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Banning Cassandra from the Market? An Empirical Analysis of Short-Selling Bans during the Covid 19 Crisis

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Abstract

During the recent COVID-19 pandemic crisis, stock markets around the world have witnessed an abrupt decline in security prices and an unprecedented increase in security volatility. In response to a week of financial turmoil on the main European stock markets, some market regulators in Europe, including France, Austria, Italy, Spain, Greece, and Belgium, passed temporary short-selling bans in an attempt to stop downward speculative pressures on the equity market and stabilize and maintain investors' confidence. This paper examines the effects of these short-selling bans on market quality during the recent pandemic caused by the spread of COVID-19. Our results suggest that during the crisis, banned stocks had higher information asymmetry, lower liquidity, and lower abnormal returns compared with non-banned stocks. These findings confirm prior theoretical arguments and empirical evidence in other settings that short-selling bans are not effective in stabilizing financial markets during periods of heightened uncertainty. In contrast, they appear to undermine the policy goals market regulators intended to promote.

Keywords: Equity Markets, Covid-19 Pandemic, Short-selling bans

JEL Classifications: G01, G18, K22

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ABSTRACT

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1. Short-Selling Bans as a Response to COVID-19

1.1. Theoretical Issues

Short selling securities is a trading strategy whereby an investor seeks a profit or other advantages from a decline in the price of listed securities;[1] short sellers have bearish expectations of the market. More specifically, short selling or, less formally, "shorting" implies selling securities that the investor does not own, but that it borrows. After shorting an asset, the investor will eventually need to buy it back and return the shares to the lender. Investors can make a profit from short selling if they buy the shares back at a price lower than the one at which they initially sold them. Investors can obviously also incur a loss if the security's price increases rather than falls, as they would have to buy the securities back at a higher cost before returning them to the lender. "Naked" short selling occurs when investors sell a security they do not initially borrow; in this case, they do not even possess the securities when engaging in the transaction. It must be noted that the risk faced by short sellers is asymmetrical, since they will need to perform their obligation no matter what the price might be.

On average, in most markets, short sellers account for roughly more than 20% of trading volume and are generally regarded as traders with access to value-relevant information.[2] This quantitative data suggests that they play an important role in price formation, and according to some analyses they contribute to price discovery by improving information efficiency and possibly market liquidity, while decreasing information asymmetry.[3] Short selling is governed, at the EU level, by Regulation No. 236/2012 of 14 May 2012, focusing on disclosure and aiming at a certain degree of harmonization, whose preamble makes reference to both the risks and beneficial effects of this practice. Many commentators, in fact, acknowledge an important and useful role of short sellers: with reference to the German scandal of the Wirecard corporation, for example, in late June the Economist

[1] *Barbara A. Bliss/Peter Molk/Frank Partnoy*, "Negative Activism", 2019, available at https://www.law.berkeley.edu/wp-content/uploads/2019/05/Negative-Activism_1.pdf (date of last access: July 14, 2020).
[2] *Ekkehart Boehmer/Charles M. Jones/Xiaoyan Zhang*, "Which Shorts Are Informed?", The Journal of Finance 63 (2008), 491-527.
[3] *Ekkehart Boehmer/Juan J. Wu*, "Short Selling and the Price Discovery Process", Review of Financial Studies 26 (2013), 287-322.

published an article tellingly entitled "In praise of short-sellers", in which the author argued that "Had the warnings from Cassandras [meaning, in particular, short-sellers] who detected a bad smell around Wirecard years ago been heeded, billions of dollars in losses, many of them borne by pension-fund investors, could have been avoided."[4] This is not always the case, of course: for several (largely intuitive) reasons, the price-discovery mechanism just mentioned might not work in all circumstances.[5]

For example, it is well known that short selling—like other tactics—might be coupled with clearly illegal behaviors. To enhance the downward spiral in prices from which they hope to profit, short sellers might generate and diffuse information on the issuer or on the securities that, although it might be true, it is also misleading and incomplete, when not utterly false—thus stepping into the realm of criminal conduct in market manipulation. The academic literature distinguishes between ethical and unethical trading activities, even if distinctions are not always clear-cut, especially in empirical analysis. The legitimacy of trading strategies in which the very fact that an investor who is engaging in or will engage in certain transactions (such as a tender offer to delist an issuer) is further complicated by recent developments concerning so-called self-insiders who exploit knowledge of their own future conduct to beat the market.[6] Based on similar distinctions, empirical work exists to analyze the effects of different short-selling strategies .[7]

In any case, while ruling out behaviors of dubious legality, short selling might have significant effects and poses new regulatory issues when combined with the diffusion of information in the era of social media and algorithmic trading, in light of the ease with which information might circulate among uninformed investors, and the automatic reactions triggered by algorithms based on price movements. For instance, a short-selling investor could open a short position and disseminate

[4] The Economist, June 24, 2020
[5] *Ekkehart Boehmer/Juan J. Wu* (fn. 3).
[6] *Stefano Lombardo*, "Some Reflections on the Self-insider and the Market Abuse Regulation–The Self-insider as a Monopoly-Square Insider", European Corporate Governance Institute-Law Working Paper No. 512/2020; *Marco Ventoruzzo*, "Qualche nota sul cosiddetto "insider di sé stesso" alla luce del Regolamento UE sugli abusi di mercato", Società 2018, 745.
[7] *Barbara A. Bliss/Peter Molk/Frank Partnoy* (fn. 1); *Itay Goldstein/Alexander Guembel*, "Manipulation and the Allocational Role of Prices", The Review of Economic Studies 75 (2008), 133–164.

negative opinions about a company on publicly available social media channels. This news may induce panic and a massive run from the stock, thus leading short-selling investors to close their positions at a profit before the stock price rebounds.[8] In an Emergency Order issued on July 15, 2008, banning short sales of 17 major financial stocks, the Securities and Exchange Commission (SEC) wrote:

> False rumors can lead to a loss of confidence in our markets. Such loss of confidence can lead to panic selling, which may be further exacerbated by "naked" short selling. As a result, the prices of securities may artificially and unnecessarily decline well below the price level that would have resulted from the normal price discovery process. If significant financial institutions are involved, this chain of events can threaten disruption of our markets.

These concerns explain why, in the past and on several occasions in bear market times, regulators around the world have introduced temporary bans on short selling. The theoretical rationale behind this choice is that in a bear market, amid widespread pessimism and negative investor sentiment, preventing short sales can help curb an allegedly perverse declining loop in a stock's fundamental value; more generally, the market can easily overshoot upward or downward. The mechanism supporting this argument is that an increase in short sales positions could become a self-fulfilling prophecy and result in a further deterioration of a company's leverage conditions and specifically an increase in the cost of capital (depending on the circumstances, both equity and debt), hindering the ability of a listed corporation to raise new equity or debt, in a way that is not entirely justified by fundamental economic data. In such a scenario, market participants might exit the market en masse, thus triggering a sale spiral, hurting prices, and eventually damaging markets. Therefore, bans – especially in a bear market – have been viewed by some as a necessary regulatory intervention to ensure financial stability, a sort of "circuit breaker" capable of avoiding dangerous overheating of the supply-demand mechanism.

[8] *Joshua Mitts*, "Short and distort". Columbia Law and Economics Working Paper, No. 592/2019. Recently, fraud investigator Harry Markopolos took General Electric (GE) security prices down more than 11% in one-day. He accused analysts, ratings agencies, and GE's management of illegal behaviors. One day later, the GE stock rebounded about 10% after GE CEO Larry Culp invested $2 million. In addition, analysts came to GE's rescue, by stating that Markopolos's claims were inaccurate and based on old news that was already embedded in GE's stock price. See: https://www.cnbc.com/2019/08/17/ge-stock-may-be-recovering-but-harry-markopolos-got-his-digs-in.html (date of last access: July 14, 2020).

Clearly enough, however, the decision to limit investors' ability to short securities lingers on a slippery slope between the (alleged) protection of investors and of market integrity, and illiberal dirigisme or paternalism. Even more important, or at least more straightforward to address, is the question of whether bans on short selling are effective in achieving the market supervisors' objectives. In light of the adoption of specific bans during the COVID-19 pandemic, as we will discuss next, the question lingers whether in a generalized crisis, due to exogenous shocks, similar measures are warranted.

1.2. Regulators' Choices in the First Few Months of the COVID-19 Pandemic

With the recent outbreak of the COVID-19 pandemic, the most impactful pandemic since the Spanish flu of 1918–1920, there has been an unprecedented shock in worldwide supply and demand caused by the imposition of various lockdown measures to prevent contagion. These measures have led to an extraordinary increase in economic uncertainty, followed by an inevitable shock to global equities. In March 2020, stock markets were down 25% compared with January 2020, one of the most brutal and fast declines in a century. Volatility has also been extreme: in Europe, the VSTOXX, which measures implied volatility of EURO STOXX 50 Index options, closed at 86% on March 16, 2020, its second highest daily close ever.[9] In this economic scenario, market supervisors and regulators worldwide have been considering the proper regulatory responses, in particular whether to restrict or ban short selling or to enhance disclosure requirements. Different approaches have emerged. In the United States, for example, the SEC has not banned short selling in response to increased market volatility and price drops, as SEC chairman Jay Clayton noted that investors "need to be able to be on the short side of the market in order to facilitate ordinary market trading."[10]

[9] See https://www.stoxx.com/index-details?symbol=V2TX. Implied volatility is the market's expectation of the future movement in a security's price. Investors use this measure to estimate future volatility of a security's price. Implied volatility generally increases in bearish markets, when investors believe security prices will decline over time. On the other hand, it decreases when the market is bullish and investors believe that prices will rise over time.

