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Financial Regulation in a Pandemic

The Consequences of Short-Selling Bans on Different Market Capitalizations in Europe

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Abstract

This thesis examines the impact of the short-selling bans implemented across six European countries during the Covid-19 pandemic in March 2020, with a focus on their effects on firms of different market capitalizations. Utilizing a difference-in-difference methodology, this study assesses the effects of these bans on market liquidity and returns, exploring whether these interventions served as protective measures or merely reactive strategies. The results indicate that the short-selling bans led to increased bid-ask spreads and higher levels of Amihud illiquidity measure. The bans disproportionately impacted smaller market-cap stocks, both in terms of returns and market quality. Additionally, the bans are associated with a statistically significant positive announcement effect on stock prices; however, this effect diminishes over the entire ban period, with abnormal returns becoming negative for stocks affected by the ban. Lastly, the study explores the determinant factors of these regulatory decisions, revealing that economic vulnerability and systemic financial risks were significant determinants in the enactment of short-selling bans. This research contributes to the ongoing debate about the efficacy of short-selling bans, suggesting that such interventions might have unintended adverse effects on market dynamics.

Keywords – short selling, ban, liquidity, returns, Covid, European stock markets, market capitalization

Abbreviations

AR	Abnormal Return
BHAR	Buy-and-Hold Abnormal Return
CDS	Credit Default Swap
CISS	Composite Indicator of Systematic Stress
CCI	Consumer Confidence Indicator
DiD/Diff-in-Diff	Difference-in-Difference
ECB	European Central Bank
ESMA	European Securities and Markets Authority
EU	European Union
GFC	Great Finanical Crisis
NCA	National Competent Agency
NSP	Net Short Position
PEPP	Pandemic Emergency Purchase Programme
RIC	Refinitiv Instrument Code
SUTVA	Stable Unit Treatment Value Assumption
SVI	Search Volume Index
WGI	World Governance Indicator

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1 Introduction

1.1 Research Objective

"The emergency order temporarily banning short selling of financial stocks will restore equilibrium to markets."

- Christopher Cox, SEC Chairman, 19 September 2008, SEC News Release 2008-211.

During the onset of the Covid-19 crisis, financial markets worldwide saw a precipitous decline in asset prices. This downturn was primarily attributed to the anticipated significant reductions in supply and demand, a consequence of global lockdown measures, coupled with profound uncertainty regarding the long-term economic outlook. Such conditions necessitated the swift price adjustments observed in financial markets. However, the descent into lower prices and increased volatility urged policymakers worldwide to act quickly to counteract the negative market trends.

Historically, in times of market volatility, short selling has often been criticized for exacerbating downturns and, in some cases, even initiating them. As a result, regulators have a proclivity to prohibit short sales in efforts to stabilize the markets and bolster prices. Their agenda are often on protecting smaller firms and investors. In response to major financial disturbances, such as the 2008-09 financial crisis, the 2011-12 European debt crisis, and the abrupt stock price declines during the 2020 Covid-19 pandemic, numerous countries have implemented bans on short selling.

This study examines the two-month-long short sale bans enacted by six European nations in March 2020 in response to the Covid-19 pandemic. By February of that year, the global spread of the virus was unmistakable, and international markets witnessed significant downturns, which persisted into late March, raising concerns about a prolonged economic recession. In an attempt to mitigate these effects, regulators in Austria, Belgium, France, Greece, Italy, and Spain introduced temporary short sale bans in mid-March, intended to last for two months.

Initially, this research will explore the impact of banning short selling on market quality and returns through a difference-in-difference (DiD) identification strategy. Further, it

will evaluate whether the bans uniformly benefited or harmed the market by exploring the possibility that its effects could vary based on the a priori market capitalizations of the stocks. Secondly, it will investigate the motivations behind imposing short sale bans by examining which countries opted for such measures and which abstained. This exploratory part of the thesis employs a logistic regression model to identify the determinant factors for imposing a ban. Given the varied responses from regulatory authorities within the EU, there is a clear lack of consensus on the optimal approach to regulation during times of market distress.

The primary objective and contribution of this research is to explore the differential impact of short sale bans on market quality and returns, with a particular focus on how these effects vary based on the market capitalization of the firms. While existing literature has extensively explored the general impacts of short sell bans during financial crises, there has been limited focus on how these effects differ based on firm size. Previous studies have often treated the market as homogeneous, overlooking potential variations in impact across different market cap segments. This research fills this gap by providing a detailed analysis of the heterogeneous effects of short sale bans, specifically examining how these bans affected small-cap, mid-cap, and large-cap firms differently.

1.2 Main Findings

Consistent with existing theoretical frameworks and empirical research, our study demonstrates that the short-selling bans during Covid-19 significantly affected market liquidity. This is evidenced by an increase of 19.2% in bid-ask spreads and a 26.8% rise in the Amihud illiquidity measure for stocks in jurisdictions enforcing the bans compared to those without such restrictions. Further analysis, segmented by market capitalization, reveals that the negative impact on liquidity is more pronounced for stocks with smaller market capitalizations. Specifically, the increase in bid-ask spread for small- mid- and large-cap firms is 30.0%, 23.3% and 5.4%, respectively.

Regarding returns, our findings indicate a significant positive announcement effect of the bans, although this effect diminishes over time, with abnormal returns being negative throughout the entire ban period. Additionally, the abnormal returns is lower for small-cap firms, compared to that of mid- and large-cap firms.

We also explore the possibility of a 'relocation' effect, where short-selling activities might shift from jurisdictions with bans to those without. This investigation, detailed in Appendix C, uses regulatory disclosures and public short position data to track the evolution of short sellers' positions during the ban period. The behavior of active short sellers in jurisdictions without a short-selling ban remained consistent before and after the enactment of the bans, suggesting no significant displacement of short-selling activities.

Lastly, the study explores the motivations behind these regulatory decisions, noting that the implementation of the ban was not an exogenous event, but rather a policy decision based on evaluating the ban's potential effects within each country. Our results reveal that economic vulnerability and systemic financial risks were significant factors in enforcing short-selling bans.

This comprehensive analysis contributes to the understanding of the impacts of short-selling bans, underscoring the complex interplay between regulatory interventions and market behavior during times of crisis. From a policy perspective, this suggests avoiding the implementation of short-selling bans during crises.

1.3 Structure of the Thesis

The primary focus of this study is to examine the impact of short-selling bans on three outcome variables: (i) Abnormal Returns, (ii) Bid-Ask Spread, and (iii) Amihud Illiquidity Measure, with the latter two serving as proxies for 'market quality'. We employ a difference-in-difference regression analysis to empirically assess the effects of the short-selling bans. Additionally, for abnormal returns, a cross-sectional regression is utilized to analyze Buy-and-Hold Abnormal Returns over various intervals. Secondly, we explore the conditions that lead countries to implement short-selling restrictions. This exploratory part of the study aims to understand the regulatory decision-making process during the pandemic. Using logistic regression, we investigate the factors that influence the likelihood of a country enacting short-selling constraints.

The rest of the thesis is organized as follows. Section 2 presents the background on short selling, its regulatory framework in the EU, and the regulatory response to the Covid-19 crisis. Section 3 contains the literature review, and section 4 presents the hypotheses development on the effects of short-selling bans. Section 5 describes the data sources,

sample selection, and data refinement techniques. In section 6, we detail the methodology used, including the difference-in-difference, OLS analysis, and logistic regression. Section 7 presents the results of the analysis on the impact of short-selling bans on market returns and liquidity, along with the results of the determinant factors behind the introduction of short-selling bans. Section 8 discusses the implications the findings, the generalizability of results, and policy considerations. Finally, section 9 concludes with a summary of key findings, and suggestions for future research.

2 Background

2.1 Short-Selling: Principles and Practices

Short sellers are investors who partake in the practice of selling borrowed assets, such as a company's shares, anticipating a decline in their price. This strategy involves the use of margin accounts where the short seller borrows shares to sell on the open market, with the intent to buy them back at a lower price. The difference between the sell and buyback price represents the profit, minus any fees or interest paid to the lender. This operation is not without its risks; should the price of the shares increase, the potential losses for the short seller can exceed their initial investment.

Historically, short selling has been met with skepticism and outright hostility. From as early as the seventeenth century, notable figures like Napoleon have denounced short sellers as 'enemies of the state'. In England widespread bans were implemented during most of the eighteenth and nineteenth centuries. Across the globe, short sellers are often depicted as unscrupulous actors, accused of spreading misinformation and targeting vulnerable companies. Such sentiments were encapsulated by the former US House Speaker J. Dennis Hastert, who criticized the practice as 'blatant thuggery'.

However, this one-dimensional portrayal overlooks the crucial role short sellers play in financial markets. Short sellers act as the market's canaries in the coal mine, often detecting financial irregularities and risks before they become apparent to the broader market. High-profile cases such as Wirecard, Luckin Coffee, and Carillion highlight the value of short selling in uncovering fraudulent practices and significant operational failures.

The debate around short selling is complex, encompassing issues of market liquidity, price discovery, and the ethical implications of betting on a company's failure. Critics argue that short selling can lead to market manipulation and contribute to undue volatility, while proponents assert its role in correcting overvalued stock prices and contributing to efficient markets. Moreover, the ethical considerations surrounding short selling are complicated. While some view profiting from a company's misfortune as morally dubious, others argue that short selling serves as a corrective mechanism that exposes overvaluation and misconduct, thereby protecting investors and the integrity of the market.

In conclusion, short selling embodies a practice fraught with controversy yet integral to market dynamics. It invites a nuanced discussion about its regulatory implications, economic function, and ethical standing. As financial markets continue to evolve, so too will the discourse surrounding short selling, underscoring the importance of understanding its principles and practices in the broader context of market regulation and fairness.

2.2 Short-Selling Regulatory Framework in the EU

The latest descriptive study on short selling activity within the European Union, by (Mazzacurati, J, 2018), reveals that approximately 1,000 unique Net Short Position (NSP) holders are engaged with EU stocks. This means that these investors have declared at least one NSP during the observed time frame, January 2013 to December 2016. These notifications of short positions pertained to 2,321 distinct shares, the majority with primary listing in the UK (755), Germany (359), Sweden (266), France (223) and Italy (199). A significant portion of the NSP holders, about 70%, have their bases in the US and UK, followed by 15% in other EU countries, and 10% in offshore locations. Approximately 150 of these holders are responsible for over 80% of all NSP declarations, which indicates a significant concentration of short-selling activities within EU shares.

Short selling in the European Union is regulated by Regulation No. 236/2012, dated 14 May 2012. Its preamble acknowledges the risks as well as the positive impacts of short selling, emphasizing disclosure and seeking to achieve a level of harmonization. This regulation was introduced in response to the financial instability that occurred during the 2007-08 Global Financial Crisis (GFC), with the aim of increasing transparency and reducing the risks associated with short selling and Credit Default Swap (CDS) transactions. Central to the enforcement and oversight of this regulation is the European Securities and Markets Authority (ESMA), which, in collaboration with National Competent Authorities (NCA), ensures that the regulation's mandates are uniformly applied across member states. To begin with, the regulation mandates that all short sales of shares and sovereign debt instruments must be covered, prohibiting naked short selling. It also requires significant NSPs in shares and sovereign debt to be reported to the NCA and, for shares, disclosed to the public once they reach certain thresholds.[1] Specifically, market participants are

[1]Market makers and authorized primary dealers are not subject to these reporting requirements.

required to notify the appropriate NCA about their NSPs once these positions reach or exceed 0.2% of a company's issued share capital. Further reports are necessary for every increase of 0.1ppt beyond the initial threshold and any NSPs surpassing 0.5% must be openly disclosed on the website of the relevant NCA. Consequently, it is primarily hedge funds and other asset managers who report their positions to NCAs. Ultimately, the regulation empowers NCAs and the ESMA to temporarily restrict or ban short selling in exceptional situations if necessary to prevent a serious threat to financial stability or market confidence.

2.3 Regulatory Response to the Covid-19 Pandemic

The Covid-19 pandemic, the most significant since the Spanish Flu 1918-20, has precipitated an unparalleled disruption in global supply and demand due to widespread lockdowns aimed at curbing the spread of the virus. This has resulted in a marked rise in economic uncertainty and a consequent jolt to global stock markets. From February 19 to March 18, the STOXX Europe 600[2] index recorded a peak-to-trough fall of 35.5%, marking one of the sharpest and quickest drops in a century. Market volatility reached extreme levels, with the VSTOXX[3] hitting its second highest daily close ever at 86% on March 16, 2020. Against this backdrop of economic turmoil, market supervisors and regulators around the world debated appropriate regulatory measures, such as whether to impose restrictions on short selling or to increase transparency requirements.

Notwithstanding the partial harmonization pursued through Regulation No. 236/2012, the response among EU countries to the Covid-19 pandemic was not uniform. On March 13, Italy and Spain imposed one-day short-selling bans on 85 and 69 stocks, respectively. On March 17, Spain implemented a long-term ban, while Belgium, France, and Italy banned short selling for one day on 17, 92, and 20 stocks, respectively. Subsequently, on March 18, Belgium, France, Italy, Austria, and Greece, in addition to Spain, issued long-term bans. Under the coordination of the ESMA, these bans were later synchronized to end on May 18, streamlining the disparate schedules initially set by each country.

[2]STOXX Europe 600 is an index with a fixed number of 600 components that represent companies among 17 European countries and covers approximately 90% of the free-float market capitalization of the European stock market.

[3]VSTOXX is an index that reflects the investor sentiment and overall economic uncertainty by measuring the 30-day implied volatility of the EURO STOXX 50.

Market regulators choosing to restrict investors' activities have pointed out that while the European short-selling regulation was not specifically designed with a pandemic in mind, such an event is included among circumstances that could significantly undermine market confidence and stability. On this basis, the responsible NCAs of Austria, Belgium, France, Greece, Italy and Spain deemed the short selling ban a necessary action in order to maintain the stability of financial markets and the confidence of investors. For example, Helmutt Ettls and Eduard Müller, directors of the Financial Market Authority (FMA) in Austria, provided the following statement along with the announcement of the short-sell ban on March 18:

"*Speculative short selling may lead to significant risks in the currently exceptionally volatile global and Austrian market environment. In the difficult situation caused by the economic impact of the Covid-19 virus pandemic, the stability of the financial markets and maintaining the confidence of investors in the orderly functioning of the markets must have absolute priority. This national measure is therefore both inevitable and appropriate.*"

The short-sell bans of these countries were imposed on both individual- and corporate investors, irrespective of their location. The bans covered all securities traded in cash and derivative markets, including bearish intra-day operations. However, the bans did not extend to market-making, convertible bond arbitrage activities that maintained a delta-neutral position, and short positions that were offset by an equivalent purchase in terms of subscription rights. Additionally, index-related instruments were exempt if the restricted shares did not exceed certain country-specific limits. Initially, these limits were set at 20% for Belgium, Greece, and Italy, and at 50% for France and Spain. Starting from April 15, a standardized limit of 50% was applied across all six countries that implemented short selling bans. Simultaneously, to enhance the oversight of short positions, ESMA temporarily reduced the reporting threshold for NSPs from 0.2% to 0.1%.

3 Literature Review

The literature review begins with theoretical perspectives on short selling and then presents findings from empirical studies on short selling bans during previous crises.

3.1 Short-Selling Regulations, Theoretical Evidence

3.1.1 Market Quality

The theoretical evidence on the impact of short-selling restrictions on market quality begins with the seminal work by Diamond and Verrecchia (1987). They analyze the effects of short-selling bans using a variation of the Glosten and Milgrom (1985) model, showing that such bans hinder the price discovery process by preventing investors from acting on negative news. This delay in resolving uncertainty about fundamental values typically results in a wider bid-ask spread.

However, the authors contend that if short sellers are viewed as 'informed' investors (consistent with intuition), their presence – due to information asymmetry – can induce market makers to widen spreads. This theoretical argument builds upon a stylized model where there are only two types of traders; uninformed traders who observe only public information and informed traders who also possess identical private information. A risk-neutral market maker in a competitive market who does not observe private information but monitors all trading activity will set the bid-ask spread such that, on average, the losses from transactions with informed traders are equal to the profits from transactions with uninformed traders. This implies that imposing a cost on short-selling both reduces the number of short sales and influences the mix of informed- and uninformed traders who remain in the pool of short sellers. As a result, a ban alleviates the information asymmetry and allows the market maker to narrow the bid-ask spread, while still breaking even in expectation. However, since the ban also delays the disclosure of information, its overall impact on the bid-ask spread remains uncertain.

3.1.2 Stock Prices

Miller (1977) theorizes that constraints on short-selling contribute to market overpricing, wherein prices exceed the equilibrium levels that would prevail in the absence of such constraints. This hypothesis is founded on the concept that, in the presence of investor heterogeneity, prohibiting short selling results in stock prices reflecting only the opinions of bullish and bearish investors who hold shares. Excluding bearish non-shareholders from the market means their more conservative valuations do not influence the stock price. Consequently, stock prices are likely to exceed their intrinsic value under a ban and to decrease upon its removal.

