

The Impact of Short Selling Disclosure Regulatory Constraint on the Lending Market and Stock Ownership

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We examine the impact of the short sell disclosure (SSD) regime on the stock lending market and investor behaviors, employing a staggered difference-indifference (DiD) methodology. Our research reveals that the introduction of the disclosure regime enhances market transparency, resulting in a diminished appeal of stock ownership in the lending market for active investors. This shift is accompanied by a reduction in information leakage risks and longer loan durations. Specifically, our analysis reveals a significant decrease in the risk of loan recall by 4.87%, accompanied by an average increase of 23.72% in loan duration for short selling activities. Furthermore, the cost associated with short-sell disclosure causes a decline in both lending supply and short demand.

Keywords: short sell disclosure, stock equity, lending market, stock ownership

Introduction

The contentious issue surrounding the merits of short selling has attracted significant public attention, particularly during financial crises and bear markets. For example, during the international financial crisis of 2007 to 2009, short sellers faced criticism for allegedly engaging in deliberate actions aimed at manipulating securities prices, jeopardizing the stability of financial markets, and exacerbating market volatility, ultimately leading to downward price distortions (Hirshleifer, Teoh, & Yu, 2011).

Given the importance of addressing questions related to short-selling activities and the potential benefits of implementing a Short Sell Disclosure (SSD) regime, the Securities and Exchange Commission (SEC) of the United States proposed a rule in April 2022 (U.S. Securities and Exchange Commission, 2022), aiming to enhance transparency by requiring the publication of short sale-related data for investors and other market participants.

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While the SEC has lately implemented the SSD regime in October 2023, other financial markets have taken steps earlier to introduce standardized market-wide reporting and disclosure procedures for short sellers based on predefined thresholds established by individual market regulators' disclosure requirements. For example, the European Market Authority (ESMA) specifies that positions exceeding the higher threshold of 0.5% should be disclosed both to the regulator and the entire market (European Securities and Markets Authority, 2015). Figure 1 and Panel A show the probability distribution of short selling positions as a percentage of the respective stock capitalization in the German stock exchange. Notably, there is a concentration of short selling positions at the minimum legal threshold of 0.5%. Furthermore, the uniform distribution observed in Panel B suggests that the frequency of short sell disclosures is not significantly influenced by macroeconomic events.

Since 2008, the Tokyo Stock Exchange (TSE) and the Australian Securities and Investments Commission (ASIC) have implemented such procedures, encompassing stocks, derivatives, and treasuries. Subsequently, the European Securities and Market Authority (ESMA), the United Kingdom Financial Conduct Authority (FCA), and the Hong Kong Securities and Futures Commission (SFC) followed suit in 2012. The Financial Services Commission (FSC) of South Korea joined in 2016, and the Monetary Authority of Singapore (MAS) adopted similar measures in 2018. Detailed information about the SSD regimes is presented in Appendix Table A1.

While the SSD regime aims to enhance transparency in short selling, it has faced criticism and generated controversy. Some argue that the regime may have adverse effects on the positive contributions of well-informed short sellers, who are known for improving market informational efficiency (Diamond & Verrecchia, 1987). Additionally, it is suggested that the regime may significantly reduce market liquidity, restrict informed short sellers from trading negative fundamental information, reduce price efficiency, and increase pricing errors (Beber & Pagano, 2013).

However, studies indicate that the presence of short sellers can influence the behavior of firm managers in a positive manner. Massa, B. Zhang, and H. Zhang (2015) demonstrate that higher potential for short selling is associated with a lower likelihood of firms engaging in earnings manipulation, illustrating the disciplinary effect exerted by short selling.

Overall, the introduction of the SSD regime introduces a trade-off between enhanced transparency and potential effects on market efficiency, liquidity, and managerial behavior. These complexities necessitate further investigation to gain a comprehensive understanding of the implications and consequences of the SSD regime in different market contexts.