[10] See *Paul Kiernan*, "SEC Chairman: Government Shouldn't Ban Short Selling in Current Market," Wall Street Journal, March 30, 2020, available at https://www.wsj.com/articles/sec-chairman-government-shouldnt-ban-short-selling-in-current-market-11585568341 (date of last access: July 14, 2020).

In Europe, on the other hand, the response to the emergency has not been uniform, notwithstanding the partial harmonization pursued through the Short Selling Regulation of 2012. In the United Kingdom, the Financial Conduct Authority (FCA) confirmed on March 23, 2020, that it would not adopt a short-selling ban.[11] The German financial supervisor BaFin has taken the same position. As a side note, it is interesting that the diverging approaches seem to replicate, in part, the "North-South" divide characterizing many EU debates, e.g. on budgetary policy, something that might reflect the degree of liquidity of different markets.

A number of national market authorities in other European Union (EU) countries have, however, introduced temporary bans on short selling in response to the pandemic crisis. In France, Spain, Italy, Austria, Greece, and Belgium, regulators have announced emergency measures banning investors from engaging in short selling and transactions that might constitute or increase net short positions on stocks from March 18, 2020, until May 18, 2020.[12] [13] These temporary measures were preceded by two one-day bans on short selling for specific stocks in Italy and Spain (on March 13) and in Italy, France, and Belgium (on March 17).[14] In total, there have been three emergency bans on short selling.[15]

Market supervisors who have opted for limiting investors' activities have highlighted that, although European regulations on short selling (Regulation (EU) No. 236/2012 and Article 24 of

[11] Shearman & Sterling, "Short Sale Bans in Response to the COVID-19 Pandemic", April 1, 2020, available at https://www.shearman.com/perspectives/2020/03/short-sale-bans-in-response-to-the-covid-19-pandemic (date of last access: July 14, 2020).

[12] Other jurisdictions around the world have introduced, or planned to, bans on short selling during the COVID-19 pandemic: "Factbox: Markets Revise Trading Rules, Hours, Circuit Breakers as Volatility Surges", Reuters, April 6, 2020, available at https://www.reuters.com/article/us-health-coronavirus-exchanges-limit-fa/factbox-markets-revise-trading-rules-hours-circuit-breakers-as-volatility-surges-idUSKBN21O0B6 (date of last access: July 14, 2020).

[13] On March 17, 2020, CONSOB, the Italian market authority, announced its decision to ban any creation of a net short position for a three-month period until June 18, 2020. On May 15, 2020, however, the Italian market authority decided to terminate the ban on net short positions early, on May 18. See CONSOB, Resolution no. 21367 of May 15, 2020, available at http://www.consob.it/web/consob-and-its-activities/other-regulatory-measures/documenti/english/resolutions/res21367.htm?hkeywords=&docid=2&page=0&hits=117&nav=false (date of last access: July 14, 2020).

[14] The European Securities and Markets Authority (ESMA) has authorized such bans with the intent to stabilize financial markets and maintain investor confidence. Moreover, ESMA's new rules require that any short-selling position accounting for 0.1% or more of a company's outstanding shares must be announced to the market, compared with the previous threshold of 0.2%.

[15] For a full description of the short-selling ban structure, refer to the Appendix.

Regulation (EU) No. 918/2012) were drafted without considering the scenario of a pandemic, a pandemic falls among situations that could pose a serious threat to market confidence and infrastructures.[16] Obviously enough, the rationale—apparently shared, or at least accepted as within the discretion of national regulators, by the EU regulator (the European Securities and Markets Authority, or ESMA)—is that, in the pandemic context, price formation may take place in an environment of partial and sometimes misleading information, caused by rumors or inexact information.[17] Such rumors may affect listed companies and damage investors' confidence, whereas prices should be formed with public and reliable information: an increase in short positions betting on negative news could destabilize markets in a way that could be self-reinforcing, determining unjustified downward security price spirals. Therefore, short-selling bans are viewed as a possible tool to limit the adverse consequences on stock market volatility and investors' confidence.

The purpose of this study is to examine whether the temporary short-selling bans in the EU during the COVID-19 crisis have achieved or could achieve the market supervisors' goals.

2. Existing Empirical Literature

Existing literature tends to agree that short selling generally has a positive effect on market quality, especially in periods when markets are not affected by an external shock.[18] It is generally accepted that short sellers are motivated by economic fundamentals[19] and skilled in identifying overvalued stocks (using, for example, accounting ratios, as studied by Dechow,[20] or press reports,

[16] See, for instance, ESMA, "Opinion on a proposed emergency measure by the Austrian Finanzmarktaufsicht under Section 1 of Chapter V of Regulation (EU) No. 236/2012" and "Opinion on a proposed emergency measure by the Autorité des marchés financiers under Section 1 of Chapter V of Regulation (EU) No. 236/2012".
[17] See ESMA, "Opinion of the European Securities and Markets Authority on a proposed emergency measure by the Financial Securities and markets Authority under Section 1 of Chapter V of Regulation (EU) No. 236/2012".
[18] *Ekkehart Boehmer/Charles M. Jones/Xiaoyan Zhang* (fn. 2).
[19] *Adam V. Reed*, "Short Selling", Annual Review of Financial Economics 5 (2013), 245–258.
[20] *Patricia M. Dechow/Amy P. Hutton/Lisa Meulbroek/Richard G. Sloan*, "Short-Sellers, Fundamental Analysis, and Stock Returns", Journal of Financial Economics 61 (2001), 77–106.

as shown by Engelberg et al.[21]) in anticipation of price declines.[22] Indeed, higher intraday short-selling activity is related to negative intraday future returns, a hint that short sellers can correctly predict future price movements .[23] As such, short sellers are found to contribute to price discovery and enhance price efficiency.[24] Short sellers are responsible for a quick convergence of stock prices toward their fundamental value after the price decline has taken place.[25] This mechanism is more pronounced in less liquid stocks.[26] To summarize, most empirical papers report that during periods of regular trading activity, short selling has a positive influence on liquidity and price efficiency, thus supporting the idea that short selling is crucial to maintain the orderly functioning of markets.

Not surprisingly, there is also academic evidence that, during periods of sharp price declines, short selling leads to downward price movements. In a recent study, Geraci et al.[27] show that high levels of short selling are generally associated with (but do not cause) low stock returns. To put it differently, short-selling activity is higher during sell-off periods, concurrent with a decline in prices of securities.

In regard to our research question, available studies indicate that bans on short selling neither sustain prices in the short run, nor make financial firms more stable. Economic theory[28] shows that the imposition of a short-selling ban is expected to slow down the price discovery process, thus leading to an increase in bid-ask spreads, and therefore to a deterioration in market liquidity.

[21] *Joseph E. Engelberg/Adam Reed/Matthew Ringgenberg*, "How are shorts informed?", Journal of Financial Economics, 105 (2012), 260–278.
[22] *Eunju Lee*, "Short selling and market mispricing", Review of Quantitative Finance and Accounting 47 (2016), 797–833.
[23] *Ekkehart Boehmer/Charles M. Jones/Xiaoyan Zhang* (fn. 2); *Karl B. Diether/Kuan-Hui Lee/Ingrid M. Werner*, "Short-Sale Strategies and Return Predictability", Review of Financial Studies 22 (2009), 575–607; *Michael J. Aitken/Alex Frino/Michael S. Mccorry/Peter L. Swan*, "Short Sales are Almost Instantaneously Bad News: Evidence from the Australian Stock Exchange", The Journal of Finance 53 (1998), 2205–2223.
[24] *Karl B. Diether/Kuan-Hui Lee/Ingrid M. Werner* (fn. 23); *Ekkehart Boehmer/Juan J. Wu* (fn. 3).
[25] *Eunju Lee* (fn. 22).
[26] *Eunju Lee* (fn. 22).
[27] *Marco Valerio Geraci/Tomas Garbaravičius/David Veredas*, "Short Selling in Extreme Events", Journal of Financial Stability 39 (2018), 90–103.
[28] *Douglas W. Diamond/Robert E. Verrecchia*, "Constraints on Short-Selling and Asset Price Adjustment to Private Information", Journal of Financial Economics 18 (1987), 277–311.

