Market reactions to the arrival and containment of COVID-19: An event study☆

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ABSTRACT

We study the short-term market reactions of US and European stocks during the beginning of the COVID-19 pandemic. Employing an event study, we document that stocks react significantly negatively to the announcement of the first death in a given country. While our results suggest that the announcements of country-specific fiscal policy measures negatively affect stock returns, monetary policy measures have the potential to calm markets. These reactions are either intensified or lessened by firm-specific characteristics such as tangible assets, liquidity, and institutional holdings.

1. Introduction

The spread of COVID-19 is taking its toll on people and harms economies around the globe. On March 12, 2020, the World Health Organization classified the COVID-19 outbreak as a global pandemic.[1] Whereas the long-term global economic consequences are not yet clear, financial markets have already responded with drastic movements: on February 19, 2020, the S&P 500 and the S&P Europe 350 both list at their all time high —only 30 days later, both indices have lost more than a third of their value, with a 12% single day drop in mid-March.[2] As Fetzer et al. (2020) show, the arrival of the Coronavirus substantially increased economic anxiety and weakened economic sentiment among the population. The recent changes in asset prices (Gormsen and Koijen, 2020) and expectations (Coibion et al., 2020; Hanspal et al., 2020) suggest that the pandemic's effects are not regarded to be temporary (Zechner et al., 2020). In order to counteract the crisis and lessen its effects on the economy, many governments and central banks have announced and implemented strong measures.

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[1] See http://www.euro.who.int/en/health-topics/health-emergencies/coronavirus-covid-19/news/news/2020/3/who-announces-covid-19-outbreak-a-pandemic.

[2] Appendix I shows the development of both indices over the course of the past 16 years.

In this study, we investigate cross-country stock market reactions to the arrival and containment of COVID-19. To the best of our knowledge, we are the first to investigate market reactions to fiscal and monetary policy measures on a cross-country level. Using a sample of US and European firms, we employ an event-study approach to analyze short-term stock market reactions. Our results show that stocks react significantly negatively to the first death in a country. This is in contrast to the announcement of the first case, which does not have a significant impact. Our findings furthermore suggest that the announcement of country-specific fiscal policy measures have strongly negative effects on stock returns, whereas monetary policy measures have the potential to ease stock markets. We argue that fiscal policy measures, in contrast to monetary measures, may add to investors' uncertainty. Moreover, this study provides insights into which firm characteristics emerge as value drivers during the pandemic and introduces two determinants that have not yet been proposed during this crisis. First, our most pronounced determinant is the ratio of tangible assets to total assets. We argue that, during this crisis, investors particularly value tangible assets, which potentially offer a way to obtain cash in case a firm files for bankruptcy. Second, the relative amount of institutional investors. Given that institutional investors tend to be better informed than other market participants and are able to engage in short-selling, (Boehmer and Kelley, 2009; Bennett et al., 2003; Boehmer and Wu, 2013) this might put pressure on stock prices.

Reflecting on our findings from a theoretical asset-pricing perspective, it is useful to recall that, in its most simplistic form, the value (V) of the stock market can be characterized as the present value of its future expected dividends, or cash flows (CFs)

$$V_t = \int_0^\infty \mathbb{E}_t[CF_t(n)]e^{-r_t n}\, dn, \tag{1}$$

where $\mathbb{E}_t[CF_t(n)]$ is the expected CF in n years and r_t is the discount rate. A drop in the stock market is either attributable to declining expectations about prospective CFs or an increasing discount rate. Changes in discount rates reflect, among others, shifting risk attitudes or uncertainty about long-term growth rates (Campbell, 2000). Thus, the higher uncertainty among investors due to the announcement of the first death or fiscal policy measures might lead to higher discount rates and, ultimately, a drop in stock prices whereas monetary policy measures have the opposite effect. In a similar vein the findings regarding firm characteristics can be interpreted, as for example tangible assets may increase cash flows in case of financial distress through their marketability.