This mechanistic prediction of Miller's model, however, does not align with the rational expectations framework articulated by Diamond and Verrecchia (1987). In their analysis, market participants re-calibrate their valuations to account for the exclusion of investors holding negative information due to short-selling constraints, ensuring that stock prices do not systematically deviate from their true values when short sales are restricted. Although, this finding hinges on the assumption that investors are risk-neutral. Bai et al. (2016) provide a nuanced perspective by introducing risk aversion among rational investors. They demonstrate that short-selling constraints, by delaying price discovery, enhance the perceived risk among investors, leading to a demand for higher expected returns and consequently lower prices, which contradicts Miller's original proposition. Nevertheless, they also demonstrate that when investors are risk-averse, a counteracting effect may be present: a ban on short sales prevents investors from adopting negative positions to hedge against other risks. This action increases the demand for the stock and tends to raise its price.

Therefore, with risk-averse investors, the overall impact of a short-selling ban on stock prices is unclear and tends to be negative the more it impedes price discovery. This concept aligns with the model proposed by Hong and Stein (2003), which suggests that a short-selling ban may exacerbate rather than prevent a drop in prices. According to their model, the concealed negative information from investors who would have engaged in short-selling only emerges when the market starts to decline, further intensifying the fall in prices. In conclusion, the theoretical evidence concerning the impact of short sales on stock prices remain ambiguous.

3.2 Short-Selling Bans during Crises

Although most of the evidence indicates that increased short selling may be more of a response to, rather than a cause of, declining prices (Geraci et al., 2018), during periods of market turmoil, the practice is scrutinized for its potential to amplify negative trends. This concern prompted numerous regulators to ban or restrict short sales during the Great Financial Crises (GFC) of 2008-09, the Eurozone debt crisis 2011-12, and most recently during the Covid-19 pandemic in 2020. This subsection will present the empirical research on the effect of short selling regulations implemented during these crises.

3.2.1 Great Financial Crisis 2008 & Eurozone Debt Crisis 2011

Beber and Pagano (2013) analyze the GFC using daily data from January 2008 to June 2009, encompassing 16,491 stocks in 30 countries. The results demonstrate that the short-selling bans implemented during the crisis led to significant liquidity disruptions, evidenced by increased bid-ask spreads and a rise in the Amihud illiquidity measure. These effects were especially pronounced for stocks with smaller market capitalizations, higher volatility, and no listed options. On the other hand, requirements for short sale disclosures were associated with notable improvements in market liquidity. Importantly, the bans did not lead to enhanced stock price performance, with the United States being the only exception.

In another of their works, (Beber et al., 2021) explore the impact of short-selling bans on bank stability during the GFC and the Eurozone debt crisis. Their findings reveal that such bans do not enhance bank stability. Instead, the evidence suggests that short-selling bans are associated with an increased probability of default, higher return volatility, and more significant declines in bank stock prices. In another study of bank stability during these two crises, Brunnermeier and Oehmke (2013) associate short-selling bans with increased risks, including a greater likelihood of default, rising CDS premiums, and intensified volatility for the affected financial institutions. The researchers indicate that bans on short selling could inadvertently serve as a negative signal regarding a bank's health, potentially triggering financial instability - the very scenario the bans aim to mitigate.

The study of Boehmer et al. (2013) examines the short-selling ban affecting nearly 1,000 financial stocks during the GFC in the US. The research reveals that small-cap stocks were mostly unaffected, while large-cap stocks subject to the ban experienced significant market quality deterioration, evidenced by widened quoted and effective spreads. The adverse impact on market quality was less pronounced for stocks with pre-existing short-selling restrictions. Regarding stock prices, those subject to the ban experienced a temporary price increase, which the authors attribute to anticipated bailout programs[4] rather than the short-selling ban itself.

Similarly, Frino et al. (2011) investigates the market quality of financial stocks affected by short-selling bans across fourteen equity markets during the GFC. By comparing these stocks to those not subjected to the bans, the study finds evidence that restrictions on short-selling lead to artificially inflated prices, as demonstrated by positive abnormal returns. This finding aligns with Miller (1977) overvaluation theory, suggesting that the bans can temporarily stabilize prices in financially troubled stocks. However, the analysis also shows that market quality worsens under these restrictions, characterized by wider bid-ask spreads, heightened price volatility, and decreased trading activity.

3.2.2 Covid-19 Crisis 2020

The empirical literature on short-selling bans during Covid-19 is relatively limited. However, key studies by Siciliano and Ventoruzzo (2020), Losada and Martinez (2020), Bessler and Vendrasco (2021), and Spolaore and Le Moign (2023) generally conclude that these bans were ineffective in stabilizing the stock markets. The consensus among these studies suggests that the bans, while aimed at curbing market declines and ensuring stability, did not have the intended stabilizing effect on stock prices and may have adversely affected market liquidity. The analysis of Spolaore and Le Moign (2023), employing a DiD approach, indicated that these bans were correlated with a significant reduction in liquidity and trading volumes, accompanied by a modest decrease in volatility. Also, the expectation that the bans would bolster the prices of the affected shares was not met. A particularly concerning finding was the persistent negative impact on liquidity even after the bans were lifted, with a pronounced effect on shares with higher pre-ban liquidity

[4]On the same day that the short sell bans were implemented, TARP (formally known as H.R. 1424, the Emergency Economic Stabilization Act of 2008) was announced.

levels.

Adding to the discourse, Bessler and Vendrasco (2021) observed that the bans adversely widened bid-ask spreads and decreased turnover, with smaller markets experiencing the most significant impact.[5] Similarly, Siciliano and Ventoruzzo (2020) demonstrated that stocks subjected to the bans suffered from increased information asymmetry, lower liquidity and inferior abnormal returns. This aligns with the theory of Bai et al. (2016) that short-selling constraints, by delaying price discovery, enhance the perceived risk among investors, leading to a demand for higher expected returns and consequently lower prices. Furthermore, Losada and Martinez (2020) provided a comparative perspective by analyzing the Spanish market, where a ban was in place, against the German market, which did not institute such measures. Their findings underscored a substantial liquidity drop in banned securities, as evidenced by bid-ask spread increases. However, their data did not substantiate any other significant ban-related impacts on trading volume, price trends, volatility, or credit risk spreads.

On the contrary, Fohlin and Zhou (2012) indicate that bans on short selling enhanced liquidity and stabilized prices for ex-ante illiquid stocks but temporarily reduced liquidity for ex-ante highly liquid stocks. These findings support theories that short sale bans may enhance liquidity by selectively excluding informed – potentially predatory – traders. This is consistent with the notion of Diamond and Verrecchia (1987) that a higher proportion of informed traders, who are particularly impacted by restrictions on short selling, can cause higher bid-ask spreads because of information asymmetry. Furthermore, Fohlin and Zhou (2012) observes that the relative reduction in spreads for ex-ante illiquid stocks persisted even after the bans were lifted, suggesting that short sellers withdrew from these stocks permanently. In contrast, more liquid stocks, which likely experienced less informed trading, saw only a temporary increase in order processing costs due to the bans, and this effect dissipated once the bans ended. Additionally, their analysis of stock prices and volatility shows that the bans were effective in supporting price levels and reducing volatility.

In a similar vein, Della Corte et al. (2021) also highlights another silver lining of the short-selling bans. The study finds that the bans helped mitigate steep price declines,

[5]Large markets include the UK, Germany, Switzerland, France, Italy, and Spain, while small markets comprise Austria, Belgium, the Netherlands, and Sweden.

as evidenced by improvements in maximum drawdown measures, especially for stocks with lower institutional ownership. They also note that countries that implemented short-selling bans typically showed lower levels of informed traders, proxied by institutional ownership. However, the study observes an increase in the average bid-ask spread by up to 13 basis points associated with these bans and it further reveals that stocks with higher institutional ownership saw a more significant decrease in liquidity; for instance, while the bid-ask spreads of stocks with low institutional ownership widened by an average of 5-8 basis points, those with high institutional ownership experienced increases of 22-29 basis points. The positive aspects highlighted by Della Corte et al. (2021) aligns with the seminal work of Bris et al. (2007) that finds, through a comprehensive examination of the regulatory environment and practical aspects of short selling in 46 equity markets worldwide, that market returns tend to show significantly lower negative skewness when short selling is either explicitly prohibited or not actively practiced.

3.3 The Case for Regulatory Action

Drawing on historical precedents, securities regulators have once again implemented bans on short-selling amidst significant declines in stock market values during Covid-19. This action persists in spite of a consistent track of empirical evidence that collectively challenge the efficacy of such measures, suggesting they may be at best ineffectual, and at worst, detrimental to market recovery and health.

To understand the underlying reasons for the short selling bans during Covid-19, Bessler and Vendrasco (2021) aims to predict, using a logistic regression, which countries are likely candidates to implement a short-selling ban in the future based on a set of independent variables that may have influenced the decision whether to ban or not. Their study utilizes two models based on distinct panel datasets from 12 EU countries: (i) annual data spanning from 2004 to 2019 and (ii) daily data covering the period from January 1, 2020, to March 17, 2020.

The annual dataset comprises variables that reflect a country's macroeconomic conditions (such as GDP growth, inflation, and unemployment), characteristics related to the financial system (including stock turnover and private credit), and institutional quality. Additionally, current account balance and government debt are used as indicators of fiscal capacity.

The daily dataset incorporates global economic indicators such as the oil price, the VIX and VSTOXX indices, and the U.S. and European inter-bank spreads (TED Spreads) to capture the impacts of global economic shocks, investor sentiment, and funding conditions. Furthermore, to gauge the severity of the pandemic, the number of Covid-19 deaths per capita and the stringency index of lockdown measures are included. Lastly, the Sovereign 5-Year CDS Spread is used as a proxy for a government's financial flexibility and fiscal response during the pandemic.

Their findings indicates that the most critical characteristics, based on the annual data, on influencing the ban decision were the levels inflation, unemployment and institutional quality. Likewise, for the daily dataset, the sovereign CDS Spread, stringency index and systematic stress indicator were the most influential factors for the ban decision. In summary, their findings highlights that countries with a weaker economic state, heightened susceptibility to economic crises and a greater risk of sovereign default are more likely to impose a short selling ban.

4 Hypotheses

To investigate the impact of the short-selling bans implemented in the EU during the COVID-19 pandemic, several testable hypotheses will be formulated. Hypothesis 1 assesses the effect of the bans on stock returns, while Hypotheses 2.1 to 2.4 examine their impact on market quality, specifically focusing on the bid-ask spread and the Amihud illiquidity measure.

4.1 Effect of Short-Selling Bans

Given the theoretical and empirical ambiguity surrounding the impact of short selling restrictions on stock prices, a definitive outcome remains elusive. Nevertheless, the hypothesis adopts the perspective that short selling restrictions can stabilize prices by minimizing negative sentiment. Viewing stock prices as an aggregate indicator of investor expectations, the limitation on short selling inherently skews this indicator by omitting bearish perspectives. Moreover, considering that a key objective for regulators implementing short selling restrictions is to enhance market stability, it is reasonable to expect that stocks subject to these restrictions may yield higher returns compared to those that are not. This leads to the formulation of the first hypothesis:

Hypothesis 1

Banned stocks experience higher ***abnormal returns*** *than non-banned stocks.*

With regards to the effect on market quality, empirical evidence - in contrast to the theoretical ambiguity - consistently indicates that short-selling bans have a negative impact on market liquidity. Accordingly, the hypothesis examined in this analysis posits that the implementation of a short selling ban, by restricting potentially informed investors from initiating new short positions, will impede the price discovery process. This delay in resolving uncertainty about fundamental values is expected to reduce market liquidity, as measured by bid-ask spreads and the Amihud illiquidity indicator. Against this backdrop, the following hypotheses are outlined:

Hypothesis 2

2.1 *The **bid-ask spreads** for banned stocks widen compared to non-banned stocks.*

2.2 *The **Amihud illiquidity measure** of banned stocks increase compared to non-banned stocks.*

Secondly, we explore whether the impact of short-selling restrictions varies among stocks with differing market capitalizations. Although empirical research on this topic is limited, it is widely acknowledged that market makers typically show a hesitancy to offer liquidity for smaller-cap and higher-risk stocks, even without short-selling restrictions in place. This behavior has been documented in studies by Easley et al. (2002), Glosten and Milgrom (1985), and Hasbrouck (1991). This serves as the basis for the last hypotheses:

2.3 *The imposition of a short selling ban will lead to a greater increase in the **bid-ask spread** for smaller cap firms compared to larger cap firms.*

2.4 *The imposition of a short selling ban will lead to a greater increase in the **Amihud illiquidity measure** for smaller cap firms compared to larger cap firms.*

5 Data

5.1 Preliminary Sample

We evaluate our hypotheses using a quasi-natural experiment derived from the implementation of temporary short-selling bans across Europe. The analysis spans a one-year period from September 18, 2019, to September 18, 2020, segmented into four distinct phases: (i) pre-crash, (ii) crash, (iii) ban, and (iv) post-ban. These phases are delineated in Figure 5.1. The 'crash' phase is defined as the period from February 20 to March 17, 2020 and the 'ban' phase corresponds to the period when the short-selling bans were actively enforced, from March 18 to May 18, 2020.[6] Lastly, the intervals before and after these events - the 'pre-crash' and 'post-ban' periods - cover the remaining portions of the year-long timeframe.

The initial sample consists of firms listed as constituents of the STOXX Europe Total Market index as of January 2, 2020.[7] This index should not be confused with the STOXX 600 index, which serves as the benchmark for calculating abnormal returns later in the analysis section.

The Refinitiv Instrument Codes[8] (RIC) of the historical constituents securities of the STOXX Europe Total Market index are sourced from the global index provider, STOXX Ltd. Firms that joined the index after January 2, 2020, are excluded from the analysis, while firms that exited the index after this date are included until the date of their departure.

Since we use Refinitiv, which is current as of 2024, to retrieve data on relevant variables, some historical constituents' RICs may not appear. This discrepancy arises because some firms either left the stock market or changed their RICs during the period between January 2, 2020, and the present, making it challenging to match historical data accurately. For

[6]This paper excludes the impact of the temporary one-day restrictions on certain stocks on March 13 (in Italy and Spain) and March 17 (in Italy, France, and Belgium) from the analysis of the ban period.

[7]The STOXX Europe Total Market Index (TMI, RIC: BKXP) encompasses the entire Western Europe region, covering approximately 95 percent of the free float market capitalization across 17 European countries: Austria, Belgium, Poland, Denmark, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom. Note that Greece is not included.

[8]Refinitiv Instrument Code (RIC) is a ticker-like code used by Refinitiv to identify financial instruments and indices.

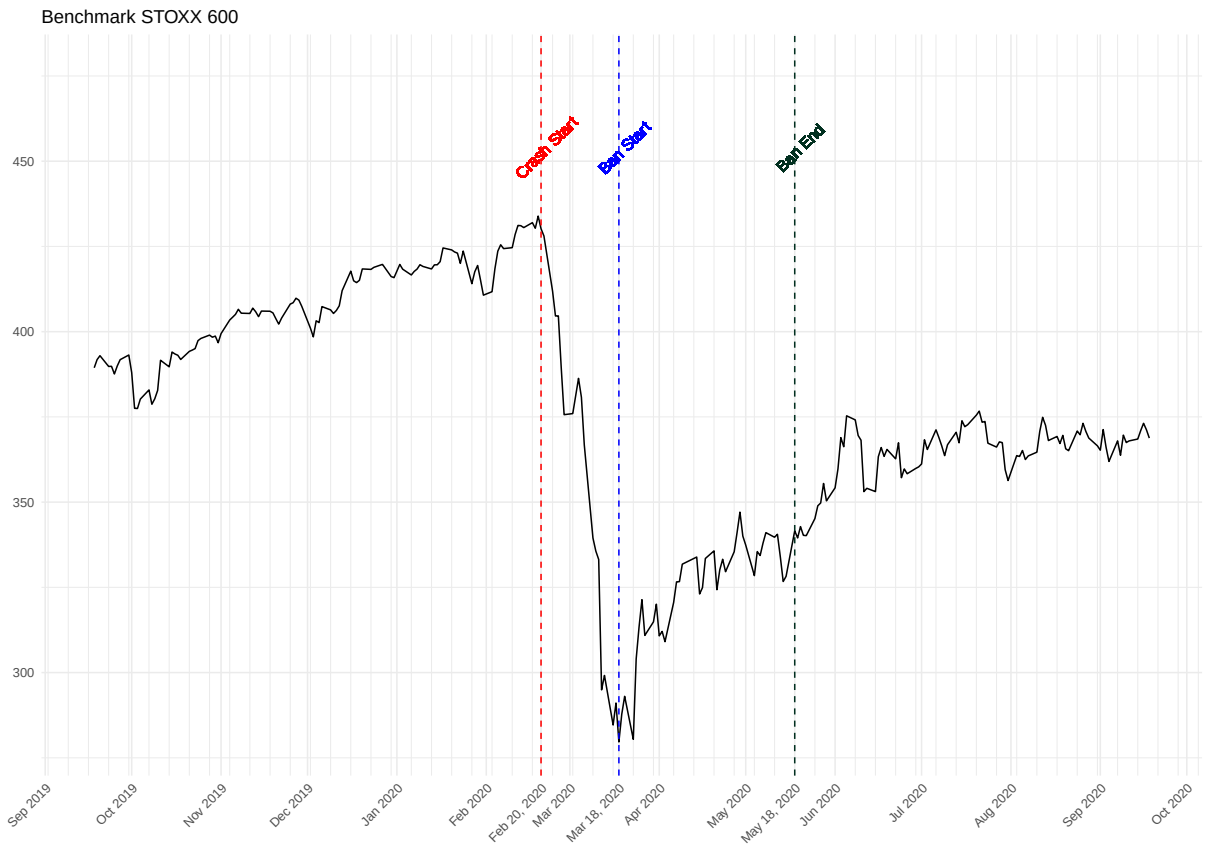


Figure 5.1: STOXX 600

Note: This graph illustrates the performance of the STOXX 600 index over the one year time span September 18, 2019, to September 18, 2020. The red dotted line indicates the start of the crash period associated with the Covid-19 pandemic. The blue dotted line marks the commencement of the short-selling ban period across various EU countries. The green dotted line denotes the end of the ban period.

example, it is the convention in Refinitiv's system that stocks exiting the public stock market (e.g. due to privatization) are marked with a suffix ^ followed by the year and a letter representing the month of departure. This letter corresponds to the alphabetical order of months, with 'A' representing January, 'B' for February, and continuing through to 'L' for December. By using Refinitiv's Search API, we are able to resolve this issue by accurately identifying and retrieving the correct historical RICs for stocks that have left the public market or changed RIC. Due to concerns about the reliability of data, securities from Luxembourg are excluded from the sample. The initial dataset includes 1,438 securities.