Empirically, Boehmer et al.[29] and Beber and Pagano[30] observe that short-selling bans imposed during the global financial crisis of 2008–2009 did not prevent a fall in security prices, contrary to market authorities' expectations. More recent theoretical work, such as that of Brunnermeier and Oehmke[31] and Liu,[32] documents that short-selling bans are responsible for a higher probability of default, higher credit default swap (CDS) premia, and heightened volatility for banned financial institutions. The authors note that short-selling bans may themselves act as a negative signal on banks' fundamentals, leading to the exact outcome that they aim to prevent. In line with these predictions, Beber et al.[33] hypothesize and empirically find that banks whose securities are subject to short-selling bans exhibit an increased probability of insolvency, compared with other banks that are of similar risk and size, but not covered by the ban. Overall, the evidence suggests that suppressing pessimist investors within the market—or, more precisely, limiting their ability to operate—makes all market participants less informed, thus increasing market uncertainty.[34]

In contrast to this stream of research, there are studies on market-negative activism (as some authors refer to short selling coupled with information dissemination, not to be confused with "activism" of institutional investors at the governance level) suggesting that short selling is not necessarily motivated by information-related incentives. Bliss, Molk, and Partnoy[35] distinguish between (1) informational-negative activists, who seek to uncover and communicate the truth about companies whose shares they believe are overvalued; and (2) operational-negative activists who, on the contrary, seek to change, and sometimes damage, the underlying state of the corporations they target through dissemination of inaccurate information.[36] They argue that negative operational

[29] *Ekkehart Boehmer/Juan J. Wu* (fn. 3).
[30] *Alessandro Beber/Marco Pagano*, "Short-Selling Bans Around the World: Evidence from the 2007-09 Crisis", The Journal of Finance 68 (2013), 343–381.
[31] *Markus K. Brunnermeier/Martin Oehmke*, "Predatory Short Selling", Review of Finance 18 (2014), 2153-2195.
[32] *Xuewen Liu*, "Short-Selling Attacks and Creditor Runs", Management Science 61 (2015), 814–830.
[33] *Alessandro Beber/Daniela Fabbri/Marco Pagano/Saverio Simonelli*, "Short Selling Bans and Bank Stability", European Systemic Risk Board, Working Paper Series No. 64/2018.
[34] *Luca Enriques/Marco Pagano*, "Emergency Measures for Equity Trading: The Case Against Short-Selling Bans and Stock Exchange Shutdowns", European Corporate Governance Institute, Law Working Paper No. 513/2020.
[35] *Barbara A. Bliss/Peter Molk/Frank Partnoy* (fn. 1).
[36] A third category is unintentional negative activism, a form of positive activism that is regarded negatively in the market.

activism creates negative externalities on investors, by harming companies' efficiency and profitability solely for the activists' individual profits. Because of these negative externalities, negative operational activists' incentives are not aligned with those of other investors. Clearly enough, as briefly mentioned above, some of these practices might be an illegal form of manipulation based on the Market Abuse Regulation and Directive. The cited authors advocate a tighter regulatory approach by market authorities to curb what they call negative operational activism. Empirical work also confirms that, with the advent of the internet and social media, it has become much easier to accomplish profitable short-selling practices through manipulative strategies. Mitts[37] suggests that pseudonymity (and anonymity) undermines reputational accountability in financial markets. Examining 2,900 attack articles against mid- and large-cap firms published on a website, Seeking Alpha, during 2000–2017, he finds that pseudonymous attacks are followed by stock-price declines and sharp reversals, leading to more than $20.1 billion in mispricing.

This study falls within the literature on the effect of short selling on markets during periods of heightened uncertainty. Recent lockdowns and related social distancing measures to constrain COVID-19 contagions have led to the abrupt evaporation of both supply and demand, with global gross domestic product (GDP) growth estimated at –5.2% for 2020.[38] As a result, increased uncertainty might have fueled panic in the stock markets, leading to one of the largest market crashes in history.[39] This has inevitably put increased pressure on national market authorities—as we will mention in our conclusion, also at the "political" level—to introduce emergency bans on short selling. The recent debate has brought different perspectives to light: on the one hand, some market supervisors and policy makers have been advocating the introduction of short-selling bans. Markus Ferber, a German lawmaker in the European Parliament, joined French finance minister Bruno Le

[37] *Joshua Mitts* (fn. 8).
[38] The World Bank, *Global Economic Prospects,* June 2020, available at https://www.worldbank.org/en/publication/global-economic-prospects (date of last access: July 14, 2020).
[39] *Michael B. Sauter/Samuel Stebbins*, "How the Current Stock Market Collapse Compares with Others in History", USA Today, March 21, 2020, available at https://eu.usatoday.com/story/money/2020/03/21/stock-market-collapse-how-does-todays-compare-others/2890885001/ (date of last access: July 14, 2020).

Maire in inviting ESMA to take unprecedented steps to address the situation, arguing that speculation on falling asset prices was "likely amplifying the market movements driving market levels even lower."[40] On the other hand, market participants, such as funds and traders associations, together with some scholars and other supervisors, have expressed concern that short-selling bans hurt markets and disadvantage investors.[41]

Who is right? What can we add to the debate looking at the actual consequences of the recent measures?

3. Sample, Measures, and Methodology

3.1. Sample

Our sample includes firms from 14 EU countries and the United Kingdom with market data available on Datastream during the period from January 24, 2020 (the date of the first confirmed COVID-19 case in the EU)[42] until May 18, 2020, when the bans on short selling were lifted. In total, there were three temporary bans: the first two bans were a one-day ban on short selling of selected stocks. The first one-day ban on short selling was implemented on March 13, 2020, in Italy and in Spain. The second one-day ban was imposed in Italy, France, and Belgium on March 17, 2020. The third ban was implemented on all stocks traded in Italy, Spain, France, Austria, Greece, and Belgium from March 18 until May 18. The Appendix summarizes the structure of our sample data in the 15 sample countries according to the ban periods. Based on available data on Datastream, our sample includes 1,356 banned stocks: 135 were banned on March 13, 107 on March 17, and all of them from March 18 until May 18. We have a total of 25,855 observations covered by the ban, and most

[40] *Alexander Weber/Silla Brush*, "EU Regulator Urged to Ban Short Selling", Bloomberg News, available at https://www.bloomberg.com/professional/blog/eu-regulator-urged-to-ban-short-selling-with-emergency-power/, (date of last access: July 14, 2020).

[41] *Philip Stafford/Laurence Fletcher*, "Europe Extends Short-Selling Bans Despite Hedge Fund Pressure", Financial Times, April 15, 2020, available at https://www.ft.com/content/d615a15d-c524-4383-b829-4f1a244db28a (date of last access: July 14, 2020).

[42] "Timeline of the COVID-19 Pandemic in January 2020", Wikipedia, available at https://en.wikipedia.org/wiki/Timeline_of_the_COVID-19_pandemic_in_January_2020 (date of last access: July 14, 2020).

securities are in France (43.78%) and in Italy (27.84%). Table 1 provides descriptive information for our total sample by country and ban status. The observations covered by a ban (25,855) are about 17% of the entire sample, which comprises daily observations on 125,186 non-banned stocks. The proportion of banned stocks observations in the six EU countries that banned short selling ranges from 35.82% (in Greece) and 44.83% (in Belgium).

Table 1. Sample Distribution by Country and Ban Status

Country	Obs. with Ban	Obs. with No Ban	% Obs. with Ban
Austria	884	1,089	44.80
Belgium	2,212	2,722	44.83
Denmark	0	5,789	0.00
Finland	0	7,687	0.00
France	11,319	14,370	44.06
Germany	0	14,583	0.00
Greece	1,310	2,347	35.82
Ireland	0	1,151	0.00
Italy	7,197	9,181	43.94
Luxembourg	0	157	0.00
Netherlands	0	4,363	0.00
Portugal	0	1,426	0.00
Spain	2,933	3,631	44.68
Sweden	0	24,546	0.00
United Kingdom	0	32,144	0.00
Total	25,855	125,186	17.12

Sample distribution by country and ban group. Countries with zero observations in the ban group are those where no ban on short selling was in place during the sample period (January 17, 2020–May 18, 2020).

3.2. Measures

We employ several measures to assess the effects of short-selling bans. First, we use abnormal returns ($ABNORM\_RET_{it}$), measured as the difference between firm *i*'s actual stock return and its expected return—estimated based on the return of the entire market—on day *t*. Similar to Beber and Pagano,[43] to estimate expected returns we use the daily return on country market indices (datatype *TOTMKT* in Datastream). In this context, abnormal returns can be defined as the unusual performance of a stock compared with the overall market performance on day *t*. Consequently, and more precisely, this measure captures the idiosyncratic effect of industry- and firm-specific events on a firm's equity

[43] *Alessandro Beber/Marco Pagano* (fn. 30).

value, beyond a firm's systematic effect as proxied by overall market performance. Abnormal returns can be either positive or negative. For example, if stock *i* on day *t* earns 3% and the expected return on the same day is 4%, the abnormal return is negative and equal to –1%. Intuitively and simplifying, this measure might be helpful in our investigation because if an issuer or security affected by the bans on short selling outperforms the market, we might have a first, rough measure of the effect of the bans: if bans work, abnormal returns should be less "negative" than non-banned stocks during the crisis.

