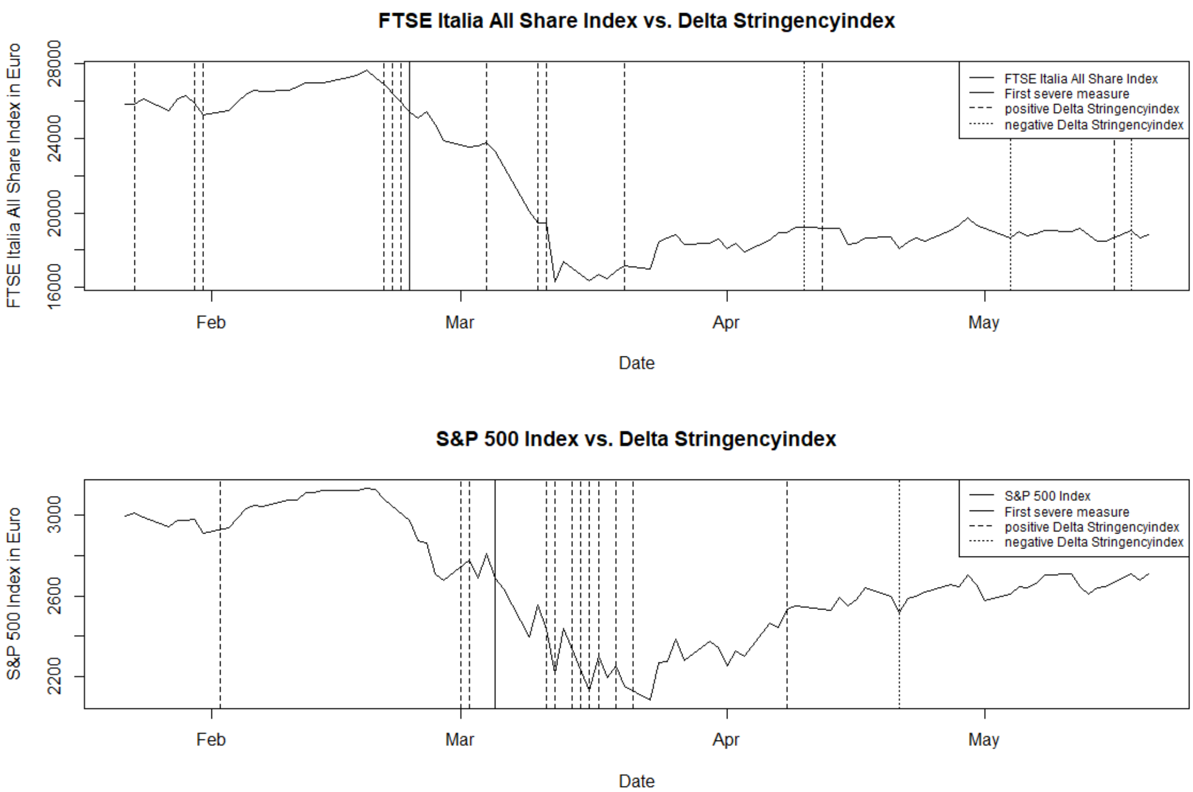
Robustness Check OECD and BRICS Countries (March 28 - May 20, 2020)

variable	coefficient	p-value
intercept	1.25E-03	0.33
new cases (country i)	-4.05E-03	0.84
new cases (global)	1.98E-02	0.56
positive stringency index t-7	2.51E-04	0.81
positive stringency index t-6	9.03E-04	0.21
positive stringency index t-5	-2.05E-03	0.03**
positive stringency index t-4	1.83E-05	0.99
positive stringency index t-3	-1.12E-04	0.74
positive stringency index t-2	4.00E-04	0.35
positive stringency index t-1	-4.28E-04	0.10*
positive stringency index t0	-5.66E-05	0.89
positive stringency index t+1	2.23E-04	0.46
positive stringency index t+2	-3.48E-04	0.26
positive stringency index t+3	7.17E-04	0.05**
positive stringency index t+4	2.03E-05	0.96
positive stringency index t+5	2.25E-05	0.95
positive stringency index t+6	2.10E-04	0.58
positive stringency index t+7	2.51E-05	0.89
negative stringency index t-7	-2.19E-04	0.34
negative stringency index t-6	-2.52E-04	0.11
negative stringency index t-5	1.54E-04	0.54
negative stringency index t-4	-2.19E-04	0.51
negative stringency index t-3	-3.71E-04	0.11
negative stringency index t-2	-1.71E-03	0.00**
negative stringency index t-1	1.69E-04	0.70
negative stringency index t0	4.12E-04	0.04**
negative stringency index t+1	1.81E-04	0.28
negative stringency index t+2	1.51E-04	0.35
negative stringency index t+3	4.78E-05	0.77
negative stringency index t+4	1.48E-04	0.46
negative stringency index t+5	-1.93E-04	0.69
negative stringency index t+6	2.73E-04	0.34
negative stringency index t+7	7.60E-05	0.77
adjusted R^2		0.03
N		1075