Although SARS-CoV-2 is a rather young virus, the literature studying its impact on financial markets is growing rapidly.[3] Ramelli and Wagner (2020) investigate stock market reactions and identify firms' international trade as well as corporate cash and debt as key drivers of exposure to the pandemic. Alfaro et al. (2020) employ unexpected changes in the trajectory of COVID-19 cases and show that an unanticipated doubling of predicted infections forecasts stock market declines. Zhang et al. (2020) and Akhtaruzzaman et al. (2020) show that, in response to the pandemic, global stock market risks respectively conditional correlations between countries' stock returns have increased substantially. Furthermore, Goodell and Huynh (2020) employ an event study examining market reactions of US industries to COVID-19 news announcements and find that legislators traded ahead of the market. We contribute to the existing literature by studying a comprehensive set of events and especially policy related market reactions.

2. Data and methodology

The data used in this event study is obtained from various sources. First, we collect most of our data from Refinitiv. Specifically, we obtain logarithmic stock returns of all firms that are constituents of the S&P 500 and the S&P Europe 350, starting January 2018. Also, we collect the values of the two indices themselves. Moreover, we receive control variables from Refinitiv[4]: we control for firm characteristics by including variables that have established as 'standard control variables' (Ramelli and Wagner, 2020) in the corresponding literature, i.e. firm size, market-to-book ratio and profitability. Given that prior research reports leverage to affect firm performance during economic downturns (e.g. Opler and Titman, 1994) and a positive role of liquidity (e.g. Bates et al., 2009) and tangible assets (e.g. Hackbarth et al., 2015) during financial distress, we also control for these firm characteristics. In addition, we include a stock's dividend yield and volatility as they are reported to affect the cross-section of stock returns (e.g. Haugen and Baker, 1996; Ang et al., 2006). We include the stock's relative amount of institutional ownership since it has established in the literature as proxy for the supply of shares available to be shorted (e.g. Asquith et al., 2005; D'avolio, 2002; Nagel, 2005). A greater supply allows more short selling to take place (Boehmer and Kelley, 2009), which has been reported to have a strong positive effect on pricing efficiency (Boehmer and Wu, 2013). Second, we determine which firm is classified as an essential business based on information from the US Department of Homeland Security.[5] These criteria are widely in line with that employed by our other sample countries. In total, our sample comprises data on 867 firms. Third, in order to obtain information on the arrival of the disease in the sample countries, we use the database on the geographic distribution of COVID-19 cases worldwide, which is provided by the European Centre for Disease Prevention and Control (ECDC).[6] Fourth, the International Monetary Fund summarizes policy responses per country on its website.[7] From there, we collect the dates when the countries first announced fiscal policy measures and when the central banks first announced

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[3] Goodell (2020) provides an overview of different avenues for finance-related COVID-19 research.
[4] Appendix II reports these variables and further details on their computation.
[5] See https://www.cisa.gov/publication/guidance-essential-critical-infrastructure-workforce.
[6] See https://www.ecdc.europa.eu/en/publications-data.
[7] See https://www.imf.org/en/Topics/imf-and-covid19/Policy-Responses-to-COVID-19.

their monetary policy measures.[8] Table 1 provides descriptive statistics from our dataset.[9]

In order to analyze the impact of the arrival of the virus and the policy responses, we perform a two-step procedure. First, we compute abnormal returns (*ARs*) for each stock i on day t, with $AR_{it} = R_{it} - E(R_{it})$. We do this by means of a standard market model in accordance with MacKinlay (1997). Using OLS estimation, we regress each stock's returns on either the S&P 500 or the S&P EUROPE 350—depending on whether it is a US or a European stock—and use the resulting coefficients to forecast expected returns $E(R)$. We avoid any confounding effects by using the last 200 trading days of the year 2019 as our estimation window. The event window is then defined as $t \in [-10; 10]$, where $t = 0$ denotes the event date. Appendix IV graphically shows the cumulative *ARs* (*CARs*) from US and European stocks resulting from the announcements of the first case, the first death, a fiscal policy measure, and a monetary policy measure.