Also, following Beber and Pagano,[44] we examine the impact of short-selling bans on market liquidity with two additional measures: (1) bid-ask spreads and (2) Amihud.[45] In this context, bid-ask spread is defined as the difference between the highest price a buyer is willing to pay for a security and the lowest price a seller is willing to accept. The larger the difference, due to information gaps between sellers and buyers on the transaction date, the larger the information asymmetry. Our goal is to examine if short-selling bans were associated with at least lower increases in bid-ask spreads (*i.e.* lower increases in information asymmetry) during the pandemic, as hypothesized by market supervisors to justify the bans. To compute bid-ask spread, we obtain for each security the closed daily price bid (datatype *PB*) and price ask (datatype *PA*) from Datastream, and we then divide their difference by their midpoint.[46] A higher (lower) value of bid-ask spreads indicates higher (lower) information asymmetry.

The Amihud[47] illiquidity measure is computed as the daily absolute stock returns divided for stock *i* by its daily euro trading volume:

$$AMIHUD_{it} = |RET_{it}|/€VOL_{it}$$

[44] *Alessandro Beber/Marco Pagano* (fn. 30).
[45] *Yakov Amihud*, "Illiquidity and Stock Returns: Cross-Section and Time-Series Effects", Journal of Financial Markets 5 (2002), 31–56.
[46] *Holger Daske/Luzi Hail/Christian Leuz/Rodrigo S. Verdi*, "Mandatory IFRS Reporting Around the World: Early Evidence on the Economic Consequences", Journal of Accounting Research 46 (2008), 1085–1142; *Holger Daske/Luzi Hail/Christian Leuz/Rodrigo S. Verdi*, "Adopting a Label: Heterogeneity in the Economic Consequences Around IAS/IFRS Adoptions", Journal of Accounting Research 51 (2013), 495–547.
[47] *Yakov Amihud* (fn. 45).

In plain English, this measure reflects the impact of orders flow on price—that is, the price response associated with one euro of trading volume: the smaller the trading volume required to change the price by one cent, the more illiquid the stock. Therefore, higher values of the Amihud index indicate less-liquid stocks, because they imply that the price change (or, more precisely, the return) is less affected by a certain trading volume. To obtain a more immediate measure of liquidity, we use the reciprocal of $AMIHUD_{it}$ and call it $(AMIHUD)_{inv}$.

Bid-ask spreads and Amihud are right-skewed. This means that their distributions have relatively few very large values, and thus the variables could exhibit multiplicative relations with the control variables (*i.e.* mechanically expanding the magnitude of the coefficients), thus making it harder to interpret the results. The log transformation essentially reels these values into the center of the distribution, making it look more like a normal distribution. Therefore, as is common in the literature,[48] we use the natural log of $Ln(BA\_SPRD)$ and $Ln(AMIHUD)_{rec}$ in our research design, which we describe next.

3.3. Research design

To evaluate the effect of short-selling bans on our three market measures (*i.e. ABNORM_RET*, $Ln(BA\_SPRD)$, and $Ln(AMIHUD)_{rec}$), we apply a difference-in-differences identification strategy using end-of-day data. The main assumption of this design is that banned and not-banned stocks would have had the same trend in short selling, were the ban not implemented. More specifically, we aim to calculate the effect of a treatment (*i.e.* imposing the ban) on an outcome (*i.e.* the three market-based variables) by comparing the mean of the outcome variables for the treatment group (the banned stocks during the ban period) with the mean of the outcome variables for the control group (the banned

[48] *E.g. Holger Daske/Luzi Hail/Christian Leuz/Rodrigo S. Verdi*, JAR 51 (2013), 495–547 (fn. 46); *Hans B. Christensen/Luzi Hail/Christian Leuz*, "Mandatory IFRS reporting and changes in enforcement", Journal of Accounting and Economics 56(2013), 147-177.

stocks during the non-ban period and the non-banned stocks). Similar to prior studies,[49] we estimate the following generalized difference-in-difference model:

$$\mathbf{MKT}_{i,t} = \beta_0 + \beta_1 BAN_{i,t} + \beta_2 VOLATILITY_{i,t} + \beta_3 Ln(STRINGENCY)_t + Firm\text{-}fixed\ effects + \varepsilon_{i,t} \quad (1)$$

where **MKT** denotes a vector of our three market measures described in Section 4.2; the variable *BAN* is an indicator that takes a value of one for trading days in which firm *i*'s security was banned from short selling. The coefficient on *BAN*, β_1, captures the average effect of short-selling bans on the three market measures across banned and non-banned observations. Following Beber and Pagano,[50] we control for volatility (*VOLATILITY*) because different levels of stock volatility might affect market liquidity by changing the inventory risk of market makers. We measure *VOLATILITY* as the 20-day rolling standard deviation of firm *i*'s stock return. We also add a variable to control for the stringency of countries' lockdowns. Specifically, we compute the natural logarithm of a stringency index, *STRINGENCY*, which takes values from zero to 100. This variable is measured as the daily average (within each country) of nine indicators pertaining to containment and closure policies.[51] This control is especially important in view of the fact that during the COVID-19 pandemic, increased uncertainty due to increases in lockdown measures is likely to have affected firms' stock returns and stock liquidity.[52] Finally, we include firm-fixed effects to control for unobserved heterogeneity due to liquidity-related characteristics, such as number of market makers, analyst coverage, firm leverage, capitalization, and size of public float. In the analyses, we truncate all continuous variables at the 1st

[49] *E.g. Alessandro Beber/Marco Pagano* (fn. 30); *Alessandro Beber/Daniela Fabbri/Marco Pagano/Saverio Simonelli* (fn. 33).
[50] *Alessandro Beber/Marco Pagano* (fn. 30).
[51] *Thomas Hale/Noam Angrist/Beatriz Kira/Anna Petherick/Toby Phillips/Samuel Webster*, "Variation in Government Responses to COVID-19", Blavatnik School of Government, Working Paper BSG-WP-2020/032, Version 6.0, May 2020, available at https://www.bsg.ox.ac.uk/sites/default/files/2020-05/BSG-WP-2020-032-v6.0.pdf (date of last access: July 14, 2020). The nine country-based indicators measure the following containment and closure policies: (1) school closing, (2) workplace closing, (3) cancellation of public events, (4) restrictions on gathering size, (5) close of public transportation, (6) stay-at-home requirements, (7) restrictions on internal movements, (8) restrictions on international movements, and (9) public information campaign. For more information about the calculation of the index, refer to: "Calculation and Presentation of the Stringency Index 4.40", April 28, 2020, available at https://www.bsg.ox.ac.uk/sites/default/files/Calculation%20and%20presentation%20of%20the%20Stringency%20Index.pdf (date of last access: July 14, 2020). We add one to the raw scores of *STRINGENCY* before computing the natural logarithm.
[52] *Gillian Tett*, "US Stock Market Rally Confuses Liquidity with Solvency", Financial Times, April 30, 2020, available at https://www.ft.com/content/cc31fe38-8adb-11ea-9dcb-fe6871f4145a (date of last access: July 14, 2020).

and 99th percentiles to avoid the effect of outliers. We also remove zero returns observations (probably corresponding to stale prices), and we use robust standard errors clustered at the stock level.

4. Results

4.1. Ban Structure, Market Trends, and Lockdown Rules Stringency

We start by documenting the structure of the three short-selling bans (see Appendix). The first one-day ban on short selling was on March 13, 2020, and was applied to a specific set of 135 stocks (with available information in Datastream) in Italy and Spain; the second one-day ban was applied on March 17, 2020, and affected 107 stocks in Italy, Belgium, and France. The last set of bans was indiscriminately extended to all stocks of six EU markets as of March 18, 2020: a total of 1,356 stocks and 25,613 trading days (see Appendix). Next, we verified whether the bans were effective. In Figure 1, we graphically depict the time-series patterns of the average short positions in six banning countries (red line) versus eight non-banning countries (black line).[53]

[53] In this figure, we purposefully remove the United Kingdom from the non-banned countries because of the much greater number of short-selling positions in this market, which is the most developed market in Europe. However, in an unreported graph, we confirm that the number of short positions in the United Kingdom did not dramatically change over the period January 24–May 18, 2020. The sources we used to retrieve short-selling positions are as follows: for Italy, http://www.consob.it/web/consob-and-its-activities/short-selling; for Spain, https://www.cnmv.es/portal/Consultas/Busqueda.aspx?id=29; for Belgium, https://www.fsma.be/en/node/7235; for Greece, http://www.hcmc.gr/en_US/web/portal/shortselling1; for Austria, https://webhost.fma.gv.at/ShortSelling/pub/www/QryNetShortPositions.aspx; for the UK, https://www.fca.org.uk/markets/short-selling/notification-and-disclosure-net-short-positions; for Germany, https://www.bundesanzeiger.de/ebanzwww/wexsservlet?global_data.language=en&nosession=true&page.navid=gotolastpage; for Sweden, https://www.fi.se/en/our-registers/short-selling/; for Denmark, https://www.dfsa.dk/Rules-and-Practice/Short-selling/Published-net-short-positions; for the Netherlands, https://www.afm.nl/en/professionals/registers/meldingenregisters/netto-shortposities-actueel; for Portugal, https://web3.cmvm.pt/english/sdi/emitentes/shortselling/index.cfm; for Luxembourg, https://www.cssf.lu/en/publication-data/; for France, https://bdif.amf-france.org/en_US/Recherche-avancee?formId=BDIF&DOC_TYPE=BDIF&LANGUAGE=en&subFormId=dpcn&BDIF_RAISON_SOCIALE=&bdifJetonSociete=&DATE_PUBLICATION=&DATE_OBSOLESCENCE=&isSearch=true; for Ireland, https://www.centralbank.ie/regulation/industry-market-sectors/securities-markets/short-selling-regulation/public-net-short-positions; for Finland, https://www.finanssivalvonta.fi/en/capital-markets/issuers-and-investors/short-positions/ (date of last access: July 14, 2020).