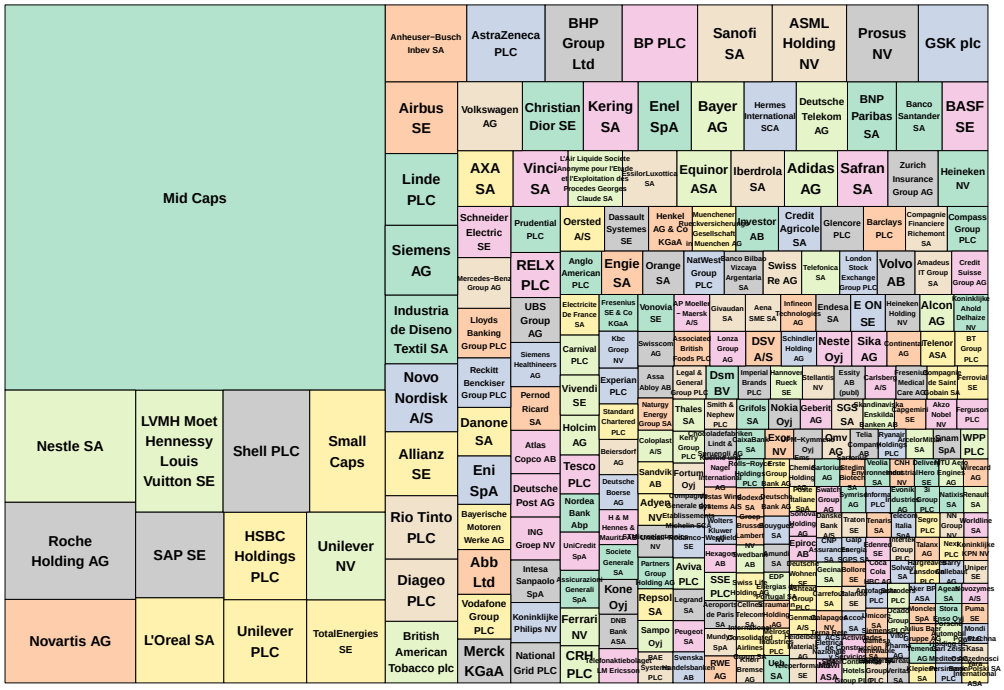


Figure 5.2: Market Capitalization Tree Map January 2, 2020

Note: This figure presents a hierarchical (tree-structured) distribution of firms based on their market capitalization. The sizes of the boxes represent the relative market capitalizations of the companies as of January 2, 2020. All mid-cap firms are represented by the green box in the top left corner, likewise all small cap firms are represented by the yellow box below the right corner of the mid-cap box. The rest of the boxes are individual large-cap companies. Data is retrieved from *Refinitiv*.

5.2 Data Refinement Techniques

Before data on relevant variables is retrieved from Refinitiv, adjustments are made to the initial sample of firms. First, only one security per firm is included in the final dataset. For companies with multi-class shares, the class with the highest total value traded is selected. Similarly, for companies with dual listings, only the security listed on the primary market is considered. However, if a company's stock is traded in two different countries, one implementing a short-selling ban and the other not, the share from the latter is included due to the continued possibility of short-selling. For consistency across data points, all prices are converted into EUR based on the daily exchange rates available from Refinitiv. After the data cleaning process, the final dataset consists of 1,395 securities.

5.3 Final Dataset

Following the establishment of the final dataset, data on relevant variables is sourced from Refinitiv. This data encompasses daily closing information on bid- and ask prices, trading volumes, and other relevant metrics for the period September 18, 2019, to September 18, 2020. Data on stock returns, bid-ask spreads and Amihud illiquidity measure are truncated at the 1st and 99th percentiles to minimize the impact of outliers.

Table 5.1 presents a country-level overview of the final dataset, highlighting the distribution of stocks across various European stock markets. Additionally, to study the potential heterogeneous effects of the bans, the companies are divided into three groups based on their market capitalization as of January 2, 2020. Companies whose market capitalization are less than EUR 1bn comprise the small-cap group, those with a market capitalization between EUR 1bn and EUR 10bn comprise the mid-cap group, and those with a market capitalization above EUR 10bn comprise the large-cap group. As shown in Figure 5.3, the distribution of firms roughly follows a quartile distribution, with the mid-cap group corresponding to the interquartile range. Table 5.2 presents the distribution of firms among countries and market cap groups.

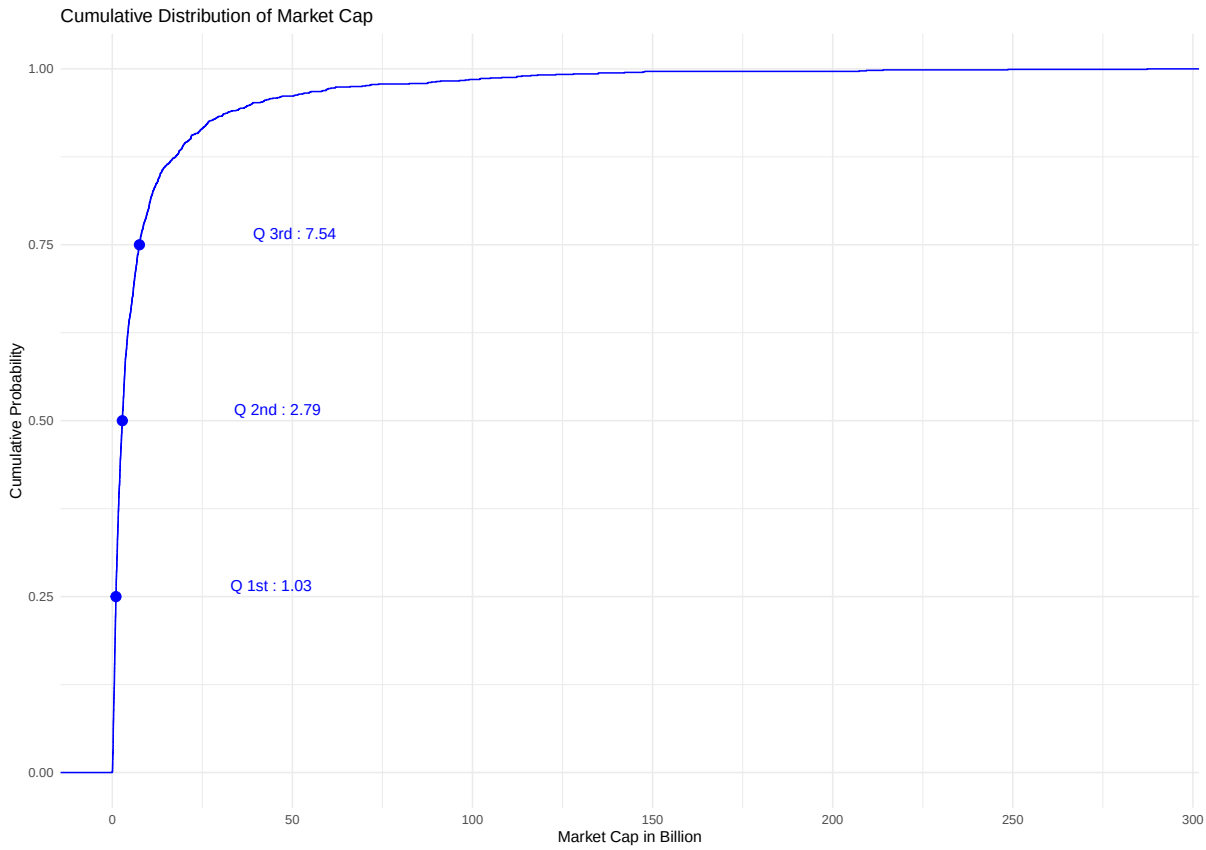


Figure 5.3: Cumulative Distribution of Market Capitalizations.

Note: This figure presents the cumulative distribution of firms, based on market capitalization. Three markers represent the quartiles, in EUR million. The final sample of firms is divided into three groups, based on market cap: small, mid, and large. Small-cap companies have a market cap below EUR 1 bn. Mid-cap companies have a market cap between EUR 1 bn and EUR 10 bn, roughly the interquartile range. Large-cap companies, have a market cap over EUR 10 bn. Data is retrieved from *Refinitiv*.

Table 5.1: Structure of the Final Dataset.

Country	Number of Securities	Market Cap EUR bn
Denmark	40	372,046
Finland	54	214,823
Germany	138	1,877,282
Ireland	10	108,410
Netherlands	45	983,434
Norway	95	269,056
Poland	105	126,323
Portugal	14	60,460
Sweden	166	694,171
Switzerland	90	1,567,920
United Kingdom	280	2,749,728
Non-ban countries	1,037	9,023,653
Austria	30	106,711
Belgium	54	321,220
France	123	2,364,175
Italy	94	629,999
Spain	57	623,520
Ban countries	358	4,045,627
Total	1,395	13,069,280

Note: This table presents the structure of the final dataset comprising stocks from 16 EU countries. The dataset is based on the constituents of the STOXX Europe Total Market Index (TMI) as of January 2, 2020. Market capitalization values also reflect data from this date. Data is retrieved from *Refinitiv*.

5.4 Summary Statistics

In concluding the chapter dedicated to data collection, a preliminary examination of the impacts of the short-selling bans is presented. This analysis juxtaposes the market quality measures and stock returns of nations enforcing these restrictions against those that refrained from such measures, over intervals preceding and succeeding the implementation of these bans.

Figure 5.4 shows the average bid-ask spread for firms in ban countries, represented by the blue line, and non-ban countries, represented by the red line.[9] The introduction of bans (indicated by the blue vertical dotted line) correlates with spikes in the bid-ask

[9]The spike in the average bid-ask spread observed on the last trading day of the year (Dec 30 or Dec 31 depending on countries) can be attributed to several factors, including reduced liquidity due to the holiday season, tax-loss harvesting, or year-end portfolio adjustments, creating temporary imbalances in supply and demand.

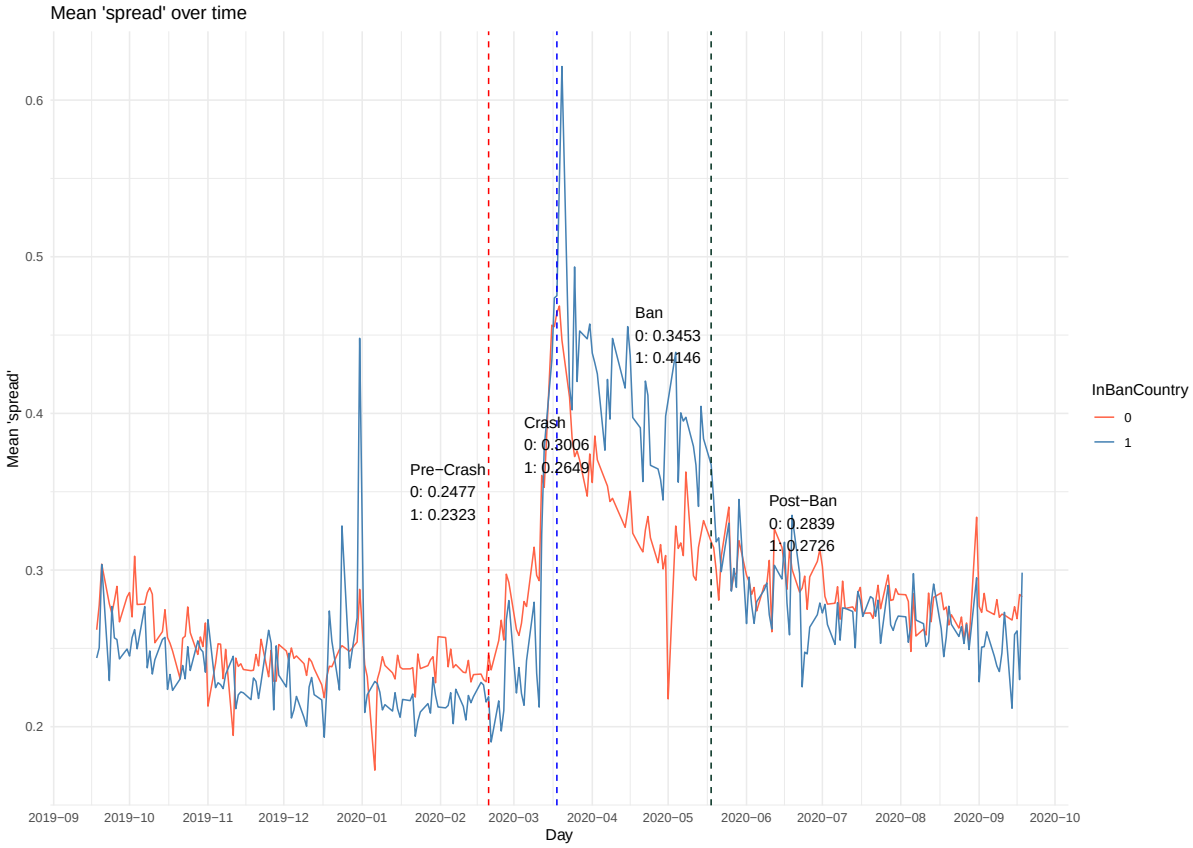


Figure 5.4: Bid-Ask Spreads over Time

Note: This figure presents a comparative analysis of the average bid-ask spreads (equally-weighted, excluding those with extreme spreads – the 1st to 99th percentile) in European stock markets during the period surrounding the enactment of temporary short-selling bans in the Covid-19 pandemic. The comparison is drawn between two groups of countries: one where short selling was banned (blue line), including Austria, Belgium, France, Italy, and Spain, and another where it was not (red line), comprising Denmark, Finland, Germany, Ireland, the Netherlands, Norway, Poland, Portugal, Sweden, Switzerland, and the United Kingdom. The red vertical dotted line indicates the start of the crash period associated with the Covid-19 pandemic. The blue dotted line marks the commencement of the short-selling ban period across various EU countries. The green dotted line denotes the end of the ban period. The average bid-ask spreads for both groups in each period are shown in the figure. Data is retrieved from *Refinitiv*.

Table 5.2: Market Capitalization

		Market Capitalization		
Country	#Stock	#Small	#Mid	#Large
Denmark	40	5	25	10
Finland	54	27	20	7
Germany	138	13	82	43
Ireland	10	1	6	3
Netherlands	45	3	25	17
Norway	95	55	34	6
Poland	105	79	25	1
Portugal	14	2	10	2
Sweden	166	70	81	15
Switzerland	90	6	54	30
United Kingdom	280	32	195	53
Non-ban countries	1,037	293	557	187
Austria	30	6	22	2
Belgium	54	13	34	7
France	123	4	70	49
Italy	94	20	57	17
Spain	57	5	36	16
Ban countries	358	48	219	91
Total	1,395	341	776	278

Note: This table presents the composition of firms for the final sample. The table categorizes firms based on their average market capitalization: 'Small' represents small-cap firms valued below EUR 1 bn, 'Mid' denotes mid-cap firms valued between EUR 1 bn and 10 bn, and 'Large' refers to firms with a valuation exceeding EUR 10 bn. Data is collected from *Refinitiv*.

spread, especially noticeable for stocks in countries where the short selling ban was implemented. After the initial spike, the average bid-ask spread in ban countries tends to decrease but remains above the levels observed in countries without bans, which is the opposite relationship to that observed before the implementation of the bans. During the 'crash' period, the observed average bid-ask spread stood at approximately 0.26% in countries that instituted restrictions, compared to 0.30% in their unrestricted counterparts. Transitioning to the 'ban' period, the mean bid-ask spread escalated to 0.41% in countries with the restriction, against 0.35% in those abstaining from such regulatory measures. This represents an increase of 58% in the former group, compared to an increase of 16% in the latter.