In the following step, we cross-sectionally analyze the determinants of the *CARs* around the arrival (i.e. first case and first death) and the containment (i.e. fiscal and monetary policy measures) of COVID-19.

3. Results

Table 2 reports our main results[10] from the second step. We analyze the effects over three different time frames, i.e. one, five, and ten days after the event. Considering both events within one regression allows us to assess whether there are significant differences in the market reactions.

Panel 1 shows the reactions of *CARs* to the arrival of COVID-19. Taking into account the set of control variables and the fixed effects, the constant represents the average reaction to the announcement of the first case in the US. We use the US as our base group because out of all sample countries they are by far the biggest and they had their first case before other western countries. The initial reaction to the announcement is not significant. This suggests that, despite the situation in China, the stock market heavily misjudges the gravity of the situation. In contrast to the first case, the announcement of the first death causes a significantly negative reaction. Thus, the first death appears to turn market sentiment and causes negative *CARs* after its announcement. This is in line with the mean values reported in Table 1.

Panel 2 shows the reactions of *CARs* to policy measures. Again, the constant represents the average reaction of US stocks. This specific event is the introduction of the CARES Act in the US Senate. Given the sign and the magnitude of the constant, our finding shows that the first announcement of the fiscal measure has no power to calm stock markets—rather, it seemingly makes things worse. This suggests that the staged decisions and communication potentially fuels investors' uncertainty. A paradigm that is generally in line with Müller (2020), who argues that governments should limit uncertainty by clear and concise communication and fast implementation of policy measures. Similar to our result, Zaremba et al. (2020) report that government policy responses increase stock market volatility. The coefficients of monetary policy, in contrast, are significantly positive. This indicates that, overall, monetary measures appear to have more credibility and thus power to calm markets. Altogether, it seems that monetary policy measures are more effective in supporting the stock market than fiscal policy measures. This finding is in line with Klose and Tillmann (2020), who study a very granular set of policy announcements.

In addition, we are interested in how stock market reactions are affected by firm-specific characteristics. The most important and intuitive drivers of our results are a firm's relative amount of tangible assets and its liquidity. The coefficient of TAN in column three suggests that within two weeks after the arrival of COVID-19, the *CARs* of a firm with no tangible assets are 7.5 percentage points below those of a firm with only tangible assets. This implies that, during this crisis, investors particularly cherish tangible assets, which potentially retain their value if the need for a sale arises. Asset sales are an effective way for firms to raise cash, particularly relevant near financial distress to avoid bankruptcy (Shleifer and Vishny, 1992; Pulvino, 1998). The effect of liquidity is even more pronounced as it produces a difference in *CARs* of more than 8.5 percentage points for firms with only liquidity compared to firms with no liquidity. This finding is in line with Ramelli and Wagner (2020) and supports the perspective of liquidity as a precautionary buffer to adverse shocks (Almeida et al., 2004; Bates et al., 2009). Moreover, larger firms appear to be less affected by the arrival of COVID-19 than smaller ones and—in the two weeks after the event—firms with a higher MTB perform better.

Interestingly, companies that are classified as an essential business do not react significantly differently. This is somehow puzzling as they should be less affected by the lockdown measures and hence suffer to a lesser extent. Thus, one would expect a positive effect at least during the arrival of COVID-19 (Panel 1).

While debt and hence leverage is reported to have a significant impact on firm value during this crisis (Ramelli and Wagner, 2020), we find that TLEV has no significant effect on *CARs* when COVID-19 arrives. Rather, our results suggest that a stock's historic volatility and its dividend yield have a negative impact.