This table reports the regression results for OECD; BRICS countries; March 28 - May 20.
$^{*}p \leq 0.1, ^{**}p \leq 0.05$

Figure 1

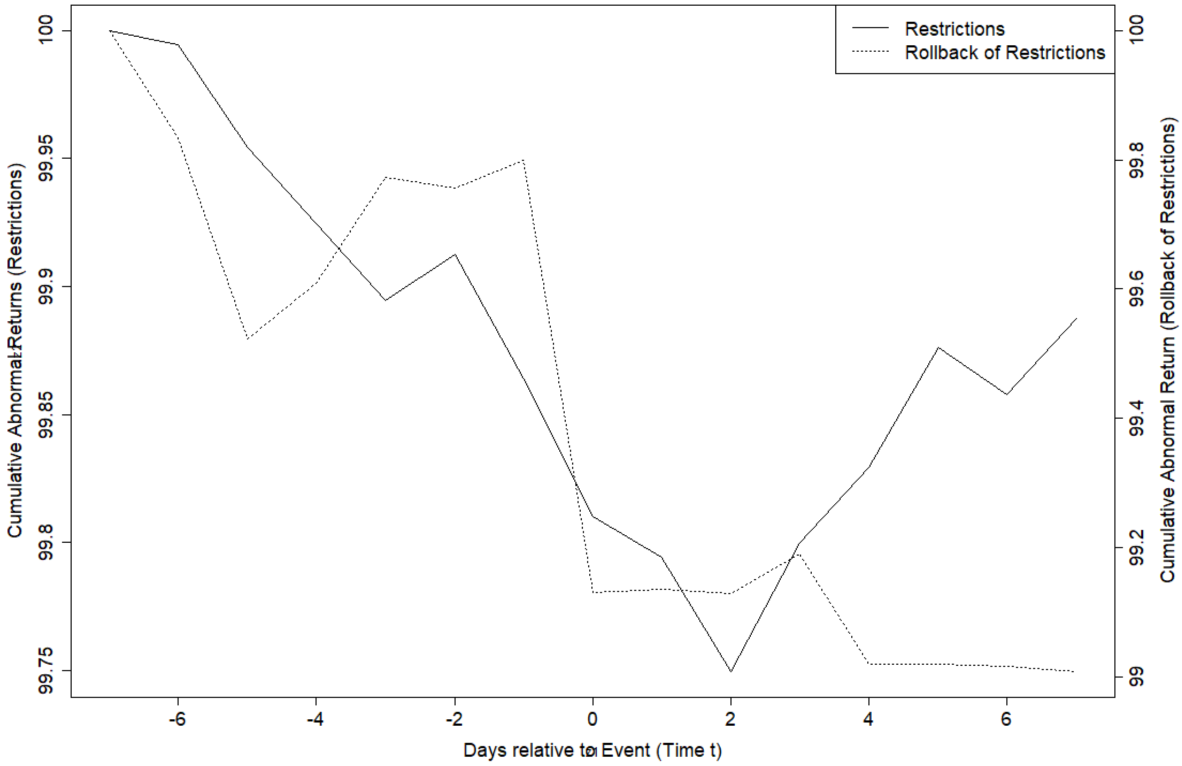
Italian and U.S. Indices vs Delta Stringency Indices



This figure shows two graphs. The first graph shows the Italian stock index in Euro terms and the second graph shows the U.S. index in Euro terms. Furthermore, both graphs feature the dates of the corresponding country's changes in government interventions against COVID-19 as a dashed or dotted vertical line. Additionally, the first severe measures of the corresponding countries are indicated as a solid vertical line.