Figure 5.5 presents the average daily stock returns – in other words, the equally-weighted

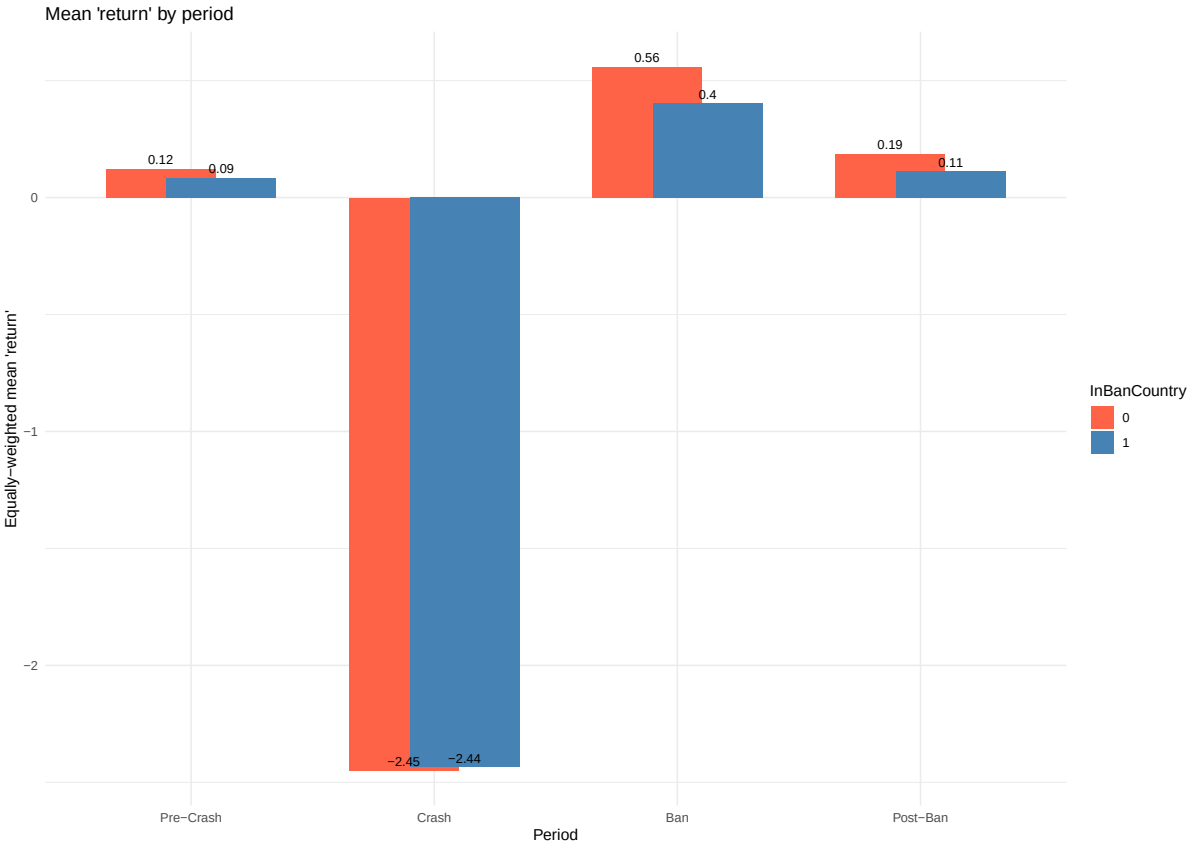


Figure 5.5: Comparison of Stock Returns between Periods

Note: This figure presents a comparative analysis of the average daily stock return (in %). The comparison is drawn between two groups of countries: one where short-selling was banned, including Austria, Belgium, France, Italy, and Spain, and another where it was not, comprising Denmark, Finland, Germany, Ireland, the Netherlands, Norway, Poland, Portugal, Sweden, Switzerland, and the United Kingdom. The time-frame designated as 'crash' (and correspondingly, 'ban') encompasses a span from February 18 to March 17, 2020 and from March 18 to May 18, 2020, respectively. Data is retrieved from *Refinitiv*.

portfolio's return – for the four distinct periods. The daily average return was -2.44% in countries with bans and -2.45% in countries without bans during the 'crash' period; this shifted to 0.40% and 0.58% respectively during the 'ban' period. Overall, stock returns improved in both groups during the 'ban' period, with stocks in non-ban countries experiencing notably higher returns.

6 Methodology

6.1 Effect of Short-Selling Ban

The central identification strategy for studying the effect of short sell bans on market quality and returns is the Difference-in-Difference (DiD) method. Additionally, the impact on Buy-and-Hold Abnormal Return (BHAR) is analyzed using OLS regression.

6.1.1 Formalization of DiD Method

We use a DiD model with variable- and fixed-effects controls. The baseline model is as follows:

$$\begin{aligned} Y_{s,t} = \alpha_s &+ \beta \text{Ban\_Countries}_s + \gamma \text{Ban\_Period}_t \\ &+ \delta \text{Ban\_Countries}_s \times \text{Ban\_Period}_t \\ &+ \theta \text{Controls}_{s,t} + \phi_t + \epsilon_{s,t} \end{aligned} \tag{6.1}$$

Three dependent variables (three models) are used to understand the nuances of the financial market's response and the effect of the ban on market quality. The first dependent variable is the abnormal return. The other two dependent variables, both serving as proxies for market quality, are the natural logarithms of the bid-ask spread and the Amihud illiquidity measure.

For the independent variables, the treatment variable Ban_Countries_s is a binary indicator that identifies whether a stock is from a country where a short-selling ban was imposed. Complementing this, the Ban_Period_t variable acts as a dummy variable indicating the days during which the short-selling ban is active. The critical piece of this setup is the interaction term $\text{Ban\_Countries}_s \times \text{Ban\_Period}_t$, which isolates the impact of the ban on the affected stocks. The coefficient of this interaction term is central to the regression analyses. For convenience, this interaction term is referred to as 'restriction' in later models.

Furthermore, control variables at both the stock and country levels are included. At

the stock level, the EUR value of the daily quantity of shares traded is controlled for, allowing for monitoring changes in trading activity independently from price movements.[10] This variable is transformed using a logarithmic scale to ensure normalization. At the country level, the stringency index is used to account for the impact of pandemic-related lockdowns. This index, provided by The Oxford Covid-19 Government Response Tracker (OxCGRT), is calculated as the daily average of nine indicators measuring the severity of containment and lockdown policies in each country.

The terms α_s and ϕ_t indicate the stock-level and the daily time fixed effects, respectively, included in the regressions. Stock fixed effects are used to account for latent factors unique to each stock that persist over time. Similarly, time fixed effects are introduced to control for factors that impact all stocks uniformly over time. Hence, the findings are presented through the lens of a two-way fixed effects model, acknowledging the potential for multicollinearity and interpreting the results with appropriate caution.[11]

In addition to examining the entire sample, the heterogeneous treatment effects are assessed by the following model:

$$Y_{s,t} = \alpha_s + \sum_j \tau_j \text{Group}_{s,j} * \text{restriction}_{s,t} + \theta \text{Controls}_{s,t} + \phi_t + \epsilon_{s,t} \tag{6.2}$$

In equation Equation 6.2, j denotes the group classified by market capitalization, i.e, either small-, mid-, or large-cap. The asterisk $(*)$ represents an operator $a * b = a + b + a \times b$. $\text{Group}_{s,j}$ acts as a dummy variable, thereby τ_j represents the group-specific effect of the ban. When running a fixed-effect model, some components of the equation may be absorbed. In this case, while $\text{Group}_{s,j} \times \text{restriction}_{s,t}$ is not absorbed, $\text{Group}_{s,j}$ will be.

Lastly, the effect on returns is also analysed through a cross-sectional regression using the BHAR, as specified in Equation 6.3.

$$BHAR_s = \beta_1 \text{Ban\_Countries}_{s,t} + \theta \text{Controls}_{s,t} + \varepsilon_{s,t} \tag{6.3}$$

[10] Trading volume is not controlled for in the models where the Amihud illiquidity measure is the dependent variable, as trading volume is an integral component of the Amihud illiquidity calculation.

[11] When including one or more fixed effects, share-invariant or time-invariant variables will be excluded from the regressions. This also applies to the 'Ban_Countries' or 'Ban_Period' variables in the regression described above.

The variable $BHAR_s$ represents a vector of BHARs across various time periods. The primary variable of interest, Ban_Countries$_{s,t}$, is an indicator variable that equals one when stocks are subject to short-selling bans. In line with the DiD approach, we include the control variables EUR value of trading volume and the stringency index. Additionally, the VSTOXX is incorporated as a control variable. These variables are designed to capture time-varying effects associated with stock valuation.

6.1.2 Dependent Variables

6.1.2.1 Abnormal Return & Buy-and-Hold Abnormal Return

Abnormal Return (AR) is defined as the difference between actual and expected returns for stock s on date t, as seen in Equation 6.4. The expected return is assumed to be equal to the market return, which serves as a proxy for the counterfactual scenario, reflecting what the return would have been in the absence of the ban. For the purposes of this analysis, the STOXX Europe 600 is adopted as the benchmark for the market return. Discrepancies in trading days can occur, as some securities may observe holidays or experience trading halts while the benchmark index continues to run. In the event of a holiday, we exclude both the holiday and the following day from the analysis. This approach ensures that the market information reflected in stock price and the index is aligned.

$$AR_{s,t} = (1 + R_{s,t}) - (1 + R_{M,t}) \tag{6.4}$$

Buy-and-Hold Abnormal Return (BHAR) is an extension of AR. It is a measure used to assess the performance of a security over a specific period by comparing its buy-and-hold return to the buy-and-hold return of a benchmark. This metric is particularly useful for evaluating the long-term impact of events or investment strategies on a security's value. BHAR is calculated by first determining the buy-and-hold return for both the security and the benchmark over a chosen period. The buy-and-hold *abnormal return* for the security is then the difference between these two returns, capturing the excess performance of the security relative to the benchmark. This process is outlined in Equation 6.5.

$$BHAR_s = \left(\prod_{t=1}^{T}(1 + R_{s,t})\right) - \left(\prod_{t=1}^{T}(1 + R_{M,t})\right) \tag{6.5}$$

6.1.2.2 Bid-Ask Spread

In line with methodology of Beber and Pagano (2013), the effects of short-selling bans on market liquidity are assessed using two specific metrics: bid-ask spread and the Amihud illiquidity measure. The bid-ask spread is the gap between the maximum price buyers are prepared to pay for a security and the minimum price sellers are willing to accept. This spread reflects the level of information asymmetry between buyers and sellers, with a wider spread indicating greater asymmetry, often due to discrepancies in available information on the day of the transaction. To compute the bid-ask spread, we retrieve the daily closing ask price and bid price for each security in the final sample from Refinitiv, calculating the spread as the difference between these prices divided by their midpoint, as seen in Equation 6.6.

$$\text{Spread}_{s,t} = \frac{(\text{Ask Price}_{s,t} - \text{Bid Price}_{s,t})}{\text{Mid Price}_{s,t}} \tag{6.6}$$

6.1.2.3 Amihud Iliquidity Measure

The Amihud illiquidity measure, proposed by Amihud (2002), is calculated by dividing the absolute daily return of a stock by its daily EUR trading volume. Simply put, this metric gauges how the flow of orders affects the stock price, specifically measuring the price change triggered by trading one EUR's worth of volume. A smaller amount of trading volume needed to alter the stock's price signifies greater illiquidity of the stock. Thus, a higher Amihud illiquidity index value points to a stock being less liquid, indicating that its price (or more accurately, its return) is more influenced by a given volume of trades.

$$\text{Amihud}_{s,t} = \frac{|\text{Return}_{s,t}|}{\text{Volumes}_{s,t} \times \text{Closing Price}_{s,t}} \tag{6.7}$$

Both the bid-ask spread and the Amihud illiquidity measure exhibit right-skewed distributions, characterized by relatively few very large values. This skewness can result in multiplicative relationships with the control variables, potentially inflating the magnitude

of the coefficients and complicating the interpretation of results. To address this issue, a log transformation is applied to these variables. This transformation effectively centralizes the values within the distribution, making it resemble a normal distribution.

6.2 Determinants of Short-Selling Bans

6.2.1 Formalization of Logistic Regression

This study explores the factors influencing the likelihood of a country implementing short-selling restrictions through logistic regression analysis. Adapting the methodology of Bessler and Vendrasco (2021), albeit with slightly different independent variables, two distinct panel datasets covering 17 European countries are analyzed.[12] Dataset A consists of annual data from 2010 to 2019, while Dataset B comprises daily data from March 3, 2020, to March 17, 2020. The variables used in each dataset are described in detail in Table A.2 and Table A.3. The following logistic regression model is employed to identify the determinants that influence the likelihood of a country imposing a short-selling ban:

$$\text{Ban}_c = \gamma' \mathbf{X}_{c,t} + \boldsymbol{\phi}_{c,t} + \varepsilon_{c,t} \tag{6.8}$$

The variable Ban_c acts as an indicator, set to one for countries that enacted a short-selling ban in 2020 and zero for countries that did not. $\mathbf{X}_{c,t}$ denotes a vector of explanatory variables and $\boldsymbol{\phi}_{c,t}$ represents a vector of dummies for either the entire year or specific calendar days, aimed at adjusting for global trends that affect all countries but are not directly observable.

6.2.2 Dataset A: Annual Data

Dataset A includes variables reflecting the political- and regulatory environment, measured at each year 2010-2019 for 17 EU countries. To begin with, 'Democracy Index' is an index published by the Economist Group that measures the quality of democracy. It ranges from 0 to 10 (least to most democratic). Secondly, the variable 'Political stability' (one of The Worldwide Governance Indicators (WGI) issued by The World Bank) measures

[12] The dataset includes the same 16 countries as the final dataset, plus Greece.

perceptions of the likelihood of political instability. Similar to Bessler and Vendrasco (2021) we use the variable 'Institutional Quality', measured as the average of the two other WGIs 'Government Effectiveness' and 'Regulatory Quality'. All WGIs are normalized on a scale from 0 to 100. Furthmore, two variables are included that aims to capture the retail investor sentiment: first, 'Consumer Confidence Index' (CCI), issued by the OECD, is a measure of expected households' consumption and saving. A value above 100, which is a benchmark CCI set in 1985, signals a boost in the consumers' confidence towards the future economic situation. In contrast, index values below 100 denote a pessimistic perspective regarding future economic developments. Secondly, the variable 'Households Assets' is shares and other equity as a percentage of total financial assets hold by households and thus aims to measure their stock market exposure. To account for fiscal health, 'Current Account Balance' and 'Government Debt' are included, both as percentages of GDP.

6.2.3 Dataset B: Daily Data

Dataset B encompasses daily data for variables - that potentially are related to the short-sell ban decision - over the two weeks span leading up to the ban implementation, i.e March 3 to March 17, 2020. Firstly, dataset B contains data directly related to the Covid-19 pandemic itself, that is the daily number of Covid-19 cases reported (per 1.000.000 residents) and stringency index of lockdown measures. Secondly, to account for the systematic stress caused by the pandemic, data for the Composite Indicator of Systematic Stress (CISS) and the daily return of the main stock market index ('Stock Market Return') in each of the countries are included. CISS is a normalized value between 0 and 1 and is developed by Hollo et al. (2012). Lastly, to take into account the retail investor attention, the Google Search Volume Index (SVI) for the country's main stock index, as a proxy for retail investor attention, is included.[13] For the variables used in Dataset A and B, table A.2 and table A.3 provides detailed definitions and descriptions.

[13]Google Search Volume Index (SVI) is frequently used as a proxy for retail investor attention in financial research, since the publication of Da et al. (2011). The rationale behind using Google SVI is that it reflects the aggregate search interest in specific terms or topics on Google, which can indicate the level of public attention or concern regarding those topics.

7 Results

In this chapter, an empirical analysis is provided, utilizing the implementation of short-sale bans in select European countries during the Covid-19 pandemic as a quasi-experimental approach. The results for the effects on returns, bid-ask spreads, and Amibid illiquidity measure of the short-sell bans are presented in subsection 7.1. The results for the analysis on determinant factors of implementing a short-sell ban are discussed in subsection 7.2.

7.1 Effects of the Bans

7.1.1 Short-Selling Bans and Stock Returns

Figure 7.1 plots the ARs for the three groups of companies: small- mid- and large-cap firms. For all three groups, the ARs hover around 0, especially during the 'pre-crash' period. This implies that there is no visually discernible difference between the three groups in term of abnormal returns. Nevertheless, the small-cap group shows higher volatility. Importantly, during the 'crash' period, ARs in all groups become more volatile, which may influence the governments to initiate interventions.

Moreover, as shown in the models from Table 7.1, ARs are negatively and significantly associated with the short-selling ban (restriction). The effect of the ban is more pronounced for small-cap firms. As shown in model 3, the ban (restriction) is associated with a decline of -0.2137% for small-cap companies compared to -0.081% (-0.2137 + 0.1327) and -0.0521% (-0.2137 + 0.1616) for mid- and large-cap companies respectively. This may indicate the ban, if intended to ameliorate the decline in the stock prices, has had the opposite effect. However, the lower R-squared values (around 10% to 11% for most AR models) suggest that these models are not as effective at explaining the variance in abnormal returns. This is expected as returns are determined by a myriad of linear- and non-linear factors and are therefore unpredictable in nature.