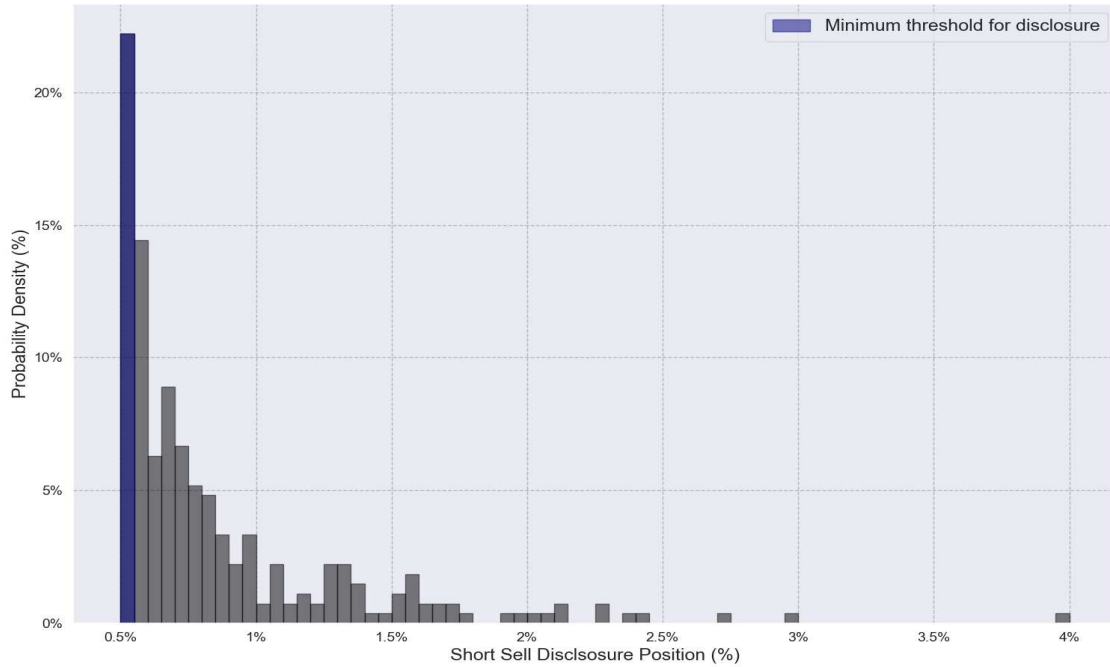
This paper aims to contribute to the ongoing debate by examining the impact of the short sell disclosure regime on the activities within the stock lending market and stock ownership.

Specifically, our research seeks to provide comprehensive insights into the following research question: How does the implementation of short sell disclosure regime influence the dynamism of the stock lending market and investor behaviors?

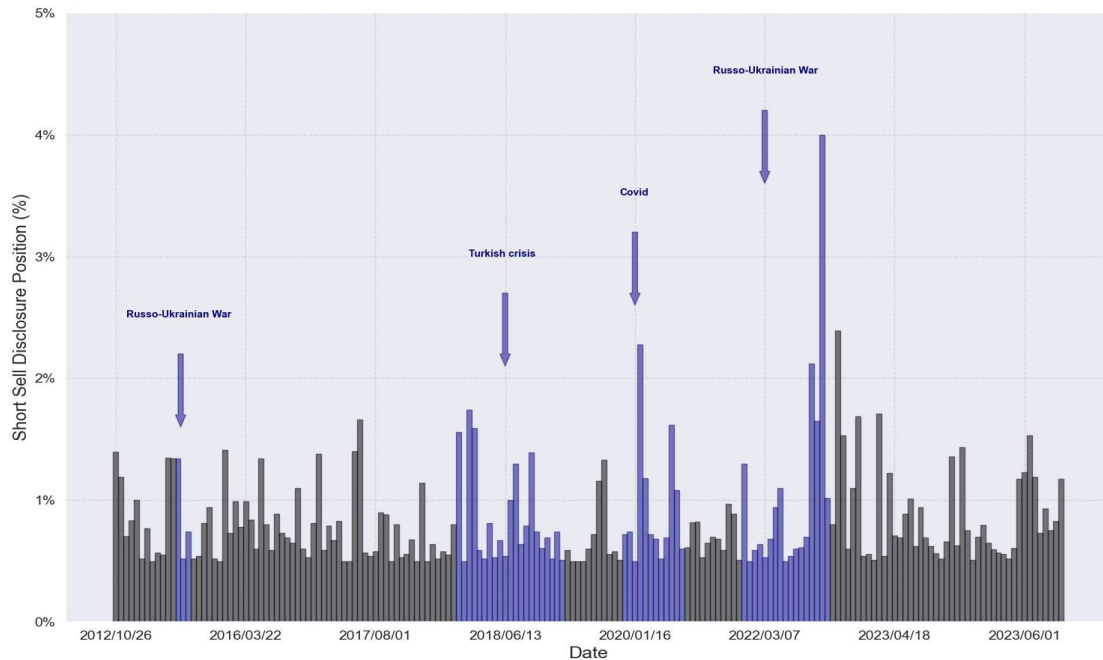
We employ a quasi-natural experiment approach, relying on variations observed within the stock lending market and investors behaviors at the stock-year-quarter level. This enables us to examine the causal impact of the implemented Short Sell Disclosure (SSD) regime on both the lending market and stock ownership. We employ a staggered difference-in-differences (DiD) methodology that incorporates heterogeneity treatment effects estimation to quantify the causal effect accurately.