In this regard, the impact of a firm's payout policy is ambiguous.[11] However, Cejnek et al. (2020) show that, during the Corona crisis, especially short-term dividend futures experience larger losses than their corresponding equities. This is due to the announcement of many firms to cut their dividends to reserve cash. Dividend decreases typically result in negative stock market

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[8] A full list of our sample countries and all dates is provided in Appendix III.

[9] Control variables are winsorized at the 5th and 95th percentile.

[10] In two separate robustness checks, we analyze abnormal levels of stock-market variance and changes in Twitter-based uncertainty indices (Baker et al., 2020), respectively. Results remain qualitatively similar and are available upon request.

[11] In their seminal paper, Black and Scholes (1974) find no significant relation between dividend yield and stock returns. Since then, many theories have emerged that pose different relationships (see Frankfurter and Wood Jr, 2002).

Table 1

Descriptive statistics of *CARs* and control variables.

Variable	N	Mean	SD	25th perc.	Median	75th perc.
Panel 1: First case						
CAR [−1,1]	866	−0.04%	2.51%	−1.36%	0.17%	1.29%
CAR [−1,5]	866	−0.14%	4.23%	−2.43%	0.15%	2.42%
CAR [−1,10]	866	−0.64%	6.48%	−4.22%	−0.37%	2.89%
Panel 2: First death						
CAR [−1,1]	867	−0.32%	4.16%	−2.90%	−0.35%	2.01%
CAR [−1,5]	867	−1.69%	9.02%	−7.81%	−0.79%	4.69%
CAR [−1,10]	867	−4.42%	13.88%	−15.31%	−4.34%	6.17%
Panel 3: Fiscal policy measure						
CAR [−1,1]	835	−1.22%	7.48%	−7.76%	−1.16%	4.52%
CAR [−1,5]	835	−0.56%	10.22%	−7.94%	−0.42%	7.08%
CAR [−1,10]	835	−2.60%	11.15%	−9.69%	−1.81%	4.81%
Panel 4: Monetary policy measure						
CAR [−1,1]	771	0.12%	7.26%	−5.53%	0.11%	5.83%
CAR [−1,5]	771	1.24%	8.65%	−4.42%	1.44%	7.46%
CAR [−1,10]	771	−0.42%	9.79%	−6.42%	0.61%	6.28%
Panel 5: Control variables						
Assets	867	$89m	$180m	$9.75m	$23.9m	$69.1m
Dividend yield (DY)	867	3.05%	2.59%	1%	2.54%	4.51%
Institutional ownership (INST)	866	67%	26%	45.7%	73.6%	88.9%
Liquidity (LIQ)	710	34%	18.8%	20.6%	31%	47.1%
Market-to-book ratio (MTB)	858	3.4	4.8	1	2.1	4.6
Tangible (TAN)	861	33.3%	19.6%	18.9%	32.8%	46.7%
Total leverage (TLEV)	867	27.9%	16.3%	16%	27.3%	39.4%
Profit margin (PROF)	867	17.4%	11.3%	8.9%	15%	23.1%
Return on equity (ROE)	837	18.8%	18.2%	8.1%	14.1%	25.6%
Volatility (Vola)	863	5.8%	1.9%	5%	6%	7%

Remark: This table reports descriptive statistics of our winsorized variables. All figures of control variables are calculated from the 2019 year-end accounting figures. See Appendix II for further details.

responses (e.g. Jensen et al., 2010; DeAngelo et al., 1992). Also, some European countries have prohibited firms to pay dividends. This might trigger a sell-off of high valued stocks that have a high dividend yield.

Evidence from Ramelli and Wagner (2020) shows that investors' concerns about liquidity and debt partially reverse after the Fed announces its quantitative easing program. Given that our sample comprises all major European countries besides the US, a similar argument holds on a cross-country level for measures imposed by the respective central banks. While TAN has a similar impact as in Panel 1, LIQ appears to be an important driver only in the shortest term but not in the week (two weeks) following the containment measures (columns 4 to 6).