The analysis of BHAR is depicted in Figure 7.2a through Figure 7.2e, which show the BHARs[14] for the three groups in countries that implemented a short-sell ban during the

[14]Note that each of the market cap subgroups, for both ban- and non-ban countries, are equally weighted whereas the benchmark index is value weighted.

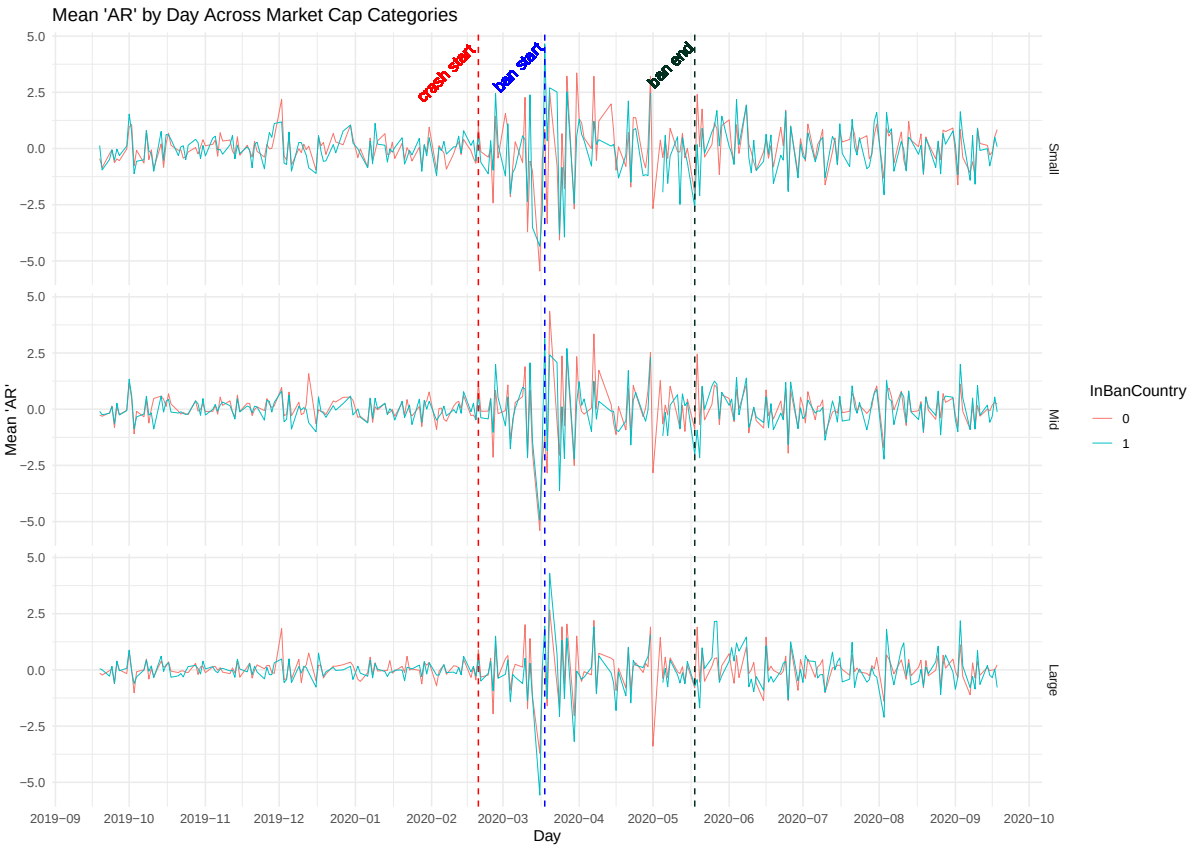


Figure 7.1: Abnormal Return across Small-, Mid-, and Large Market Cap Firms

Note: This figure presents a comparative analysis of the average abnormal returns between stocks in ban countries and non-ban countries for the period September 19, 2019, to September 18, 2020. In both groups of countries, the sample is divided into three groups based on market capitalization. Stocks in ban-countries (non-ban countries) is represented by the blue (red) line. A value-weighted index STOXX600 is used as a benchmark against equal-weight portfolios, for each category of firm size. Data is retrieved from *Refinitiv*.

Table 7.1: Abnormal Returns Regression Results

Dependent Variable:	Abnormal Return			
Model:	(1)	(2)	(3)	(4)
Variables				
Constant	0.0089*			
	(0.0046)			
restriction	-0.0475**	-0.0912***		
	(0.0225)	(0.0284)		
restriction (Small)			-0.2137***	-0.1492**
			(0.0669)	(0.0679)
restriction × Mid			0.1327*	0.1077
			(0.0699)	(0.0710)
restriction × Large			0.1616**	0.0961
			(0.0748)	(0.0761)
log(Daily_Value_Traded)				0.3400***
				(0.0157)
Stringency				0.0068***
				(0.0009)
Fixed-effects				
Instrument	No	Yes	Yes	Yes
Timestamp	No	Yes	Yes	Yes
Fit statistics				
Observations	344,103	344,103	344,103	341,378
R^2	1.3×10^{-5}	0.10367	0.10368	0.10916
Within R^2		3.46×10^{-5}	4.83×10^{-5}	0.00750

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Note: This table presents the results of the Diff-in-Diff regression. 'restriction' is the interaction variable for the two dummy variables (not shown in the table): (i) 'Ban_Countries' that equals one for stocks in banned countries and (ii) 'Ban_Period' that equals one for all trading days during the validity of the short-selling ban. Hence, the term 'restriction' isolates the effect of the treatment on the affected stocks. In models (3) and (4), 'restriction' uses small-cap stocks as the reference group and correspond to Equation 6.2. Small-cap firms are defined as stocks with a market cap of less than EUR 1B. Mid-cap companies have a market cap between EUR 1B and 10B, while large-cap companies have a market cap greater than EUR 10B. The terms 'restriction x Mid' and 'restriction x Large' represent the effect only of the interaction term (e.g., Y = restriction + Large + restriction x Large + ...) on mid-cap and large-cap groups, respectively. The variables 'Ban_Countries', 'Ban_Period', 'Mid', and 'Large' (not shown in the table) are naturally absorbed by fixed effects due to collinearity. We incorporate the value of trading volume and the stringency index as control variables. Omitting these control variables does not alter the primary findings.

Table 7.2: Spread Regression Results

Dependent Variable:	log(spread)			
Model:	(1)	(2)	(3)	(4)
Variables				
Constant	-1.897***			
	(0.0020)			
restriction	0.3867***	0.1760***		
	(0.0097)	(0.0162)		
restriction (Small)			0.2621***	0.2398***
			(0.0462)	(0.0444)
restriction × Mid			-0.0529	-0.0490
			(0.0484)	(0.0464)
restriction × Large			-0.2099***	-0.1996***
			(0.0536)	(0.0517)
log(Daily_Value_Traded)				-0.0631***
				(0.0045)
Stringency				-9×10^{-5}
				(0.0003)
Fixed-effects				
Instrument		Yes	Yes	Yes
Timestamp		Yes	Yes	Yes
Fit statistics				
Observations	351,125	351,125	351,125	348,399
R^2	0.00452	0.67709	0.67723	0.67929
Within R^2		0.00188	0.00233	0.00594

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Note: This table presents the results of the Diff-in-Diff regression. 'restriction' is the interaction variable for the two dummy variables (not shown in the table): (i) 'Ban_Countries' that equals one for stocks in banned countries and (ii) 'Ban_Period' that equals one for all trading days during the validity of the short-selling ban. Hence, the term 'restriction' isolates the effect of the treatment on the affected stocks. In models (3) and (4), 'restriction' uses small-cap stocks as the reference group and correspond to Equation 6.2. Small-cap firms are defined as stocks with a market cap of less than EUR 1B. Mid-cap companies have a market cap between EUR 1B and 10B, while large-cap companies have a market cap greater than EUR 10B. The terms 'restriction x Mid' and 'restriction x Large' represent the effect only of the interaction term (e.g., Y = restriction + Large + restriction x Large + ...) on mid-cap and large-cap groups, respectively. The variables 'Ban_Countries', 'Ban_Period', 'Mid', and 'Large' (not shown in the table) are naturally absorbed by fixed effects due to collinearity. We incorporate the value of trading volume and the stringency index as control variables. Omitting these control variables does not alter the primary findings.

Table 7.3: Amihud Regression Results

Dependent Variable:	log(amihud)			
Model:	(1)	(2)	(3)	(4)
Variables				
Constant	-15.25***			
	(0.0042)			
restriction	0.2631***	0.2372***		
	(0.0204)	(0.0226)		
restriction (Small)			0.0843*	0.0728
			(0.0503)	(0.0501)
restriction × Mid			0.1502***	0.1488***
			(0.0552)	(0.0550)
restriction × Large			0.2385***	0.2354***
			(0.0569)	(0.0567)
Stringency				0.0012**
				(0.0006)
Fixed-effects				
Instrument	No	Yes	Yes	Yes
Timestamp	No	Yes	Yes	Yes
Fit statistics				
Observations	349,650	349,650	349,650	346,924
R^2	0.00048	0.77143	0.77146	0.77174
Within R^2		0.00109	0.00122	0.00127

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Note: This table presents the results of the Diff-in-Diff regression. 'restriction' is the interaction variable for the two dummy variables (not shown in the table): (i) 'Ban_Countries' that equals one for stocks in banned countries and (ii) 'Ban_Period' that equals one for all trading days during the validity of the short-selling ban. Hence, the term 'restriction' isolates the effect of the treatment on the affected stocks. In models (3) and (4), 'restriction' uses small-cap stocks as the reference group and correspond to Equation 6.2. Small-cap firms are defined as stocks with a market cap of less than EUR 1B. Mid-cap companies have a market cap between EUR 1B and 10B, while large-cap companies have a market cap greater than EUR 10B. The terms 'restriction x Mid' and 'restriction x Large' represent the effect only of the interaction term (e.g., Y = restriction + Large + restriction x Large + ...) on mid-cap and large-cap groups, respectively. The variables 'Ban_Countries', 'Ban_Period', 'Mid', and 'Large' (not shown in the table) are naturally absorbed by fixed effects due to collinearity. We incorporate the stringency index as a control variable. Omitting this control variable does not alter our primary findings.

COVID-19 pandemic, compared to those in countries without such a ban, over various time intervals. Note that the time windows are specified with reference to the implementation date of the bans (March 18, 2020). The 'pre-crash' period (event window [-42, -1]), shown in Figure 7.2a, exhibits relative stability which suggests a normal market environment. However, during the 'crash' and the 'ban' period, there is a clear bifurcation between ban- and non-ban countries, with firms in the former experiencing significantly lower BHARs.

Furthermore, during the few days following the implementation of the ban, firms in ban countries experience an increase in BHAR (clearly visible in Figure 7.2d). The effect may be explained by the model outlined by Miller (1977), positing that a ban on short selling temporarily restricts bearish investors from acting on their pessimism toward a stock. If so, the implementation of such a ban is likely to temporarily drive up the prices of the impacted stocks. Table 7.6 further highlights the significant positive difference between BHAR values for banned and non-banned stocks during the days surrounding the announcement and implementation. However, the confounding announcement of the Pandemic Emergency Purchase Programme (PEPP) from the European Central Bank (ECB) may cloud the causal effect of the bans on stock prices. Yet, unlike the 'Miller' effect, a price change due to the PEPP should affect firms in both ban- and non-ban countries to a similar extent and therefore, the observed positive BHAR values exclusive to banned stocks in conjunction with the short-sell ban implementation is likely to be a 'Miller' effect. Similarly, lifting the ban on May 18 appears to have a positive, yet gradually diminishing, effect across all three sub-groups, as seen in Figure 7.2e.

Table 7.4, which presents the results of cross-sectional OLS regressions on the full sample (Equation 6.3), corroborates the insights observed in the previous graphical analyses, showing a negative correlation between short-sale bans and BHAR. During the ban period (event window [1, 42]), the results indicate a 4.4% lower BHAR for stocks in ban countries compared to stocks in non-ban countries. Furthermore, Table 7.5 breaks out the results by market cap groups. Over the entire ban period, small-cap stocks in the ban countries experience a 9.6% lower BHAR compared to small-cap stocks in non-ban countries. In contrast, mid- and large-cap firms in ban countries experience 2.0% and 2.9% lower BHAR values, respectively, compared to their counterparts in non-ban countries, although the

results for mid- and large-cap firms are statistically less significant.[15]

In conclusion, the findings indicate that the regulators' objective of stabilizing stock prices through short-selling restrictions was largely unsuccessful. Although the bans appeared to have a positive announcement effect, over the entire ban period, companies in ban countries experienced lower BHAR compared to those in non-ban countries. Furthermore, the negative effect is more pronounced for small-cap firms. Consequently, Hypothesis 1 must be rejected.

Table 7.4: BHAR across Periods

Dependent Variable:			BHAR		
Period:	[-42, -1]	[1, 42]	[1, 84]	[-42, 42]	[-42, 84]
Variables					
Constant	-4.612	32.32	-8.704	-27.60*	-47.34***
	(9.560)	(19.75)	(26.93)	(14.31)	(16.44)
Ban_Countries	-4.414***	-4.433***	-12.79***	-2.715*	-7.355***
	(1.286)	(1.556)	(2.278)	(1.456)	(1.751)
log(Daily_Value_Traded)	0.8034***	0.3921	1.753***	0.6804**	1.784***
	(0.1955)	(0.2930)	(0.4452)	(0.2757)	(0.3408)
VSTOXX Close	-0.2442**	-0.4501	-0.0289	0.8192*	1.069*
	(0.1187)	(0.6191)	(0.9343)	(0.4484)	(0.5604)
Stringency	0.1270***	-0.3024***	-0.1066	-0.1499*	-0.1841**
	(0.0263)	(0.0908)	(0.0994)	(0.0766)	(0.0736)
Fit statistics					
Observations	1,394	1,388	1,388	1,394	1,394
R^2	0.02781	0.02452	0.03179	0.01419	0.03292
Adjusted R^2	0.02501	0.02170	0.02899	0.01135	0.03014

IID standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Note: This table presents the results of the cross-sectional regression analyses, using buy-and-hold abnormal returns (BHARs) over various interval as the dependent variables. The event windows are specified with the reference to the implementation date of the bans March 18, 2020. BHAR is calculated using the STOXX Europe 600 index as benchmark. All variables are listed and defined in Table A.1.

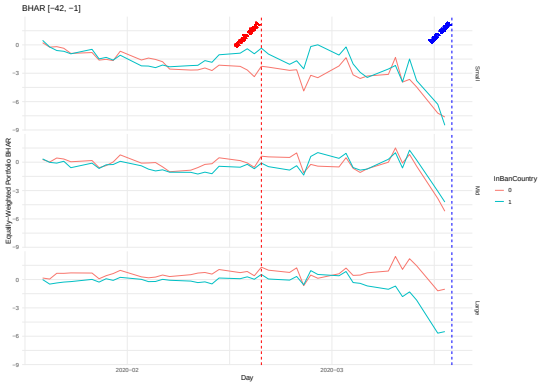
[15]The effect on mid-cap (large-cap) companies is derived by adding the coefficient for Ban_Countries and the coefficient for BAN × Mid (BAN × Large).

Table 7.5: BHAR across Periods and Firm Sizes

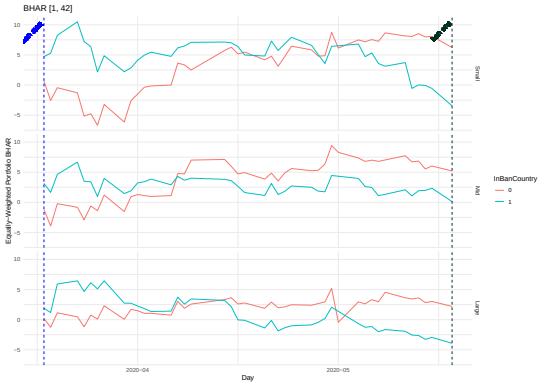
Dependent Variable:			BHAR		
Period:	[-42, -1]	[1, 42]	[1, 84]	[-42, 42]	[-42, 84]
Variables					
Constant	2.023	7.330	-71.23***	-22.11	-66.29***
	(10.15)	(20.48)	(27.08)	(15.23)	(17.24)
Ban_Countries	-4.125	-9.644***	-22.54***	-5.849*	-12.08***
	(2.529)	(3.710)	(5.687)	(3.506)	(4.448)
Mid	2.647*	-6.670***	-25.28***	1.096	-9.396***
	(1.473)	(2.098)	(3.166)	(1.994)	(2.492)
Large	5.663**	-14.63***	-43.33***	3.808	-12.88***
	(2.234)	(3.170)	(4.744)	(3.014)	(3.735)
log(Daily_Value_Traded)	0.2942	1.960***	6.175***	0.4094	3.242***
	(0.3177)	(0.4480)	(0.6489)	(0.4239)	(0.5086)
VSTOXX Close	-0.2621**	-0.2659	0.5752	0.7260	1.208**
	(0.1187)	(0.6171)	(0.9106)	(0.4500)	(0.5611)
Stringency	0.1331***	-0.2679***	-0.0857	-0.1497*	-0.1711**
	(0.0267)	(0.0916)	(0.0984)	(0.0777)	(0.0745)
Ban_Countries × Mid	0.6821	7.613*	13.84**	5.465	8.247*
	(2.795)	(4.189)	(6.381)	(3.972)	(4.999)
Ban_Countries × Large	-5.058	6.749	17.48**	-2.112	2.711
	(3.195)	(4.820)	(7.297)	(4.571)	(5.730)
Fit statistics					
Observations	1,394	1,388	1,388	1,394	1,394
R^2	0.03559	0.04134	0.09091	0.01953	0.04521
Adjusted R^2	0.03002	0.03578	0.08564	0.01387	0.03969

IID standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

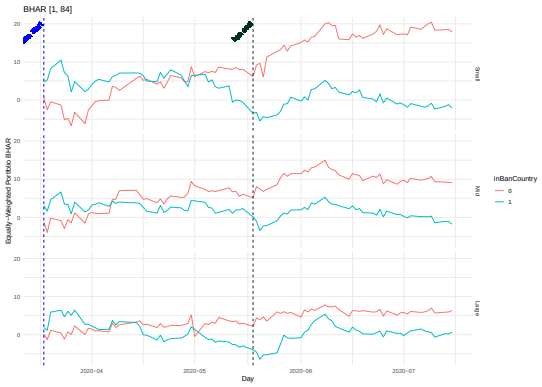
Note: Similar to Table 7.4, this table presents the results of cross-sectional regression analyses, using buy-and-hold abnormal returns (BHARs) over various interval as the dependent variables. In addition, it groups the instrument by market cap, isolating the Ban_Countries coefficients by firm sizes. Here Ban_Countries has the small-cap firms as the reference group. All variables are listed and defined in Table A.1.