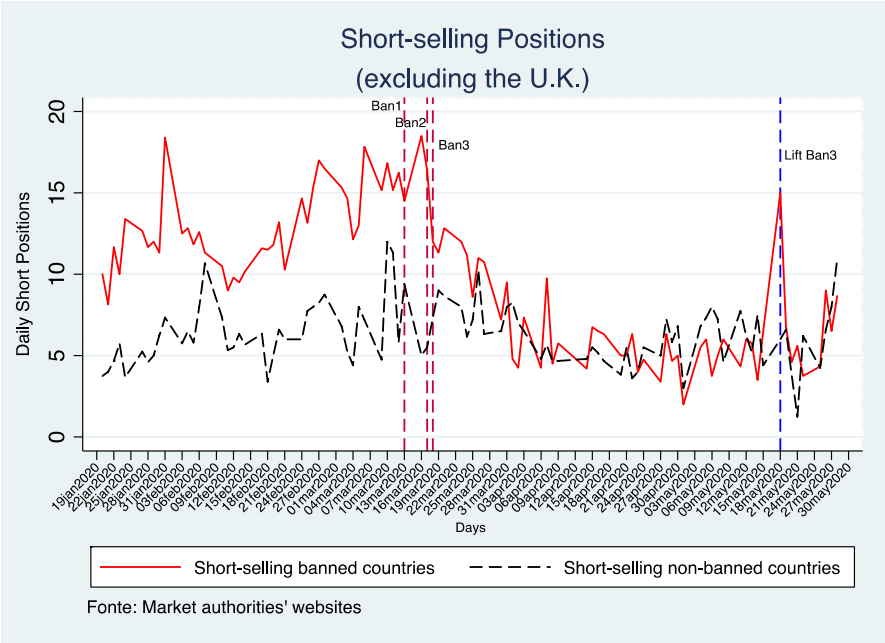

Figure 1. Trend in Short-Selling Positions in Banned vs. Non-Banned Countries

The figure – which suggests higher levels of shorting in ban countries as opposed to no-ban-countries, however the UK, where shorting is significant, is not represented in Figure 1 – provides three insights. First, in the group of countries that did not ban short selling (represented by the black line), there are virtually no substantial changes in short positions leading up to March 18: we document around 7–8 positions, on average, per day, and the trend does not change substantially after this date. Second, the group of countries that banned short selling (represented by the red line) display a large decrease in short positions around March 18, which is when short-selling restrictions began, declining from a daily average of 14 positions during the pre-ban period, to a daily average of 5 positions in the post-ban period.[54] Third, short-selling activities pick up again on the first day after the ban ends, on May 18, increasing from a daily average of 5 positions to 15 positions, and this change occurred only in the banned countries.

Figures 2 and 3 show the average trend in stock market return and volatility, respectively, in the sample countries.

[54] We do not observe zero short positions during the two-month bans, as the short-selling bans did not apply to the creation of, or increase in, net short positions: (1) through index-related instruments or baskets of financial instruments; (2) when the investor who acquires a convertible bond has a delta-neutral position between the equity component of the convertible bond and the short position taken to cover that component; (3) where the creation of, or increase in, the short position in shares is hedged by a purchase that is equivalent in terms of proportion on subscription rights.

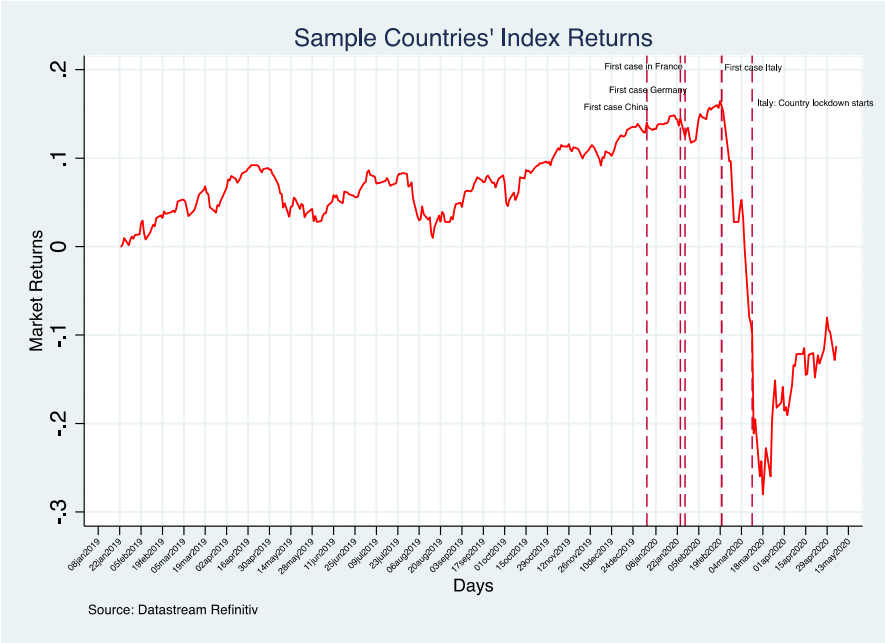

Figure 2. Market Index Returns in the Sample Countries

Figure 3. Stock Return Volatility in the Sample Countries during the COVID-19 Crisis

Figure 2 indicates that the 15 European indices' cumulative returns[55] exhibited a decrease of 42% (from +14% to –28%) from February 20, 2020 (the announcement of the first COVID-19 cluster in Italy) until March 18, 2020. Figure 3 shows that volatility (*i.e.* 20-day rolling standard deviation of returns) at the European level increased from 0.027 on February 20 to 0.076 at its peak on March 31: an increase of 292% (= 0.076/0.027). The figure also shows that, even though market volatility

[55] We use the country-based datatype *TOTMKT* in Datastream to compute the index return.

decreased compared with the levels reached in mid-March 2020, it remained extremely high compared with the pre-COVID-19 period. Finally, Figure 4 displays the time-series pattern of the variable *STRINGENCY*, which captures the severity of lockdown measures imposed in the sample countries.

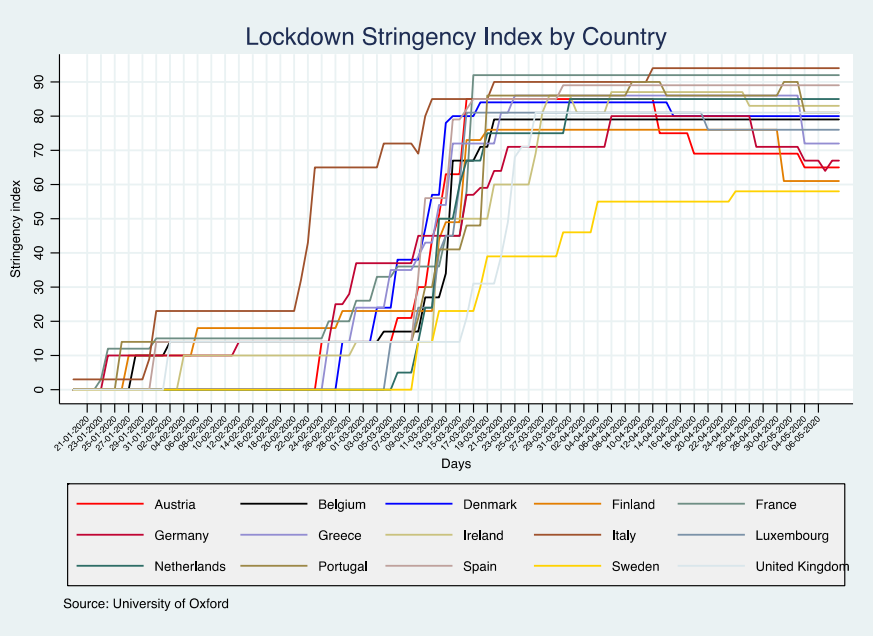

Figure 4. Timeline of Lockdown Stringency in the Sample Countries

We observe great variation in the implementation of lockdowns across the sample: more timely and stringent measures were taken in Italy, where COVID-19 spread earlier, faster, and stronger, while softer measures were introduced in Sweden. Interestingly, we observe that in most countries, lockdown measures toughened right around March 18—that is, when short-selling bans were implemented. This is why it is important to control for *Ln(STRINGENCY)* in our analysis: the severity of lockdown measures could drive the association between *BAN* and our three market measures.