Furthermore, companies with a larger share of institutional investors perform better over this time frame. Considering that INST has a significantly negative impact on *CARs* two weeks after the arrival of COVID-19, we argue this might be because institutional investors tend to be better informed than other market participants (Chen et al., 2000; Bennett et al., 2003). Moreover, the share of institutional ownership is commonly used as a proxy for the amount of short sales (e.g. Boehmer and Wu, 2013; Boehmer and Kelley, 2009). Hence, this might lead to an increased price pressure on these stocks. As fiscal and monetary policy measures are announced, this increased pressure reverses and leaves these stocks as attractive investment opportunities.

Another variable that switches signs from negative to positive is historic volatility. As with INST, a higher VOLA leads to a stronger drop in returns after the arrival of COVID-19, which makes these companies attractive investments after policy responses.

4. Conclusion

Our results suggest that stock markets react differently to the announcement of the first case and the first death in a country. While there is no significant reaction to the first case, the announcement of the first death leads to significantly negative reactions. Furthermore, market reactions also differ when the initial fiscal and monetary policy measures are announced. While fiscal policy potentially adds to uncertainty among investors, responses from central banks can have a reassuring character and help to calm markets. Considering the extent and range of both measures in virtually all European countries and in the US, this might be due to more direct communication styles of central bankers. Moreover, our findings show that there are other important factors driving the cross-section of stock returns, which have not yet been addressed during this crisis.

CRediT authorship contribution statement

Kim J. Heyden: Conceptualization, Data curation, Formal analysis, Writing - original draft, Writing - review & editing. **Thomas Heyden:** Conceptualization, Methodology, Software, Formal analysis, Writing - original draft.

Table 2

Cross-sectional analysis of cumulative abnormal returns.

	Panel 1: Arrival of COVID-19			*Panel 2*: Policy Response		
	[−1,1]	[−1,5]	[−1,10]	[−1,1]	[−1,5]	[−1,10]
Constant	−0.753	2.566	2.824	−11.763***	−12.009***	−15.286***
	(−0.779)	(1.390)	(0.958)	(−5.344)	(−3.878)	(−4.774)
First death	0.047	−0.663*	−2.221***			
	(0.261)	(−1.955)	(−4.250)			
Monetary policy				0.947**	0.988*	1.481***
				(2.297)	(1.905)	(2.699)
Essential	0.041	0.428	1.718*	−0.152	−0.311	0.389
	(0.150)	(0.776)	(1.880)	(−0.230)	(−0.367)	(0.431)
INST	0.208	−1.620	−5.355***	−0.940	4.256**	4.829**
	(0.292)	(−1.175)	(−2.657)	(−0.596)	(2.040)	(2.303)
TLEV	1.586	1.476	4.392	8.612***	3.738	5.195
	(1.540)	(0.813)	(1.533)	(4.046)	(1.265)	(1.616)
VOLA	−0.139**	−0.875***	−1.310***	0.627***	0.673***	−0.301
	(−2.076)	(−6.938)	(−6.732)	(4.417)	(3.482)	(−1.468)
TAN	1.344	3.808**	7.591***	11.527***	5.973**	10.706***
	(1.615)	(2.380)	(3.006)	(6.329)	(2.383)	(4.085)
LIQ	2.043***	4.425***	8.572***	4.287***	0.630	3.248
	(2.750)	(3.270)	(3.991)	(2.781)	(0.285)	(1.366)
ln(Assets)	0.342***	0.156	0.535*	0.574**	0.455	0.870***
	(3.296)	(0.766)	(1.728)	(2.464)	(1.489)	(2.793)
DY	−0.246***	−0.348***	−0.347**	−0.178	−0.046	0.198
	(−3.965)	(−3.411)	(−2.321)	(−1.486)	(−0.278)	(1.109)
MTB	0.073	0.121	0.430***	0.050	0.356**	0.711***
	(1.411)	(1.231)	(2.627)	(0.419)	(2.380)	(4.411)
PROF	0.011	−0.019	−0.011	−0.014	0.048	0.066*
	(0.936)	(−0.834)	(−0.296)	(−0.554)	(1.417)	(1.753)
ROE	−0.020*	0.005	−0.010	0.020	−0.047	−0.076**
	(−1.850)	(0.247)	(−0.332)	(0.860)	(−1.552)	(−2.359)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.171	0.257	0.27	0.162	0.117	0.217
N	1,340	1,340	1,340	1,245	1,245	1,245