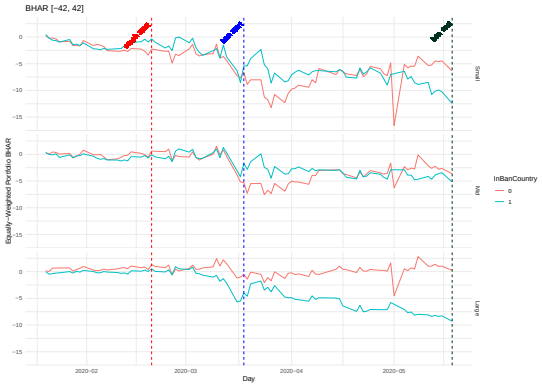
(a) BHAR From Day -42, 2020-01-20 to Day -1, 2020-03-17



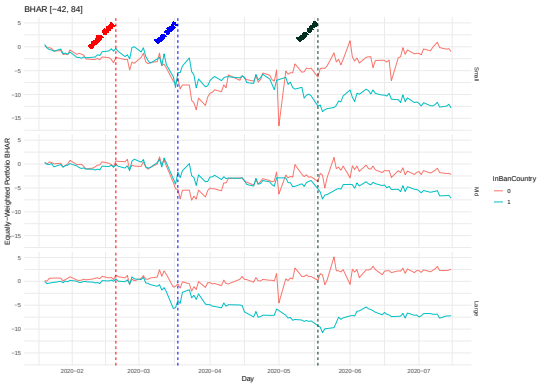
(b) BHAR Day 1, 2020-03-18 to Day 42, the last day the ban was in effect, 2020-05-18



(c) BHAR Day 1, 2020-03-18 to Day 84, 42 days after the ban was lifted, 2020-07-15



(d) BHAR Day -42, 2020-03-18 to Day 42, the last day the ban was in effect, 2020-05-18



(e) BHAR Day -42, 2020-01-20 to Day 84, 42 days after the ban was lifted, 2020-07-15

Figure 7.2: BHAR across Different Event Windows

Note: These figures present the average Buy-and-Hold Abnormal Returns (BHARs) over different event windows surrounding the implementation date of the short-sale bans on March 18, 2020. The specified windows refer to this date as day 1. The average BHAR for firms in 'ban countries' (represented by the blue line) and 'non-ban countries' (represented by the red line) are shown. The dotted vertical red line indicates the start of the 'crash' period, while the dotted black line indicates the start of the 'ban' period, and the end of the 'ban' period. As defined in the Data section, 'small' refers to companies with a market cap lower than EUR 1bn, 'mid' refers to companies with a market cap between EUR 1bn and 10bn, and 'large' refers to companies with a market cap greater than EUR 10 billion, as of January 2, 2020.

Table 7.6: Announcement Effect t-tests

Event window	Ban Countries Stocks BHAR (%)	Non-ban Countries Stocks BHAR (%)	Δ Mean	t-statistic
1	3.0354	-0.4420	3.4774***	-8.9197
-1, 2	0.7224	-4.2826	5.005***	-6.779
2, 6	1.4293	-0.6261	2.0554**	-2.4531
-4, 5	-2.3509	-9.3093	6.9584***	-8.748

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Note: This table shows the average Buy-and-Hold Abnormal Return (BHAR) for stocks in 'ban countries' and 'non-ban countries' over various event windows surrounding the announcement day of the short-sell bans on 18 March 2020 (Day 1). For each event window, BHAR, the difference between the mean BHAR of the two groups, and the t-statistic are reported. The significance of the mean is tested against zero.

7.1.2 Short-Selling Bans and Market Quality

Figure 7.3 illustrates the daily progression of average bid-ask spreads across the three market-cap groups. Initially, bid-ask spreads for the two groups of countries moved in tandem. However, after the enactment of short-selling bans, there was a noticeable increase in spreads in the countries that implemented these restrictions. These effects apply to all three market cap groups. In the group of small-cap firms, the confidence interval grew visually larger during the ban period, implying less efficiency.

Table 7.2 presents the regression results analyzing the effects on market quality. Short-selling bans correlate with a deterioration in bid-ask spreads, showing a 17.2% increase for stocks in banned jurisdictions during the restriction period (model 2). Similarly, in Table 7.3, it shows a 25.1% increase in the Amihud illiquidity indicator (model 2).[16] This confirms Hypotheses 2.1 and 2.2.

Further analysis across different market caps reveals that the ban is also associated with increases of 29.97%, 23.27%, and 5.35% in the bid-ask spreads for small-, mid-, and large-cap stocks, respectively, as indicated in model 3 in Table 7.2. This more pronounced increase in the bid-ask spread for small-cap firms may be attributed to their inherently

[16]Note that 17.2% and 25.1% are calculated as $e^{0.1591} - 1$ and $e^{0.2236} - 1$, respectively, where the exponents corresponds to the coefficients in the table. This is because the regression model uses the natural logarithm of the bid-ask spread as the dependent variable. In such log-linear models, the coefficients represent proportional changes. Exponentiating the coefficients and subtracting one provides the percentage change in the original variable. This back-transformation is necessary to interpret the coefficients correctly in percentage terms. The same procedure applies to models where the (log) Amihud illiquidity measure is the dependent variable.

lower trading volumes and market depth. Small-cap stocks typically experience higher information asymmetry and lower liquidity, leading market makers to widen spreads more significantly during periods of uncertainty such as a pandemic.

In contrast, with regards to the Amihud illiquidity measure, the results indicate increases of 8.8%, 26.43%, and 38.1% for small-, mid-, and large-cap stocks, respectively. The greater percentage increase in the Amihud illiquidity measure for large-cap firms highlights a different aspect of liquidity. Large-cap firms usually enjoy higher trading volumes and better market depth under normal conditions, but the short-sell bans restrict liquidity even in these typically liquid stocks. This results in a higher price impact per unit of trading volume, as captured by the Amihud measure. In other words, the effect of the short-sell ban on the Amihud illiquidity measure may be more pronounced for large-cap firms due to the significant disruption in their usual liquidity dynamics.

To summarize, the ban not only worsened the market quality for the countries that implemented it but also affected small companies disproportionately. Moreover, the discrepancy between the bid-ask spread and the Amihud illiquidity measure underscores the multi-dimensional nature of liquidity. The bid-ask spread reflects the immediate cost of trading and is more sensitive to the lower baseline liquidity and higher information asymmetry of small-cap stocks. In contrast, the Amihud measure captures the broader price impact of trading volumes, revealing that even large-cap stocks can experience significant liquidity constraints under a short-sell ban. These findings confirms Hypothesis 2.3, but rejects Hypothesis 2.4.

The high R-squared values (around 67.9% to 77.2%) for log(spread) and log(amihud), respectively, suggest that the models effectively explain the variance in these dependent variables overall. However, the very low within R-squared values indicate that the explanatory power is mainly driven by differences between instruments and timestamps, rather than changes within individual stocks.

7.1.3 Relocation Effect Analysis

Our analysis in Appendix C utilizes short selling disclosures at the share level and publicly disclosed short positions by position holders to examine whether there was a migration of short selling activities from jurisdictions that imposed bans to those that did not. The

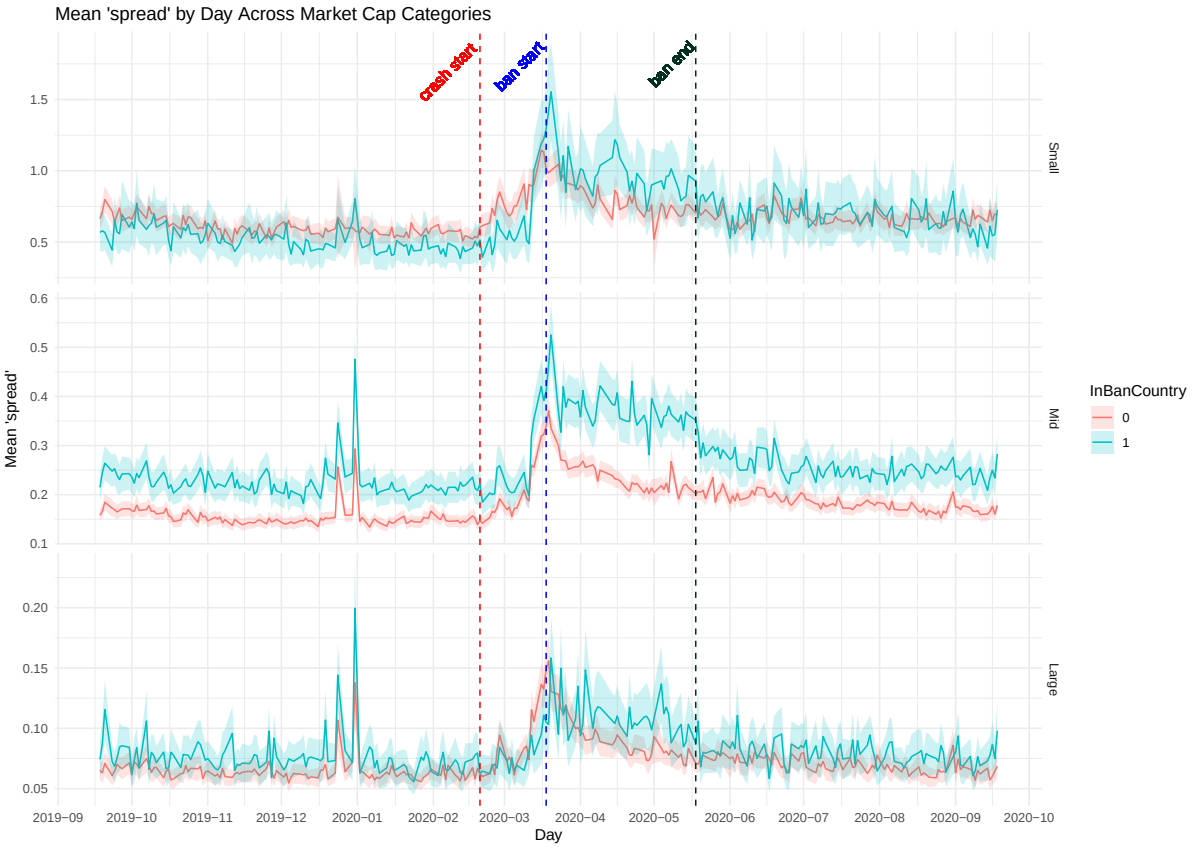


Figure 7.3: Mean Bid-Ask Spread

Note: This figure presents a comparative analysis of the average bid-ask spread between stocks in 'ban countries' and 'non-ban countries' for each day in the period from September 18, 2019, to September 18, 2020. The red dotted vertical line indicates the start of the 'crash' period. The blue dotted line indicates the start of the 'ban' period, and the red dotted line indicates the end of the 'ban' period. The shaded area represents the 95% confidence interval. In both groups of countries, the sample is divided into three groups based on market capitalization. Stocks in 'ban countries' are represented by the blue line, while stocks in 'non-ban countries' are represented by the red line. Data is retrieved from *Refinitiv*.

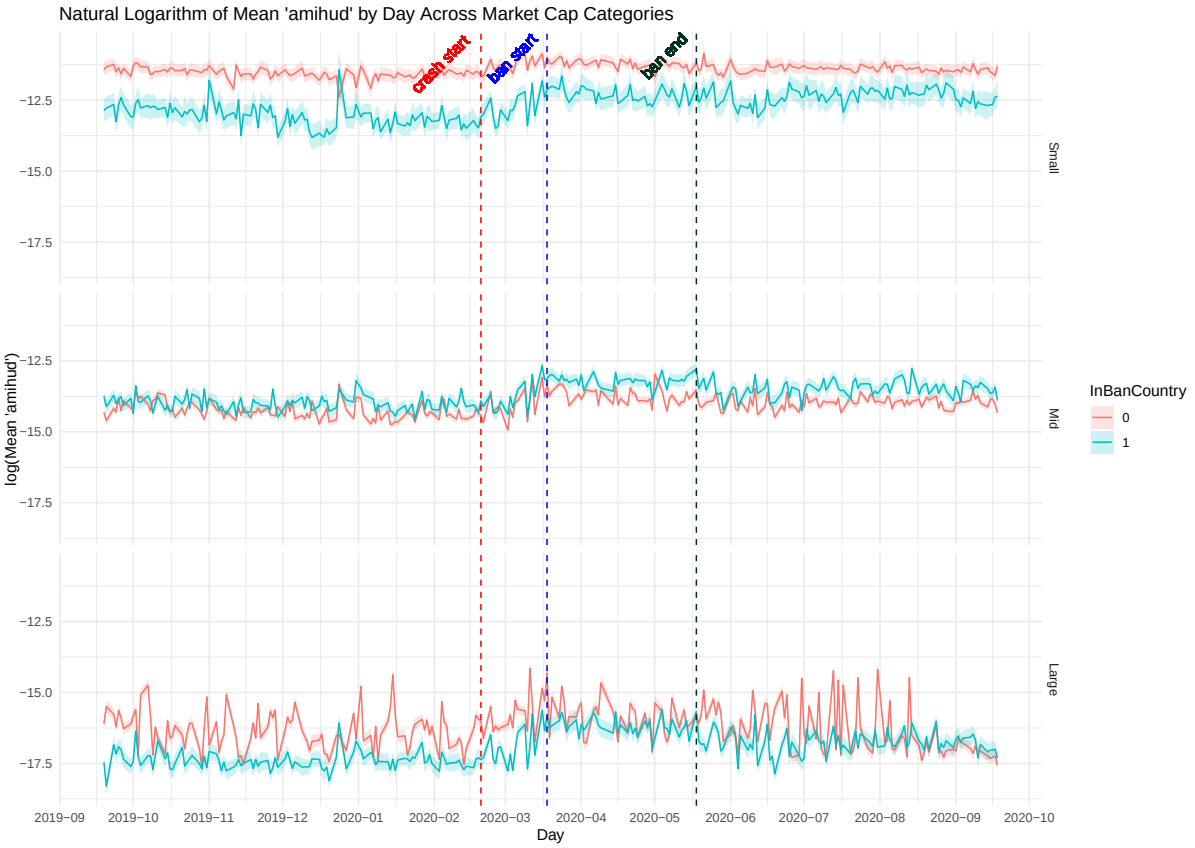


Figure 7.4: Mean Amihud Illiquidity Measure

Note: This figure presents a comparative analysis of the natural logarithm of the daily mean of Amihud illiquidity measure between stocks in 'Ban countries' and 'Non-ban countries' for each day in the period from September 18, 2019, to September 18, 2020. The red dotted vertical line indicates the start of the 'Crash' period. The blue dotted line indicates the start of the 'Ban' period, and the red dotted line indicates the end of the 'Ban' period. The shaded area represents the 95% confidence interval. In both groups of countries, the sample is divided into three groups based on market capitalization. Stocks in 'Ban countries' are represented by the blue line, while stocks in 'Non-ban countries' are represented by the red line. Data is retrieved from *Refinitiv*.

reduction in short selling positions in both jurisdictions, combined with the unaltered number of active short sellers before and after the bans in non-ban countries, indicates that there was no apparent relocation of short selling activity during the period of the bans.

7.2 Determinants of Short-Selling Bans

In examining the determinants of short-selling bans, the analysis leverages logistic regression models using two different sets of data: (i) yearly data spanning from 2010 to 2019 and (ii) daily data spanning from March 3 to March 17. The logistic regression approach was employed to investigate the likelihood of countries implementing short-selling bans in response to various indicators. The results for the yearly- and daily datasets are presented in Table 7.7 and Table 7.8, respectively.