4.2. Preliminary Results

In Table 2, we present descriptive statistics of the variables used in Equation (1).

Table 2. Descriptive Statistics for the Variables Used in the Analyses

Variables	BAN (a): N = 25,855					NO BAN (b): N = 125,186					Diff. (a) - (b)	
	1Q	Median	3Q	Mean	Sd	1Q	Median	3Q	Mean	sd	*t*-stat	*z*-stat
Ln(BA_SPRD)	–5.519	–4.432	–3.638	–4.654	1.403	–5.732	–4.624	–3.619	–4.718	1.440	6.60	8.76
$LN(AMIHUD)_{rec}$	–0.141	–0.110	–0.088	–0.123	0.051	–0.144	–0.112	–0.088	–0.124	0.053	5.04	3.76
ABNORM_RET	–0.024	–0.001	0.022	0.000	0.041	–0.018	0.000	0.018	0.001	0.039	–1.32	–4.24
VOLATILITY	0.028	0.039	0.054	0.044	0.025	0.017	0.027	0.043	0.034	0.026	58.03	85.12
Ln(STRINGENCY)	4.500	4.533	4.533	4.500	0.066	2.398	3.045	4.190	2.771	1.575	182.00	242.57

All variable definitions are provided in the Appendix. Variables are truncated at the 1st and 99th percentiles to alleviate the impact of outliers in the analyses.

We observe that information asymmetry is, on average, higher during the ban period: the mean and median of *Ln(BA_SPRD)* are –4.72 and –4.62 in non-banned trading days versus –4.65 and –4.43 during the banned trading days, respectively (the differences are statistically significant at the 1% levels). As for liquidity, we observe slightly higher values of the mean and median of $Ln(AMIHUD)_{rec}$ in banned trading days than in non-banned trading days (–0.122 vs. –0.124 for the means and –0.110 vs. –0.112 for the medians, respectively). This is possibly because the March 13 and March 17 bans were implemented on a restricted number of stocks, usually representing the most capitalized (and liquid) firms, which lost a significant share of their capitalization value in the preceding trading days.[56] Finally, we observe that banned stocks were subject to more intense downward pressure: both the mean and median *ABNORM_RET* are slightly lower in the banned stock group than in the non-banned stock group (0.000 vs. 0.001 for the means, and –0.001 vs. 0.000 for the medians). As for the control variables, the mean and median *VOLATILITY* are significantly higher in the banned subsample (0.044 and 0.039) than in the non-banned subsample (0.034 and 0.027). The same is true for *Ln(STRINGENCY),* with banned firm-years having mean (median) *Ln(STRINGENCY)* of 4.500 (4.533) compared with 2.771 (3.044) (p-value < 0.01) for the non-banned firm-years.

In Table 3 we provide the regression estimates of Equation (1).

[56] When we remove the first two ban days (March 13 and March 17) from the analysis, we note that the differences in mean and median of the variable $Ln(Amihud)_{rec}$ become statistically smaller.

Table 3. The Effect of Short-Selling Bans on Market Quality

$$\mathbf{MKT}_{i,t} = \beta_0 + \beta_1 BAN_{i,t} + \beta_2 VOLATILITY_{i,t} + \beta_3 Ln(STRINGENCY)_t + Firm\text{-}fixed\ effects + \varepsilon_{i,t} \qquad (1)$$

VARIABLES	(1) *ABNORM_RET*	(2) *ABNORM_RET*	(3) *Ln(BA_SPRD)*	(4) *Ln(BA_SPRD)*	(5) $LN(AMIHUD)_{rec}$	(6) $LN(AMIHUD)_{rec}$
	Coeff. (*t*-stat)	Coeff. (*t*-stat)	Coeff. (*t*-stat)	Coeff. (*t*-stat)	Coeff. (*t*-stat)	Coeff. (*t*-stat)
BAN	–0.001***	–0.001***	0.285***	0.151***	–0.005***	–0.001***
	(–3.59)	(–4.20)	(25.49)	(12.87)	(–14.02)	(–3.47)
VOLATILITY	0.078***	0.073***	6.085***	3.498***	–0.139***	–0.062***
	(10.04)	(8.68)	(30.14)	(19.75)	(–15.72)	(–7.25)
Ln(STRINGENCY)		0.000***		0.103***		–0.003***
		(2.68)		(50.48)		(–31.84)
FIRM F.E.	YES	YES	YES	YES	YES	YES
N	151,041	151,041	151,041	151,041	151,041	151,041
Adjusted R^2	0.8%	0.8%	77.3%	78.1%	71.1%	71.7%

This table presents the results of estimating Equation (1). In Columns 1, 3, and 5, we report the results of estimating Equation (1) without controlling for the effect of lockdown measures imposed in each European country. The full results, which also include a control for the stringency of lockdown measures, are reported in Columns 2, 4, and 6. *T*-statistics are reported in parentheses below the coefficient estimates. The estimates displaying three (two, one) asterisks are significantly different from zero at the 1% (5%, 10%) level. The regressions are estimated by OLS on daily data with robust standard errors clustered at the stock level.

The baseline regression results are reported in the odd columns (1, 3, and 5) of Table 3, whereas the results with all control variables (*VOLATILITY* and *Ln(STRINGENCY)*) are reported in the even columns. Columns (1) and (2) refer to the return regressions (dependent variable is *ABNORM_RET*), Columns (3) and (4) to the information asymmetry regressions (dependent variable is *Ln(BA_SPRD)*), Columns (5) and (6) to the liquidity regressions (dependent variable is $Ln(AMIHUD)_{rec}$). The findings in the first two columns reveal that banned stocks significantly underperform non-banned stocks: the coefficient on *BAN* is negative and significant (–0.001 and *p*-value < 0.01) in both Columns (1) and (2). This result indicates that firms' excess returns in the banned period were, on average, 0.1% lower than in the non-banned period and compared with firms in countries that did not impose short-selling bans.

In addition, the findings indicate that information asymmetry is significantly higher during the banning period. The coefficient on *BAN* is 0.285 in Column (3) and statistically different from zero at the 1% level. This coefficient remains positive and significant (at the 1% level) even after the inclusion in Column (4) of *Ln(STRINGENCY)*, which is positively and significantly associated (at the 1% level) with *Ln(BA_SPRD)*. This is consistent with the idea that the enhancement of lockdown measures during the COVID-19 crisis increased uncertainty and thus information asymmetry. The coefficient decreases by about 47% (from 0.285 in Column (3) to 0.151 in Column (4)). This result implies that during the banning days, on average, bid-ask spreads increase by 1.16 ($= e^{(0.151)}$) or by 16% compared with banned stocks in the non-banning period and to stocks in countries with non-banning policies.

In the last two columns of Table 3, we explore the effect of short-selling bans on liquidity. The results document that liquidity decreases during the ban period. The coefficient on *BAN* is –0.005 in Column (5) (statistically significant at the 1% level). The same relation persists after we include *Ln(STRINGENCY)*: the coefficient is negative (–0.003) and statistically significant at the 1% level, suggesting that with higher lockdown measures, the coefficient on *BAN* decreases by 80% (from –0.005 in Column (5) to –0.001 in Column (6)). This finding suggests that the liquidity of banned

stocks decreased by 1.001 (= $e^{(0.001)}$), or by 0.1% as compared with the same banned stocks in the non-banning period and to stocks in countries that did not impose bans.

As for the last control variable, the coefficient on *VOLATILITY* is positive and significant at the 1% level in both the return regressions and bid-ask spread regressions, consistent with the idea that increases in risk are associated with increases in returns and bid-ask spread. The coefficient on *VOLATILITY* becomes negative and different from zero at the 1% level in the liquidity regression, in line with the idea that increases in risk are associated with decreases in liquidity. [57]

Next, we examine whether the abovementioned market effects of short-selling bans were different for financial stocks as compared with non-financial stocks. To accomplish this, we create an indicator, *FINANCIAL*, that is equal to one if a firm's SIC code is between 6000 and 6999. In total, we have 758 financial stocks. Then, we augment Equation (1) with an interaction term, *BAN* × *FINANCIAL*. Our modified Equation (1) is:[58]

$$\mathbf{MKT}_{i,t} = \beta_0 + \beta_1 BAN_{i,t} + \beta_1 BAN_{i,t} \times FINANCIAL_{i,t} + \beta_2 VOLATILITY_{i,t} + \beta_3 Ln(STRINGENCY)_t + \textit{Firm-fixed effects} + \varepsilon_{i,t} \quad (1')$$

The results are reported in Table 4.