Remark: This table reports OLS estimates of the effects the arrival of COVID-19 and policy measures have on *CARs* in the USA and in Europe. Panel 1 and Panel 2 report the reactions on the arrival of COVID-19 and a policy measure, respectively. The dependent variables are *CARs* of different time windows relative to the event date. First death and Monetary policy are dummy variables that assume a value of one when the *CARs* are in response to the first death and a monetary policy measure, respectively. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively; *t*-values from robust standard errors are in parentheses. The full set of coefficients are available upon request.

Appendix

Appendix I. Daily values of S&P 500 and S&P EUROPE 350.
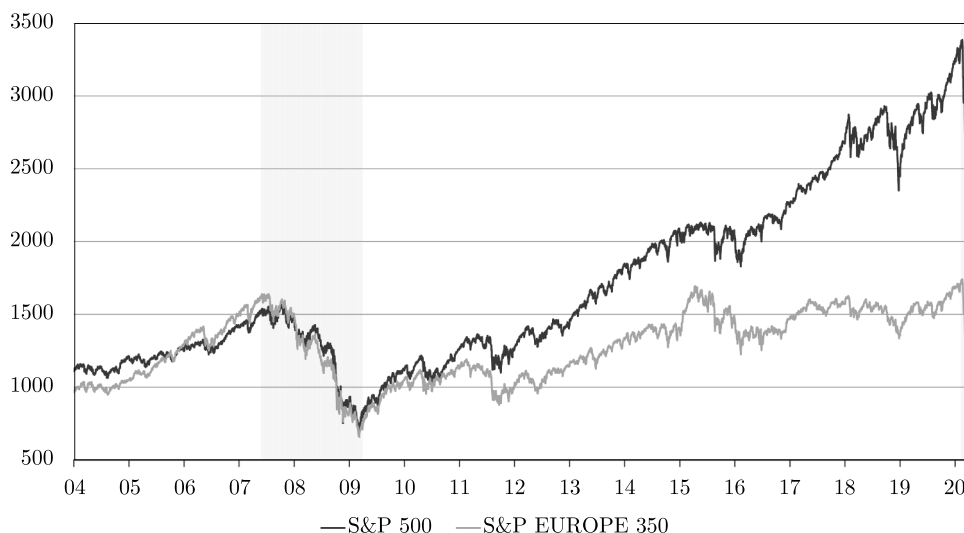
Appendix II. Overview of firm-level control variables.

Variable	Description
Assets	Total assets
Dividend yield (DY)	Ratio of firm's last dividend payout to current stock price
Institutional ownership (INST)	Percentage of stocks that are in possession of institutional investors
Liquidity (LIQ)	Ratio of current to total assets
Market-to-book ratio (MTB)	Ratio of equity's market value to book value
Tangible (TAN)	Ratio of tangible assets to total assets
Total leverage (TLEV)	Ratio of total debt to total assets
Profit margin (PROF)	Ratio of net income to sales
Return on equity (ROE)	Ratio of net income to the book value of equity
Volatility (Vola)	The stock's annual volatility based on weekly prices

Remark: This table reports details on the computation of the control variables employed in our analysis. All variables are based on the 2019 year-end accounting figures. See Table 1 for the descriptive statistics.