7.2.1 Yearly Data

Table 7.7 presents the findings from the analysis that examines the determinants, based on yearly data, influencing the implementation of short-selling bans during the Covid-19 crisis. Utilizing a dataset with various political- and economic variables, the study evaluates the extent to which these factors affected the probability of countries resorting to short-selling bans.

The current account balance, represented as a ratio to GDP, displays a positive and statistically significant relationship with the decision to implement short-selling bans. This relationship may reflect the protective strategies of countries with more substantial external surplus positions during periods of financial uncertainty. Government debt levels relative to GDP also show a significant positive correlation with the imposition of short-selling bans. The consistent significance of this variable across different model specifications indicates that countries with higher government debt may be more likely to intervene in financial markets, perhaps to maintain stability or investor confidence during times of fiscal stress.

The institutional quality index, a composite measure of government effectiveness and regulatory quality, exhibits a significant positive association with short-selling bans in one model, but the relationship becomes statistically insignificant in other specifications.

Table 7.7: Determinants of the Short-Selling Ban Decision - Dataset A

Dependent Variable:			Ban		
Model:	(1)	(2)	(3)	(4)	(5)
Variables					
Current Account Balance	0.0200***		0.0052**	0.0106***	
	(0.0044)		(0.0023)	(0.0020)	
Government Debt	0.0062***	0.0059***	0.0086***	0.0052***	0.0054***
	(0.0003)	(0.0004)	(0.0003)	(0.0004)	(0.0004)
Institutional Quality	0.0069**			-0.0015	-0.0008
	(0.0028)			(0.0021)	(0.0033)
Households Assets	0.0176***	0.0144***	0.0129***		
	(0.0014)	(0.0009)	(0.0009)		
Democracy	-0.1765***			-0.0573**	-0.0464*
	(0.0276)			(0.0184)	(0.0208)
CCI	0.0106	0.0297			0.0210
	(0.0182)	(0.0163)			(0.0186)
Political Stability	-0.0108***	-0.0111***		-0.0085***	-0.0088***
	(0.0010)	(0.0009)		(0.0011)	(0.0010)
Fixed-effects					
Year	Yes	Yes	Yes	Yes	Yes
Fit statistics					
Observations	160	160	170	170	160
Squared Correlation	0.51649	0.48850	0.44197	0.45065	0.42983
Pseudo R^2	0.51923	0.47902	0.42491	0.43633	0.40143
BIC	193.94	187.71	200.98	208.59	210.16

Clustered (Year) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*
Note: This table presents the results of the logit regression using yearly data from 2010 to 2019 on implementing a short-selling ban as dependent variable. All variables are defined in Table A.2.

This implies that institutional quality may not be a strong predictor of short-selling bans. Furthermore, institutional quality and government debt is the only two variables in the logistic regression analysis that is highly correlated with each other.[17] Similarly, CCI does not exhibit any significant correlation association with the implementation of short-selling bans.

Additionally, the data indicates a positive relationship between the proportion of households' financial assets in equities and the imposition of short-selling bans. This may reflect a policy inclination to shield domestic investors' wealth, particularly in economies where personal investment portfolios are significantly exposed to equity markets.

The political dimension is also noteworthy. Political stability and the democracy index are negatively correlated with the enactment of short-selling bans, indicating that nations with robust political structures and democratic processes are less likely to intervene in market mechanisms. These findings align with the notion that such countries may prefer market resiliency and the natural correction of financial imbalances over regulatory impositions.

In conclusion, the empirical evidence suggests that a complex interplay of economic health, political stability, and confidence in institutional governance frameworks significantly informs the regulatory stance on short-selling bans.

7.2.2 Daily Data

Table 7.8 shows the results of the empirical investigation into the daily determinants of short-selling ban enactment, conducted against the backdrop of the Covid-19 pandemic. The analysis draws on a dataset encompassing various economic and health-related variables to ascertain their impact on the likelihood of short-selling bans being imposed.

Retail investor attention, as captured through search query volumes for stock market indices, is positively correlated with the imposition of short-selling bans in some models, although the results are non-significant. On the other hand, the CISS exhibits a positive and significant correlation, which could reflect an interventionist stance by regulators in times of heightened financial system stress.

Similarly, the progression of the Covid-19 pandemic, operationalized through the daily

[17] The correlation between institutional quality and government debt is negative 0.77, see correlation matrix in Table B.1

Table 7.8: Determinants of the Short-Selling Ban Decision - Dataset B

Dependent Variable:	Ban			
Model:	(1)	(2)	(3)	(4)
Variables				
Retail Investor Attention	0.0026		0.0038	
	(0.0022)		(0.0024)	
CISS	0.8164***	0.8507***		
	(0.0483)	(0.0565)		
Covid-19 Cases	0.0033***	0.0034***	0.0032***	
	(0.0006)	(0.0007)	(0.0007)	
Stringency	0.0103***	0.0104***	0.0108***	0.0121***
	(0.0007)	(0.0008)	(0.0008)	(0.0007)
Stock Market Return	-0.0391**	-0.0384*	-0.0461**	-0.0414*
	(0.0175)	(0.0177)	(0.0181)	(0.0189)
Fixed-effects				
Date	Yes	Yes	Yes	Yes
Fit statistics				
Observations	187	187	187	187
Squared Correlation	0.30258	0.29924	0.26582	0.22374
Pseudo R^2	0.26269	0.25921	0.22525	0.18463
BIC	272.84	268.50	277.21	277.17

Clustered (Date) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Note: This table presents the results of the logit regression using daily data from 3 March to 17 March on imposing a short-selling ban as dependent variable. All variables are defined in Table A.3.

count of new cases per capita, is strongly and positively associated with the enactment of short-selling bans. This trend may reflect the broader economic uncertainties and volatilities engendered by the health crisis, prompting regulatory bodies to take decisive action in an attempt to stabilize financial markets. Further, the stringency of government responses to the pandemic also appears to play a role in the decision to implement short-selling bans. The stringency index, which aggregates various measures of government response, correlates positively with the enactment of bans. This finding suggests that more rigorous public health interventions coincide with increased financial regulatory actions, underscoring a holistic approach to crisis management that spans health and economic domains. Lastly, market performance, specifically the daily returns on stock markets, inversely affects the probability of a ban, indicating a pattern of protective regulatory measures following negative market movements.

In summary, the research delineates a reactive regulatory landscape the severity of the pandemic, governmental stringency, and market performance dynamically influence the activation of financial safeguards such as short-selling bans. These insights contribute to the understanding of regulatory responses to crises and the balancing act between market freedom and the need for stability during periods of acute stress.

To ensure the robustness of our results, the models encompassing yearly (daily) data control for time-specific effects by including fixed-effects for years (days), and standard errors are clustered by years (days) to address any potential correlation within these temporal groups. Furthermore, to control for multicollinearity, Pearson correlation coefficients are calculated, see Table B.1 and Table B.2 in appendix. With regards to the fit of the model, there is no universally agreed-upon benchmark for interpreting pseudo R-squared values in model evaluation. Nonetheless, McFadden (2021) suggests that values between 0.2 and 0.4 represent a good fit, while values exceeding 0.4 are indicative of an excellent fit. Hence, the models in Table 7.7 exhibit relatively good fit statistics, whereas the models in Table 7.8 shows satisfactory fit statistics.

7.3 The Results in Relation to Previous Research

Existing empirical research on the effects of short selling bans primarily focuses on those implemented during the GFC, while studies on bans during the Covid-19 pandemic

are more limited. Regardless of the crisis, empirical evidence generally indicates that short-selling bans are, at best, neutral on average with respect to stock prices and market quality. Some studies, including this one, highlight the potential heterogeneous effects of short-selling bans depending on the characteristics of the affected stocks. For example, Boehmer et al. (2013) examined financial stocks, Della Corte et al. (2021) investigated the differential impact based on a stock's ex-ante liquidity, and this study focuses on the effects for firms with different market capitalizations. In this section, the results of our study will be compared with similar, previous studies.

Similar to Beber and Pagano (2013), our findings indicate a more pronounced impact on stocks with smaller market capitalizations. However, they study the short sell bans of the GFC and employs a dataset comprising daily data for 16,491 stocks across 30 Western nations, including Hong Kong, Japan, and Singapore. Also, in terms of methodology, we utilize a DiD strategy that enable us to isolate the specific effects of the ban, while Beber and Pagano (2013) rely on a firm-day panel that, which inherently gives more weight to firms in countries with prolonged bans relative to those with shorter bans. This approach overlooks cross-country distinctions, including variations in financial market development, information environments, and investor protection regulations. In contrast, our research offers a complementary perspective by eliminating the need for subjective weighting of observations (as all bans are of equal duration) and mitigating the impact of cross-country heterogeneity (given the relative similarity of the EU countries included in this study).

Conversely, Boehmer et al. (2008), find that the negative effects of short selling restrictions during the 2008-09 ban on US financial stocks were less significant on small-cap stocks. They mention that this is likely because the shorting ban temporarily restricted many market participants who, although not formally market makers, typically provided substantial liquidity through short selling. These informal market makers are known to focus their efforts on large-cap stocks, so their absence would not have been as acutely felt in smaller stocks. Although this result may not be directly analogous - since it is financial stocks during the GFC that is studied - it is contrasting the results of our study. Similarly, in their comparison of the French and Dutch equity markets during the Covid-19 short sell ban, Benhami et al. (2022) note that the imposition of the ban correlates with reduced liquidity and diminished volatility, with a more pronounced effect in large-cap stocks.

With regards to the effect on stock prices, we find a statistically significant positive – but diminishing – announcement effect of the bans. Boehmer et al. (2008) briefly mention that a short sell ban, by temporarily filtering out bearish opinions from the market, should lead to a temporary rise in the prices of the impacted stocks. However, they also highlight that this 'Miller' effect is unlikely, as market participants could take a bearish position through ETFs, puts, credit default swaps, or other derivative instruments. Unlike the GFC studied in Boehmer et al. (2008), the short sale bans implemented in the EU during Covid-19 covered all positions that increased the NSP, including derivatives. Against this backdrop, and in line with our results, it is possible that the announcement of a short sale ban will lead to a temporary rise in the prices of the impacted stocks.

In terms of the whole ban period, our results indicate that the bans did not stabilize prices. Although some studies find that bans can have a stabilizing effect for certain stocks, e.g., Fohlin and Zhou (2012) suggests that bans stabilized prices for illiquid stocks and Beber and Pagano (2013) found a positive and significant response to short-selling bans in the U.S. during the GFC, the general empirical evidence shows that bans do not stabilize stock prices.

The second part of this study uses logistic regression to investigate the factors prompting nations to enact short-selling constraints, with Bessler and Vendrasco (2021) being the only notable previous study in this area. Consistent with their findings, our analysis reveals that both long-term national characteristics present before the pandemic and the immediate impacts of Covid-19 significantly influenced decisions to implement short-selling bans. This analysis helps illuminate the rationale and retrospective justifications for why six European countries chose to enforce such bans. Key characteristics of these countries include weaker economic conditions, higher susceptibility to economic crises, and more stringent lockdown measures. However, while our results provide a general overview, they do not precisely identify the specific reasons for implementing short-selling bans. The potential for omitted variable bias makes it challenging to account for all factors that influence the decision to implement such a ban, underscoring the need for further, more detailed research.

8 Discussion

8.1 Generalizability of Results

The findings of this study, which examines the effects of short-selling bans in the EU amid the Covid-19 pandemic, provide significant insights into market behavior during periods of financial stress. However, generalizing these results requires careful consideration of the study's specific context and the conditions under which similar outcomes might occur elsewhere.

The study focuses on the EU's unique market structure, characterized by a high degree of regulatory harmonization and transparency. ESMA coordinated the bans across six countries, illustrating a level of regulatory cohesion that might not be present in other markets. Furthermore, the unprecedented nature of the Covid-19 pandemic and the subsequent global economic slowdown introduced significant external factors affecting the study's findings. Government interventions, central bank policies, and widespread uncertainty played critical roles in shaping market behavior during this period. Thus, the applicability of these results to other timeframes is limited by the uniqueness of this crisis. However, historical comparisons with past crises, such as the GFC or the Eurozone debt crisis, suggest that short-selling bans could have similar effects during future economic downturns, particularly regarding liquidity.

In summary, while the study provides valuable insights into the effects of short-selling bans, the generalizability of these findings is bounded by the specific conditions of the EU market and the Covid-19 pandemic. These factors are important to consider when applying the study's insights to different contexts, acknowledging that regulatory environments, market structures, and external factors significantly influence the effectiveness and impact of short-selling bans.

8.2 Identification Assumptions

This section delves into the core identification assumptions underpinning the study. Given the dynamic and complex environment of the financial markets during the onset of the Covid-19 pandemic, each of these assumptions warrants thorough examination.

8.2.1 Difference-in-Difference

A crucial assumption underlying the DiD analysis is that of parallel trends, which presumes that in the absence of the short selling bans, the evolution of stock market returns and market quality indicators would have followed similar trajectories across countries that did and did not implement such bans. Visual inspection of pre-treatment trends provides prima facie evidence for this assumption, as depicted in Figure 7.2a, Figure 7.3 and Figure 7.4, which show the market quality measures and stock returns, all moving in tandem across both groups of countries up until the implementation of the bans. This parallel movement suggests that any post-intervention divergence in these trends could plausibly be attributed to the treatment. However, it is important to consider that countries were not equally affected by the pandemic. For instance, the weakened tourism industry, which was heavily affected by the pandemic, might have disproportionately contributed to the decline in returns in ban countries, and caused the counterfactual trends (post-intervention) to diverge. Spain, France, and Austria had the highest percentages of tourism relative to their total GDP among the 17 countries in this study, with 12.4%, 7.5%, and 5.6% respectively in 2019 (OECD, 2018). In other words, the investors may flock from riskier economies to safer ones. This is especially true for BHAR as a measure because it depends on non-panel, OLS regression.

In addition to the parallel trends assumption is the Stable Unit Treatment Value Assumption (SUTVA), which is two-fold in our context. First, it entails the assumption of no interference between units, i.e that the treatment applied in one unit (country) does not influence the outcomes in another. Given the global interconnectedness of financial markets, the possibility of cross-border spillover effects must be considered. Second, SUTVA requires the treatment effect to be consistent across treated units. In the context of this study, these assumptions would mean that the short-selling bans would need to have a homogeneous effect across all affected markets. However, variability in market structure, investor composition, and regulatory compliance could lead to differentiated impacts among countries.

This potential country heterogeneity extends to the analysis of effects on firms with different market capitalizations. The composition of small- mid- and large cap firms varies substantially across countries, as shown in Table 5.2. For example, among the 91

companies in the large cap group of ban countries, Austria and Belgium have only 2 and 7 companies, respectively. Therefore, if there is significant country heterogeneity, our findings regarding the differential effect for small-, mid-, and large-cap firms may reflect differences in nationality rather than firm size.

Finally, the analysis is contingent upon the assumption that there are no contemporaneous treatments, meaning no other significant regulatory changes, economic shocks, or policy interventions concurrently affecting the treated or control groups that could confound the observed effects of the short-selling bans. It is difficult to validate this assumption as several measures were undertaken to ameliorate the effects of the pandemic. For example, on the same day as the short-selling bans were implemented, the ECB announced its Pandemic Emergency Purchase Programme (PEPP), a substantial monetary policy intervention designed to mitigate the economic impact of the pandemic. Such a significant policy move has the potential to influence the financial markets independently of, and contemporaneously with, the short-selling bans. However, unlike the short-selling bans, PEPP affected both ban and non-ban countries in a relatively uniform manner, which may minimize its potential to substantially skew the results.

8.2.2 Logistic Regression

Central to our logistic regression methodology, there are two key identification assumptions which warrant discussion. First, in our panel data analysis, the assumption of independent observations is essential yet challenging to maintain. This assumption is particularly tested by potential autocorrelation, where conditions in one period could influence those in subsequent periods. To address these concerns, fixed effects are incorporated to control for unobserved, time-invariant characteristics within each country and robust standard errors to counteract biased estimates caused by such dependencies. Nevertheless, it is crucial to acknowledge that these methodological adjustments, although beneficial, may not fully resolve all issues of dependency within the data.

Secondly, the analysis presumes homogeneity of effects across units, suggesting that the influence of explanatory variables such as the ‘stringency index’ on the probability of a short-selling ban remains consistent across different countries. This assumption risks oversimplifying complex interactions between country-specific factors and the dependent

variable. This aspect highlights the need for careful interpretation of the generalized findings, considering the potential for underlying variability.

In addition to the general assumptions of the DiD and the logistic regression methodologies, there is a caveat pertaining to concept of abnormal returns. For the calculation of abnormal returns, we assume the potential outcome for stock returns to be equal to the market return. This method not only neglects the stock's β but also the idiosyncratic component of volatility, i.e the methodology builds upon the assumption that stock prices are perfectly correlated with the total market. A more precise methodology, such as the market model, would take into account systematic risk. However, accurately forecasting future stock price returns remains an inherently complex endeavor, with no single methodology demonstrably superior to others.