Figure 2

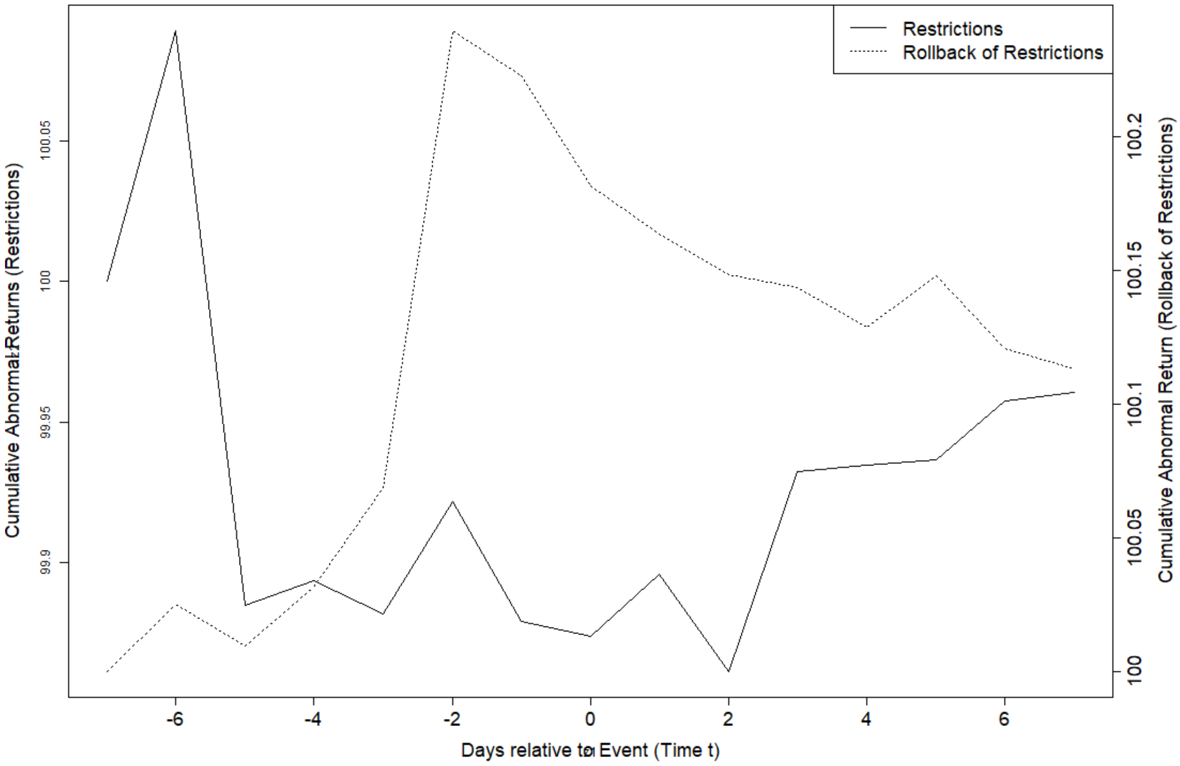
OECD and BRICS Cumulative Country Return Index base 100 (first half)



This figure shows the cumulative abnormal returns around the event day (t=0), which are either restrictions or the rollback of restrictions, for the period January 22 till March 27, 2020. For better illustration, the returns have been rebased to create an index around the event day which starts at t-7 with a value of 100. The next index points are calculated as follows:
Index value$_t$ = Index value$_{t-1} \cdot (1 + \beta(\Delta S_{i,t}))$ for $t = \{-6...7\}$.

Figure 3

OECD and BRICS Cumulative Country Return Index Base 100 (second half)



This figure shows the cumulative abnormal returns around the event day (t=0), which are either restrictions or the rollback of restrictions, for the period March 28 till May 20, 2020. For better illustration the returns have been rebased to create an index around the event day which starts at t-7 with a value of 100. The next index points are calculated as follows:
Index value$_t$ = Index value$_{t-1} \cdot (1 + \beta(\Delta S_{i,t}))$ for $t = \{-6...7\}$.