*Appendix III. Sample countries and event dates.*

| Country	First case	First death	Fiscal policy	Monetary policy
Austria	02.25.2020	03.12.2020	03.15.2020	03.18.2020
Belgium	02.04.2020	03.11.2020	03.20.2020	03.18.2020
Denmark	02.27.2020	03.14.2020	03.12.2020	03.19.2020
Finland	01.29.2020	03.21.2020	03.20.2020	03.18.2020
France	01.24.2020	02.26.2020	03.17.2020	03.18.2020
Germany	01.27.2020	03.09.2020	03.13.2020	03.18.2020
Ireland	02.29.2020	03.11.2020	03.15.2020	03.18.2020
Italy	01.31.2020	02.21.2020	03.10.2020	03.18.2020
Luxembourg	02.29.2020	03.13.2020	03.25.2020	03.18.2020
Netherlands	02.27.2020	03.06.2020	03.17.2020	03.18.2020
Norway	01.26.2020	03.12.2020	03.18.2020	03.13.2020
Portugal	03.02.2020	03.16.2020	03.26.2020	03.18.2020
Spain	02.01.2020	03.01.2020	03.17.2020	03.18.2020
Sweden	01.31.2020	03.11.2020	03.11.2020	03.13.2020
Switzerland	02.25.2020	03.05.2020	03.13.2020	03.19.2020
UK	01.31.2020	03.05.2020	03.11.2020	03.11.2020
USA	01.20.2020	02.29.2020	03.19.2020	03.23.2020

Remark: This table reports the announcement dates of the events used in our analysis. For example, on January 20, 2020, the first Corona case was reported in the USA; on February 29, the first death. The government introduced the CARES Act on March 19, and on March 23, the Fed first announced its quantitative easing program.

*Appendix IV. Cumulative abnormal returns graphs.*

Remark: The following graphs show the *CARs* from US and European stocks resulting from the first case, first death, fiscal policy measure, and monetary policy measure announcement. The horizontal axis shows the days relative to the event day $t = 0$. The dashed lines denote the 95% confidence intervals. On the left hand side (lhs) are reactions from US stocks, on the right hand side (rhs) are reactions from European stocks.
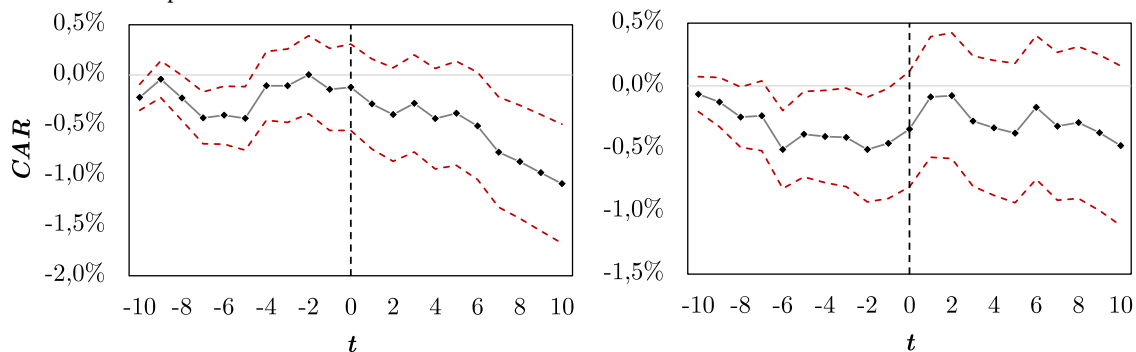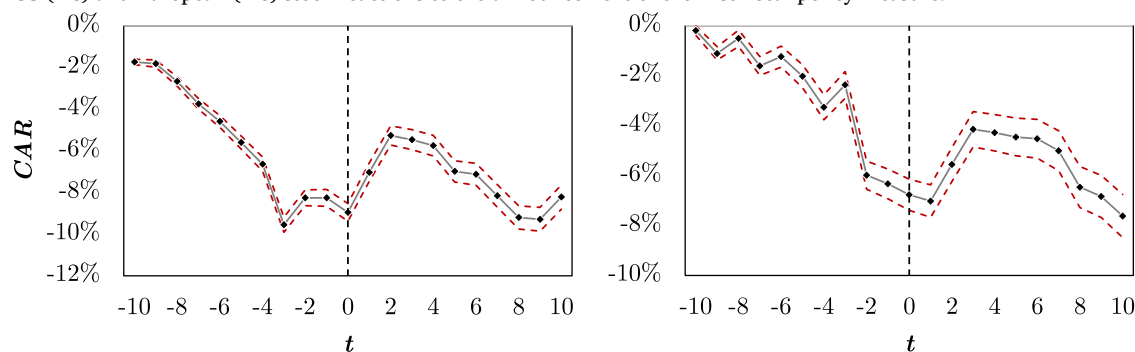