8.3 Policy Implications

During the Covid-19 crisis, it is noteworthy that while six European countries implemented short-selling bans, other European nations chose not to adopt such measures. Central to the rationale on regulatory interventions during financial crises is the assumption that stock prices, in these periods of turmoil, fall beneath their intrinsic values, posing a risk of destabilization to the financial system. This theory underpins the regulatory stance on prohibiting short-selling, positing that such measures prevent an overly pessimistic valuation of stocks from exacerbating market instability. However, this line of reasoning encounters significant critique, both in principal and in fact. The assertion presumes that regulatory authorities possess a superior understanding over the market regarding the 'true value' of securities. This raises an important question: if regulatory authorities truly possess superior market insight, why is their intervention sporadic and often unable to prevent excessive optimism that leads to inflated valuations and market bubbles? This discrepancy points to a broader inconsistency in regulatory philosophy and underscores the complexity of market dynamics that cannot be effectively moderated through isolated interventions.

In light of our results, and consistent with previous studies in the field, countries should reconsider adopting short-selling bans. However, financial regulation also has a significant political dimension. Market-wide short sell bans allow regulators to balance the need for

immediate political action with the imperative to maintain market integrity. Alternative interventions might have lacked perceptible efficacy from the standpoint of public opinion – consider, for example, implementation of the 'uptick rule', which may be perceived as a mere technical detail. Conversely, more extreme measures, such as the complete closure of market trading – similar to the actions taken by the Russian federal securities agency in October 2008 – could have sparked greater market turmoil. Although the concept of inaction might be justifiable in theory, in practice, it's politically untenable. There's a necessity for action, or at least the illusion of action. Competent financial regulators prioritize substance over form, emphasizing the importance of meaningful regulation. However, competent regulators also recognize that they should put image over form, as the image presented to the public can be as crucial as the substantive actions taken. Hence, preserving the appearance of activity by implementing a short sell ban while actually introducing minimal innovation could actually be the optimal strategy for policymakers.

Concerns regarding public sentiment can significantly alter regulatory behaviors. Similarly, an undue emphasis on the short-term perspectives, exemplified by financial analysts' quarterly assessments of a company's outlook, may skew managerial decisions. Within the private sector, mechanisms of corporate governance – emanating from either private agreements or legislative endeavors – act to mitigate such biases and the broader spectrum of agency dilemmas. Notwithstanding, the discourse is notably scant concerning analogous governance frameworks that could ensure agents within governmental entities align their actions with their principal stakeholders (the general populace). This gap presents a critical area for further research, especially in understanding how governance mechanisms can be structured to uphold the alignment of governmental organizations' operations with the interests of the public at large.

9 Conclusion

The primary objective of this thesis is to explore and elucidate on the rationales behind, and the effects of, the short-selling bans imposed during the Covid-19 pandemic in Europe. Our analysis, combined with an in-depth discussion, sheds light on the intricacies of these bans during the pandemic.

The results reveal a significant correlation between the bans and negative market outcomes. Although there appears to be a significant positive announcement effect on prices, the analysis shows that prohibiting short selling is associated with reduced stock liquidity and lower abnormal returns for the entire ban period, which contradicts the intended objectives of such regulations. Additionally, these adverse effects are particularly pronounced in small-cap companies.

These findings, aligned with earlier theoretical and empirical studies, underscore the importance for financial regulators to carefully consider the repercussions of imposing short-selling bans during market crises, given their ineffectiveness and potential negative impact on market quality. In addition to highlighting the effects of short-selling bans on market returns and quality measures, this analysis emphasizes the critical need for future research to understand the ramifications of political interventions during crises.

That is the long and short of it.

"Knowing what we know now, I believe on balance the commission would not do it again. The costs appear to outweigh the benefits."
- Christopher Cox, telephone interview to Reuters, 31 December 2008.

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AI tools that have been used in the work on this master's thesis:

Name (and version) of the AI tool: ChatGPT, 4.0.

The purpose of the use of the tool: Organize data, data analysis, grammar.

We are aware that we are responsible for all content of this master's thesis, including the parts where AI tools are used. We are responsible for ensuring that the thesis complies with ethical rules for privacy and publication.

Appendices

A Variable definitions

Table A.1: Variable Definitions DiD and OLS Regressions

Variable	Definition / Description	Source
AR	Abnormal return (AR) is the difference between security s's daily return and the daily return of STOXX600.	Refinitiv
BHAR	Buy-and-Hold Abnormal Return (BHAR) is the difference between security s's and the return of STOXX600 over a specified event window.	Refinitiv
log(amihud)	Natural logaritm of the Amihud illiquidity measure that is the ratio between the absolute value of security s's return and EUR trading volume on day t. It can be interpreted as the daily price response associated with one EUR of trading volume, thus serving as a rough measure of price impact.	Refinitiv
log(spread)	Natural logarithm of bid-ask spread. Bid-ask spread is the difference between average daily bid- and ask price, divided by their mid-point.	Refinitiv
log(Daily Value Traded)	Natural logarithm of Euro value of daily quantity of shares traded.	Refinitiv
Large	An indicator for instrument with market cap greater than EUR 10B.	-
Mid	An indicator for instrument with market cap between EUR 1B to 10B.	-
restriction	An interaction term for (i) the treatment variable 'Ban_Countries' that that identifies whether a stock is from a country where a short-selling ban was imposed and (ii) the 'Ban_Period' variable that indicates the period during which the short-selling ban is active.	ESMA
Stringency	A composite index (0-100) of Covid-19 government responses based on nine country-level indicators, e.g school closing, close public transport, stay-at-home requirements, etc.	OxCGRT
VSTOXX	Measuring the 30-day implied volatility of the EURO STOXX 50 to gauge the investor sentiment and overall economic uncertainty.	Refinitiv

Note: This table presents the definitions, calculations, and description of the used variables in the DiD- and OLS regressions. Abbreviations: ESMA (European Securities and Markets Authority) OxCGRT (Oxford COVID-19 Government Response Tracker by Blavatnik School of Government, University of Oxford).

Table A.2: Variable Definitions Logistic Regression Dataset A

Variable	Definition / Description	Source
CCI	The consumer confidence indicator predicts households' future consumption and saving trends based on their expectations for personal finances, the overall economy, unemployment, and saving potential. A value above 100 indicates increased consumer confidence, leading to decreased savings and more spending on major purchases over the next year. Values below 100 reflect a pessimistic outlook, likely increasing savings and reducing consumption.	OECD
Current Account Balance	The sum of net exports of goods and services, net primary income, and net secondary income (as % of GDP).	WDI
Democracy Index	Combines information on the extent to which citizens can choose their political leaders in free and fair elections, enjoy civil liberties, prefer democracy over other political systems, can and do participate in politics, and have a functioning government that acts on their behalf. It ranges from 0 to 10 (most democratic).	EIU
Government Debt	Gross amount of government liabilities reduced by the amount of equity and financial derivatives held by the government as (% of GDP). Because debt is a stock rather than a flow, it is measured as of a given date, i.e. the last day of the fiscal year.	WEO
Households' Assets	Shares and other equity as % of total financial assets for households.	WDI
Institutional Quality	The average of the WGIs 'Government Effectiveness' and 'Regulatory Quality'. Estimate gives the country's score on a normalized scale 0-100.	WGI
Political Stability	Measures perceptions of the likelihood of political instability and/or politically-motivated violence, including terrorism. Estimate gives the country's score on a normalized scale 0-100.	WGI

Note: This table presents the definitions of the variables in dataset A. Abbreviations: EIU (Economist Intelligence Unit); GFD (Global Financial Development database by World Bank); OECD (The Organization for Economic Cooperation and Development); WDI (World Development Indicators database by World Bank); WEO (World Economic Outlook database by International Monetary Fund (IMF)); WGI (Worldwide Governance Indicators database by World Bank).

Table A.3: Variable Definitions Logistic Regression Dataset B

Variable	Definition / Description	Source
CISS	Composite Indicator of Systemic Stress (CISS) measures the level of frictions, stresses and strains in the financial system, comprising financial intermediation, money markets, equities markets, bonds markets and foreign exchanges markets. CISS is a normalized value between 0 and 1. (Holló et al., 2012).	ECB
Covid-19 Cases	The daily number of new reported cases of Covid-19, per 1 million inhabitants.	ECDC
Retail Investor Attention	As a proxy for retail investor attention, search frequency for the main stock market index in each country in Google (Search Volume Index (SVI)) is used. Google SVI is measured for each day within each country. The SVI value is normalized and indexed on a scale from 1-100. Information of the indices used is provided in the table notes.	Google Trends
Stock Market Return	The daily return of the main stock index (in %) in each of the respective countries. Information of the indices used is provided in the table notes.	Refinitiv
Stringency	A composite index (0-100) of Covid-19 government responses based on nine country-level indicators, e.g school closing, close public transport, stay-at-home requirements, etc.	OxCGRT

Note: This table presents the definitions of the variables in dataset B. Abbreviations: ECB (European Central Bank); ECDC (European Centre for Disease Prevention and Control); OxCGRT (Oxford COVID-19 Government Response Tracker by Blavatnik School of Government, University of Oxford). The indices used for the Retail Investor Attention- and Stock Market Return variables are; Austria: ATX, Belgium: BEL 20, Denmark: OMXC20, Finland: OMX Helsinki 25, France: CAC 40, Germany: DAX, Greece: ATHEX Composite Index, Ireland: ISEQ Overall Index, Italy: FTSE MIB, Netherlands: AEX Index, Norway: OSEAX, Poland: WIG20, Portugal: PSI-20, Spain: IBEX 35, Sweden: OMX Stockholm 30, Switzerland: SMI, United Kingdom: FTSE 100.

B Correlation matrices

Table B.1: Correlation Matrix Independent Variables Dataset A

	Current A.	Government D.	Institutional Q.	Household A.	Democracy	CCI	Political S.
Current A.	1.00	-0.51	0.52	-0.07	0.60	0.39	0.49
Government D.	-0.51	1.00	-0.77	-0.10	-0.66	-0.46	-0.67
Institutional Q.	0.52	-0.77	1.00	0.03	0.81	0.41	0.68
Household A.	-0.07	-0.10	0.03	1.00	0.15	0.08	0.12
Democracy	0.60	-0.66	0.81	0.15	1.00	0.28	0.64
CCI	0.39	-0.46	0.41	0.08	0.28	1.00	0.34
Political S.	0.49	-0.67	0.68	0.12	0.64	0.34	1.00

Note: The values in the table represent Pearson correlation coefficients between the independent variables in Dataset A. The magnitude and sign of the coefficients indicate the strength and direction of the relationship between the variables. A value close to +1 or -1 indicates a strong correlation, while a value near 0 suggests a weak correlation.

Table B.2: Correlation Matrix Independent Variables Dataset B

	Retail Investor Attention	CISS	COVID-19 Cases	Stringency	Stock Market Return
Retail Investor Attention	1.00	0.29	0.20	0.26	-0.33
CISS	0.29	1.00	0.23	0.42	-0.08
COVID-19 Cases	0.20	0.23	1.00	0.39	-0.02
Stringency	0.26	0.42	0.39	1.00	-0.03
Stock Market Return	-0.33	-0.08	-0.02	-0.03	1.00

Note: The values in the table represent Pearson correlation coefficients between the independent variables in Dataset B. The magnitude and sign of the coefficients indicate the strength and direction of the relationship between the variables. A value close to +1 or -1 indicates a strong correlation, while a value near 0 suggests a weak correlation.

C Relocation effect analysis

We conduct an exploratory analysis to assess the potential shift of short selling activities from jurisdictions with bans to those without (a 'relocation' effect) and the extent of this phenomenon. It is challenging to separate the effects of the ban from the economic downturn due to the COVID-19 pandemic, so a direct causal relationship regarding relocation due to the short selling ban is not estimated. However, descriptive data offer valuable insights into whether such an effect occurred. Our analysis utilizes data from publicly disclosed short positions at the position holder - share level, specifically for NSPs that exceed the 0.5% disclosure threshold of a company's issued share capital.

First, the analysis examines the overall trends in reported NSPs. A relocation effect would be evidenced by a reduction in NSP levels for stocks subject to bans , paired with an increase in NSP levels for stocks not subject to bans. However, while the expected decrease in short selling activity for banned stocks in our sample was observed, there is no discernible migration of NSPs to non-banned stocks, as shown in Figure C.1. The data reveals that prior to the introduction of short selling bans, there was a substantial increase in short positions in both set of countries. Following the implementation of these bans, NSPs in banned countries began to decrease immediately. Interestingly, activity in non-banned jurisdictions also showed a significant decline starting from mid-March, suggesting a broader slowdown in short selling activity overall.

Additionally, the number of unique active position holders declined from 97 to 59 in countries implementing bans, and increased from 223 to 228 in countries without such bans. This corresponds to a decrease of 39% in countries with bans and an increase of 2% in countries without bans. Overall, these numbers do not indicate a relocation effect from countries with bans to those without bans.

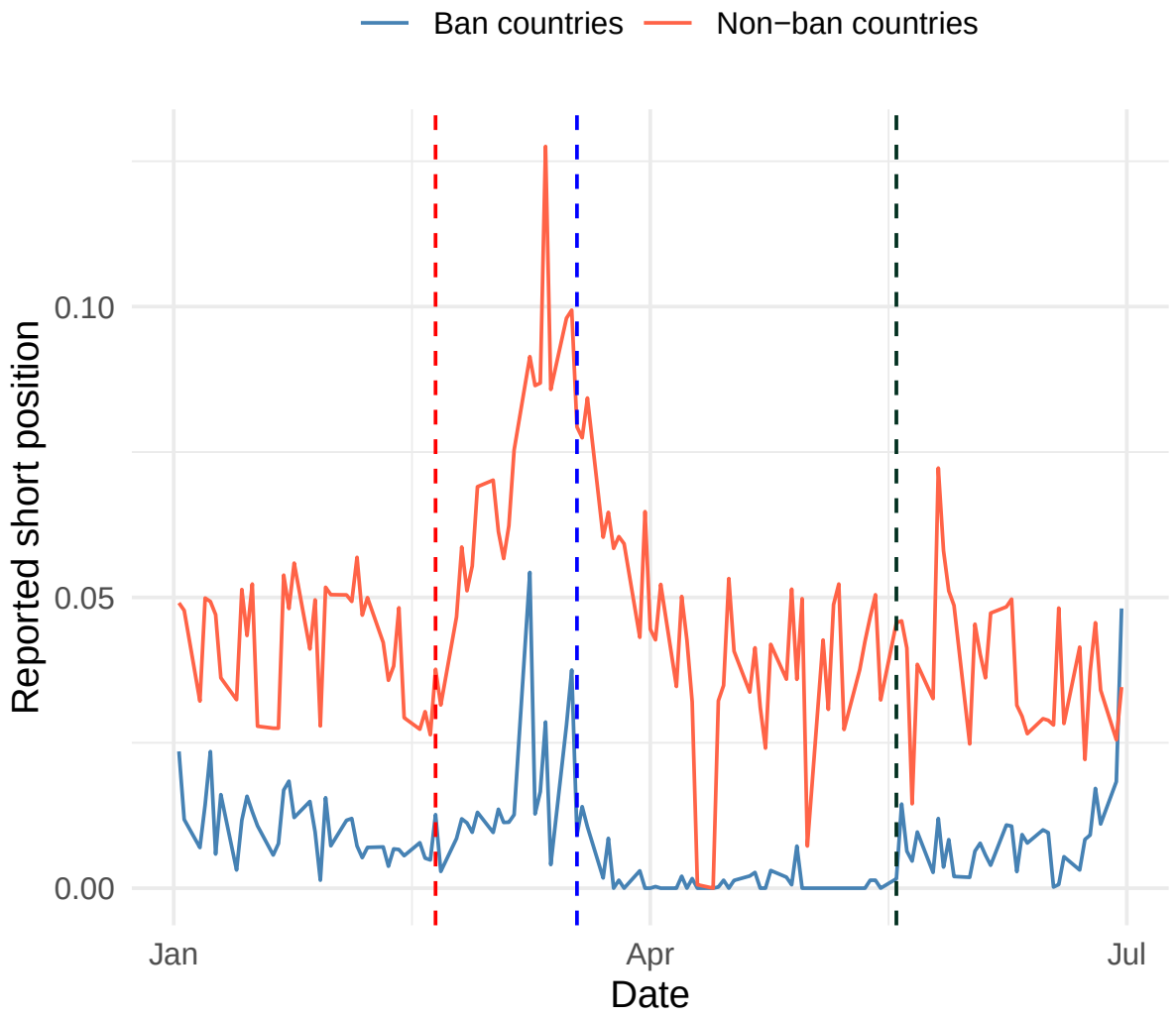

Figure C.1: Reported Short Positions

Note: This figure illustrates the average reported new short positions, or increases in existing short positions (as a percentage of issued capital), for all firms in Ban countries (blue line) and Non-ban countries (red line) for each day from January 1st to June 30th. The sample is based on the final group of firms in our study, which includes constituents of the STOXX Europe Total Market index. Of the 1,397 firms in the final sample, 539 were shorted at some point during this period. The data is retrieved from the WRDS European Short Data, a compilation of reports from the financial supervisory authority of each respective country. Consequently, all short positions below 0.5 percent of the issued share capital are excluded as they are not subject to public disclosure.