[57] In an (untabulated) analysis, we use the variable *VOLATILITY* computed on a weekly basis as our dependent variable, and we regress it on *BAN* and weekly values of *Ln(STRINGENCY)* and firm fixed effects. We find that the coefficient on *BAN* is 0.006 (with *p*-value < 0.001). The result of this additional analysis suggests that the volatility of banned stocks was significantly higher than the volatility of non-banned stocks during the pandemic.

[58] Please note we do not estimate the coefficient on *FINANCIAL* due its perfect collinearity with firm-fixed effects.

Table 4. The Effects of Short-Selling Bans on Market Quality Conditioning for Financial Firms

$$\mathbf{MKT}_{i,t} = \beta_0 + \beta_1 BAN_{i,t} + \beta_2 BAN_{,t} \times FINANCIAL_{i,t} + \beta_2 VOLATILITY_{i,t} + \beta_3 Ln(STRINGENCY)_t + Firm\text{-}fixed\ effects + \varepsilon_{i,t} \quad (1')$$

VARIABLES	(1) *ABNORM_RET*	(2) *ABNORM_RET*	(3) *Ln(BA_SPRD)*	(4) *Ln(BA_SPRD)*	(5) $LN(AMIHUD)_{rec}$	(6) $LN(AMIHUD)_{rec}$
	Coeff. (*t*-stat)	Coeff. (*t*-stat)	Coeff. (*t*-stat)	Coeff. (*t*-stat)	Coeff. (*t*-stat)	Coeff. (*t*-stat)
BAN	–0.001***	–0.001***	0.268***	0.135***	–0.005***	–0.001***
	(–2.60)	(–3.19)	(21.43)	(10.33)	(–12.12)	(–2.77)
BAN × FINANCIAL	–0.001*	–0.001*	0.092***	0.093***	–0.001	–0.001
	(–1.84)	(–1.84)	(3.52)	(3.50)	(–0.96)	(–0.99)
VOLATILITY	0.078***	0.073***	6.088***	3.501***	–0.139***	–0.062***
	(10.03)	(8.67)	(30.18)	(19.80)	(–15.74)	(–7.26)
Ln(STRINGENCY)		0.000***		0.103***		–0.003***
		(2.67)		(50.50)		(–31.84)
FIRM F.E.	YES	YES	YES	YES	YES	YES
N	151,041	151,041	151,041	151,041	151,041	151,041
Adjusted R^2	0.76%	0.76%	77.29%	78.12%	71.13%	71.69%

This table presents the results of estimating Equation (1) with the inclusion of the interaction *BAN × FINANCIAL*. The variable *FINANCIAL* is an indicator that is equal to one if a firm's SIC code is between 6000 and 6999. In total, we have 758 financial stocks. We do not estimate the coefficient on *FINANCIAL* due its perfect collinearity with firm-fixed effects. In the odd columns (1, 3, and 5) we report the results of estimating Equation (1) without controlling for the effect of lockdown measures imposed in each European country. The full results, which also include a control for the stringency of lockdown measures, are reported in the even columns (2, 4, and 6). *T*-statistics are reported in parentheses below the coefficient estimates. The estimates displaying three (two, one) asterisks are significantly different from zero at the 1% (5%, 10%) level. The regressions are estimated by OLS on daily data with robust standard errors clustered at the stock level.

In Table 4, we document that the negative effects from short-selling bans on returns and information asymmetry were more pronounced for financial stocks than for non-financial stocks, as indicated by the negative and significant coefficient on *BAN* × *FINANCIAL* in Columns (1) and (2) and by the positive and significant coefficient on *BAN* × *FINANCIAL* in Columns (3) and (4). Specifically, when focusing on the models where all control variables are included (*i.e.* Columns (2) and (4)), we observe that financial firms' excess returns in the banned period were, on average, 0.2% (coefficient on *BAN* plus the coefficient on *BAN* × *FINANCIAL*) lower than in the non-banned period. Said differently, financial firms' abnormal returns in the banned period were twice as low as those of non-financial firms. Similarly, financial firms' bid-ask spreads were, on average, 0.228 higher (coefficient on *BAN* plus the coefficient on *BAN* × *FINANCIAL*) than in the non-banned period. Said differently, the bid-ask spread of financial firms increased by 25.6% ($=e^{(0.228)}$) versus 14.4% ($=e^{(0.135)}$) for non-financial firms during the banned period.

However, we do not find that liquidity levels of financial firms were any different from non-financial firms during the bans, given the non-significant coefficient on *BAN* × *FINANCIAL* in Columns (5) and (6). The overall evidence in Tables 2, 3, and 4 indicates that there was a significant deterioration of market conditions around the introduction of short-selling bans in the EU during the COVID-19 crisis, and these effects were somehow more intense for financial firms than non-financial firms.

4.3. Endogeneity

Although we strive to control for other possible factors affecting market characteristics, other potential omitted variables may yet exist.[59] Our firm fixed-effect structure is intended to minimize correlated omitted variables (and related endogeneity). However, it could also be that the bans themselves (as well as the selection of stocks to ban in the first two one-day bans) are the result of an

[59] Omitted variables may generate bias in the model, with the bias resulting in the model attributing the effect of the missing variables to those that were included.

endogenous choice made by the market regulator. More specifically, market authorities imposed a ban on stocks that were already illiquid even before the ban. In other words, we cannot completely rule out that these short-selling bans were introduced at random. Therefore, the relation between imposing a ban and lower returns and liquidity in Table 3 could well run in the opposite direction: since stocks are illiquid or underperforming, regulators impose a short-selling ban. To alleviate this concern, we use two approaches. As a first approach, we remove observations of the first two one-day bans because these bans were issued to purposefully protect the most hard-hit stocks in the previous trading days.[60] It is highly likely, therefore, that if we include these two bans' observations, omitted variables may drive our results. As a second approach, we use the coarsened exact matching (CEM) technique, which consists of constructing a matched sample of banned and non-banned firms to correct for endogenous selection on observed variables. In our analysis, each banned firm is matched with a non-banned firm according to its industry (SIC codes), corporate governance (independence score in Amadeus), and firm size (average market capitalization during fiscal year 2019). The resulting sample consists of 1,289 banned firms matched to 1,289 non-banned firms for a total of 86,840 firm-years, representing a 42.5% loss of the sample used to estimate Equation (1) in Table 3 (= 1 – 86,840/151,041). The two types of firms do not have any discernible differences in the matching variables. Untabulated results document that banned and non-banned firms operate in similar industries, have similar independence scores,[61] and were of similar size before the COVID-19 crisis. Panels A and B in Table 5 report the results of these two endogeneity tests.

[60] Specifically, following Article 23 of Regulation (EU) n. 236/2012 on short selling, market authorities in Spain, Italy, France, and Belgium prohibited short selling on stocks that had lost more than 10% in the previous trading day.

[61] Independence scores capture the degree of a company's independence in relation to its shareholders, which may exhibit different levels of information asymmetry and liquidity. The indicators are represented by letters. The indicator A is used for companies with known recorded shareholders, none of which have more than 25% of direct or total ownership. The indicator B is attached to any company that has at least one known recorded shareholder—none with an ownership percentage (direct, total, or calculated total) over 50%, but one or more with an ownership percentage above 25%. The indicators A and B are further divided into three categories ("+", none, "–"): "+" indicates companies with six or more identified shareholders whose ownership is known; no label is given to companies that have four or five identified shareholders; "–" indicates companies with fewer than four identified shareholders. The indicator C is given to any company with a recorded shareholder with total or calculated total ownership over 50%. "+" is used for C companies in which the summation of direct ownership percentage (all categories of shareholders included) is 50.01% or higher. The C indicator is also given to a company when a source indicates that the company has an ultimate owner, even though its percentage of ownership is unknown. Finally, the indicator D is allocated to any company with a recorded shareholder with a direct ownership of over 50%.