US (lhs) and European (rhs) stock reactions to the announcement of the first case.
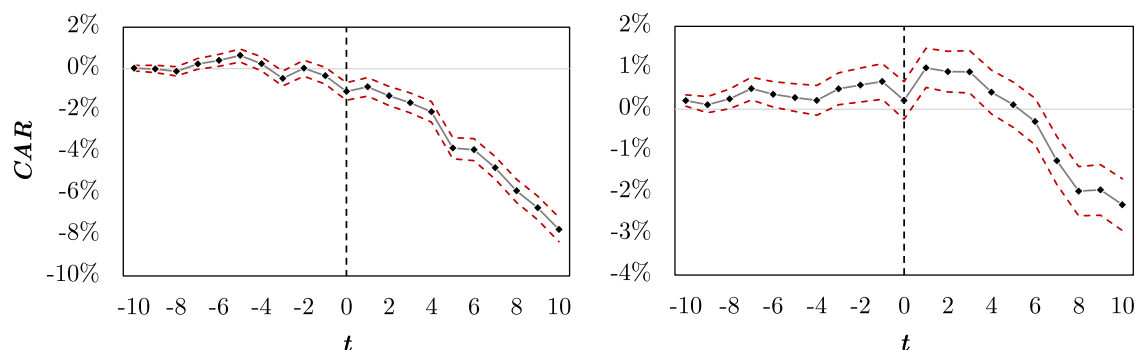
US (lhs) and European (rhs) stock reactions to the announcement of the first death.
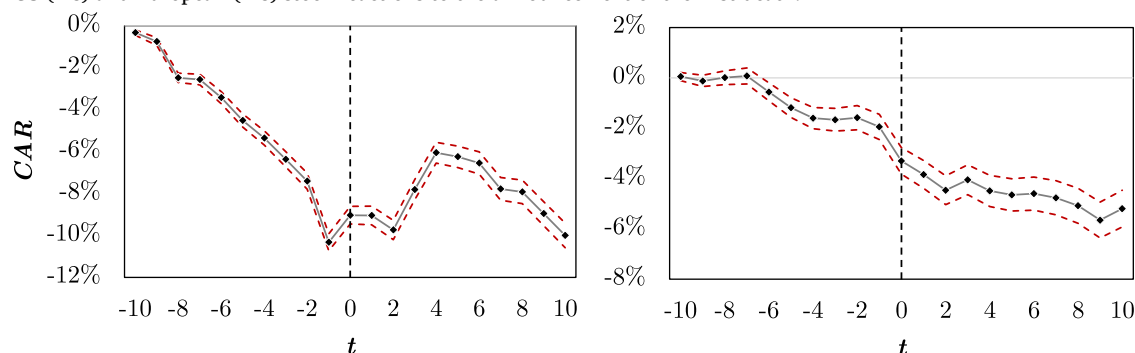
US (lhs) and European (rhs) stock reactions to the announcement of the first fiscal policy measure.

US (lhs) and European (rhs) stock reactions to the announcement of the first monetary policy measure.

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