Table 5, Panel A. Excluding Temporary Bans on Restricted Stocks

VARIABLES	(1) *ABNORM_RET*	(2) *ABNORM_RET*	(3) *Ln(BA_SPRD)*	(4) *Ln(BA_SPRD)*	(5) $LN(AMIHUD)_{rec}$	(6) $LN(AMIHUD)_{rec}$
	Coeff. (*t*-stat)	Coeff. (*t*-stat)	Coeff. (*t*-stat)	Coeff. (*t*-stat)	Coeff. (*t*-stat)	Coeff. (*t*-stat)
BAN	–0.002***	–0.003***	0.320***	0.189***	–0.006***	–0.002***
	(–7.51)	(–8.88)	(28.82)	(16.10)	(–15.24)	(–4.47)
VOLATILITY	0.095***	0.086***	5.772***	3.404***	–0.132***	–0.056***
	(12.08)	(10.08)	(28.91)	(19.33)	(–14.98)	(–6.69)
Ln(STRINGENCY)		0.000***		0.096***		–0.003***
		(5.37)		(47.30)		(–31.32)
FIRM F.E.	YES	YES	YES	YES	YES	YES
N	145,649	145,649	145,649	145,649	145,649	145,649
Adjusted R^2	1.1%	1.1%	77.7%	78.4%	71.2%	71.7%

Table 5, Panel B. Matching Firms on Size, Governance Characteristics, and Industry

VARIABLES	(1) *ABNORM_RET*	(2) *ABNORM_RET*	(3) *Ln(BA_SPRD)*	(4) *Ln(BA_SPRD)*	(5) $LN(AMIHUD)_{rec}$	(6) $LN(AMIHUD)_{rec}$
	Coeff. (*t*-stat)	Coeff. (*t*-stat)	Coeff. (*t*-stat)	Coeff. (*t*-stat)	Coeff. (*t*-stat)	Coeff. (*t*-stat)
BAN	–0.001	–0.001**	0.284***	0.143***	–0.005***	–0.001**
	(–1.46)	(–2.37)	(22.22)	(10.40)	(–12.22)	(–2.58)
VOLATILITY	0.051***	0.045***	5.878***	3.484***	–0.134***	–0.064***
	(5.09)	(4.16)	(20.62)	(13.70)	(–10.34)	(–5.18)
Ln(STRINGENCY)		0.000***		0.103***		–0.003***
		(3.15)		(36.95)		(–24.06)
FIRM F.E.	YES	YES	YES	YES	YES	YES
N	86,840	86,840	86,840	86,840	86,840	86,840
Adjusted R^2	0.5%	0.5%	76.0%	76.8%	70.9%	71.4%

Consistent with the findings in Table 3, in Table 5, Panel A, we continue to observe a deterioration of market conditions for banned stocks. Specifically, the value of the coefficient on *BAN* in the abnormal returns (Column (1) and (2)) and liquidity analyses (Column (5) and (6)) is twice or even three times larger than in Table 3: –0.001 (–0.001) in Table 3 versus –0.003 (–0.002) in Table 5, Panel A, when *ABNORM_RET* (*Ln(AMIHUD)*$_{rec}$) is the dependent variable. When we use *Ln(BA_SPRD)* as the dependent variable, the coefficient on *BAN* in Panel A of Table 5 is about 25% larger than in Table 3 (= 0.189/0.151). Overall, the results indicate that the deterioration of market conditions was perhaps attributable to the longer short-selling ban.[62]

Panel B of Table 5 presents the estimates of Equation (1) using the CEM matched subsamples. Focusing on the results in the even columns (where all controls are included), consistent with the findings in Table 3, we continue to find that banned stocks underperform non-banned stocks, have higher bid-ask spreads, and have lower liquidity.

5. Conclusions

In this study, we take advantage of the unique (albeit tragic) natural experiment due to the exogenous shock caused by the COVID-19 outbreak, which, as discussed, has determined different reactions by supervisory authorities in similar countries and somehow similar markets and issuers. This unique setting allows us to examine the effects of short-selling bans. More specifically, we empirically examine the effect of introducing temporary short-selling bans on different measures of market quality during the recent financial crisis following the pandemic outbreak. We show that, across 15 European countries, banning short selling is associated with lower stock liquidity, higher information asymmetry, and lower abnormal returns as compared with non-banning short selling, thus leading to the exact outcome that these restrictions aim to prevent. We further show that these

[62] In untabulated analyses, we estimate Equation (1) using only observations of the first two one-day bans. Specifically, we compare market characteristics of banned and non-banned stocks within the same country since the regulators imposed the bans only on a subset of stocks. The results indicate that during these days banned stocks exhibited a decline in liquidity. We find no significant difference in abnormal returns and bid-ask spreads.

negative effects are more pronounced in the case of financial securities. A possible explanation of this difference, in line with previous research, might be that the price discovery mechanism associated with short selling is greater in the financial industry, possibly due to the prevailing more widespread ownership structure and connected greater analysts' coverage. Based on these results, and consistent with prior theoretical and empirical work in other settings, our findings suggest financial regulators should be cautious in their decisions to introduce short-selling bans during market crises, given these bans' lack of effectiveness and negative consequences on market quality.

This leads us to a second conclusion. We of course understand that short selling, which is a form of "speculation" on the negative price effects of, in this case, a health emergency, can be politically unpalatable or, at a minimum, might be (also instrumentally or irrationally) characterized as tainted by unethical goals. Market supervisors might therefore be subject to a certain degree of pressure—including "political" pressure writ large—to react, to "do something." From this perspective it is interesting to observe that short-selling restrictions were adopted in only some countries. As a suggestion for future research, it might be interesting to investigate a possible relation between the governance of supervisors and measures of independence of regulators from socio-political influences and the propensity to adopt such measures that theoretically and empirically appear of dubious utility. Additionally, general economic preconditions, pre-dating the COVID-19 crisis, might have played a role in the probability of introducing short-selling bans, as discussed in previous research.[63] In the year pre-dating the pandemic outbreak, the country average 5-year credit default swaps (CDS) spread, a market-based measure of insolvency risk, in countries that did not ban short selling was 104.70, compared with 177.11 (+69.15%) in countries that did ban short selling. Therefore, it is possible that countries where financial stress was higher were more likely to impose protective regulations like short-selling bans during the pandemic.

[63] *Alessandro Beber/Marco Pagano* (fn. 30).

Finally, the past few months lay bare the absence of stronger coordination mechanisms among EU market supervisors. Our analysis does not allow a precise conclusion on the desirability of greater coordination, because it is unclear how a European regulator with direct powers might have acted; it might also be argued that flexibility could be preferable to adapt to specific local conditions and because it allows experimentation. The question of whether it is rational and equitable to treat issuers and investors differently in an otherwise partially harmonized system, such as the EU, remains unanswered, however, and it seems undeniable that these differences are not easy to justify.

Appendix

Short-Selling Bans' Structures Across 15 Countries during the COVID-19 Crisis

Country	Ban 1				Ban 2				Ban 3				Tot obs. under ban	%
	Start date	Lift date	Stocks	Obs.	Start date	Lift date	Stocks	Obs.	Start date	Lift date	Stocks	Obs.		
Austria	no ban	no ban			no ban	no ban			18-Mar-20	18-May-20	39	884	884	3.42
Belgium	no ban	no ban			17-Mar-20	17-Mar-20	15	15	18-Mar-20	18-May-20	110	2,197	2,212	8.56
Denmark	no ban	no ban			no ban	no ban			no ban	no ban				
Finland	no ban	no ban			no ban	no ban			no ban	no ban				
France	no ban	no ban			17-Mar-20	17-Mar-20	74	74	18-Mar-20	18-May-20	601	11,245	11,319	43.78
Germany	no ban	no ban			no ban	no ban			no ban	no ban				
Greece	no ban	no ban			no ban	no ban			18-Mar-20	18-May-20	118	1,310	1,310	5.07
Ireland	no ban	no ban			no ban	no ban			no ban	no ban				
Italy	13-Mar-20	13-Mar-20	77	77	17-Mar-20	17-Mar-20	18	18	18-Mar-20	18-Jun-20	340	7,102	7,197	27.84
Luxembourg	no ban	no ban			no ban	no ban			no ban	no ban				
Netherlands	no ban	no ban			no ban	no ban			no ban	no ban				
Portugal	no ban	no ban			no ban	no ban			no ban	no ban				
Spain	13-Mar-20	13-Mar-20	58	58	no ban	no ban			18-Mar-20	18-May-20	148	2,875	2,933	11.34
Sweden	no ban	no ban			no ban	no ban			no ban	no ban				
United Kingdom	no ban	no ban			no ban	no ban			no ban	no ban				
Total			135	135			107	107			1,356	25,613	25,855	

Variable Definitions

Variables	Definitions	Source
ABNORM_RET	The difference between firm *i*'s actual security return and its expected return on day *t*. Expected return is the daily return on country market indices (datatype *TOTMKT*).	Datastream
Ln(BA_SPRD)	Natural logarithm of *BA_SPRD*. *BA_SPRD* is the difference between daily price bid (datatype *PB*) and price ask (datatype *PA*), divided by their mid-point.	Datastream
$Ln(AMIHUD)_{rec}$	The reciprocal of the natural logarithm of *AMIHUD*. *AMIHUD* is computed as the ratio between the absolute value of firm *i*'s return on day *t,* and the euro trading volume of the security of firm *i* on day *t*.	Datastream
BAN	Indicator variable that is equal to one for trading days in which firm *i*'s security was banned from short selling.	ESMA
VOLATILITY	The 20-day rolling standard deviation of firm *i*'s security return.	Datastream
Ln(STRINGENCY)	Natural logarithm of a stringency index. The stringency index, *STRINGENCY*, takes values from zero to 100.	www.bsg.ox.ac.uk/covidtracker
MKT_CAP	Market capitalization of firm *i* (datatype *MV*) in euros.	Datastream
INDEPENDENCE	Independence scores capturing the degree of a company's independence in relation to its shareholders.	Amadeus
INDUSTRY	SIC codes.	Datastream
FINANCIAL	Indicator variable that is equal to one if a firm's SIC code is between 6000 and 6999.	Datastream

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