Our research methodology involves constructing a treated group consisting of stocks listed on stock exchanges in countries where the corresponding market authority has implemented the short sell disclosure

regime. Specifically, the treated group includes stocks in countries such as Japan, Australia, the European Union, Great Britain, South Korea, Hong Kong, and Singapore. Conversely, our control group comprises stocks listed on the Securities and Exchange Commission (SEC) of the United States and the Investment Industry Regulatory Organization of Canada (IIROC), both of which have yet to adopt the disclosure regime.



Panel A. Short sell disclosed density



Panel B. Short sell disclosure frequency

Figure 1. Short sell disclosure analysis: outlook on the German Stock Exchange.

In this figure, we examine the short sell positions disclosed above or equal to the minimum legal threshold, as officially

reported by the Bundesanzeiger. Panel A presents the probability distribution of the market capitalization shorted per stock since 2012. The blue bar represents the minimum legal threshold of 0.5%, which accounts for approximately 22.5% of the total short sells. Panel B focuses on the frequency of short sells being disclosed after the implementation of the regulation. The blue bars highlight macro-events that impacted the European market.

Our study uncovers compelling evidence indicating a notable decline in the percentage of active investors following the implementation of the Short Sell Disclosure (SSD) regime. Concurrently, there is an increase observed in the contribution of passive investors. This finding underscores the diminished profitability associated with engaging in stock manipulation practices. Active investors, who previously benefited from participating in the stock lending market to imitate informed short sellers (Honkanen, 2020), now perceive fewer advantages in holding stocks since the information underlying short selling activities is publicly disclosed.

Consistent with D'Avolio (2002), who suggests that stocks held by passive investors face a reduced likelihood of unexpected share recalls and mimicry of short-selling strategies, our results show that the decrease of active investor participation effectively diminishes the "information leakage" risk faced by short sellers when borrowing shares from active investors. Specifically, our analysis reveals a significant decrease in the risk of loan recall by 4.87%, accompanied by an average increase in loan duration by 23.72%.

While one might anticipate that the reductions in both dynamic short-selling risks and information leakage risks would enhance the attractiveness of stocks for borrowing, leading to increased short-selling activity, our observations present a contrasting outcome. Surprisingly, we find that both the lending supply and the demand for short positions have experienced significant decreases. This finding raises valid arguments as active investors constitute a substantial proportion of stock lending market participants and are associated with lower, more favorable lending fees. Consequently, despite the increased safety in engaging in short selling activities, the associated costs have also escalated.

The stock lending market has been the subject of extensive research, exploring various aspects such as the relationships between equity lending stocks and institutional ownership (Christoffersen, Geczy, Musto, & Reed, 2007; Kolasinski, Reed, & Ringgenberg, 2013; Porras Prado, Saffi, & Sturgess, 2016; Ordóñez-Calafí & Thanassoulis, 2020). Additionally, prior studies (Massa et al., 2015; Grullon & Michaely, 2002; Grullon, Michenaud, & Weston, 2015) have investigated the impact of frictions in short selling activity on investor behavior and the distortion of firm fundamentals, impeding firms' capital-raising capabilities and prompting managerial responses to speculative trading. Building upon existing literature, our study contributes novel insights by investigating the effects of the Short Sell Disclosure (SSD) regime as a regulatory constraint. We explore how this regime influences both the dynamics of the stock lending market and the shifts in investor behaviors.

The remainder of this paper is as follows. Section 2 discusses the relevant literature and the development of our hypotheses. Section 3 describes our data, sample, and variable construction. Section 4 introduces our empirical strategies and presents the results. Section 5 concludes.

Hypothesis Development

Research on short-selling rules suggests that increased transparency can enhance market price efficiency, but it can also lead to reduced quote depths as traders seek to limit their trade exposure (Boehmer, Saar, & Yu, 2005). Empirical studies have found that market transparency improves liquidity by making order flows' size and direction more apparent to traders (Pagano & Röell, 1996; Naik, Neuberger, & Viswanathan, 1999).

Critics of short sell disclosure raise concerns about the potential infringement on informed investors'

intellectual property. The preference for non-disclosure among informed investors leads to reduced short selling activities to maintain trade privacy (Madhavan, 1995; Easley, O'Hara, & Yang, 2014). This reduction can limit the availability of underlying information from short sells (Di Maggio & Pagano, 2018) and prompt investors to avoid transparent markets. In contrast, uninformed investors may trade more aggressively due to lower selection costs associated with short selling (Chowdhry & Nanda, 1991). Consequently, the short sell disclosure regime has the potential to shape the composition of investors.

Honkanen (2020) finds that passive investors are less likely to utilize information from security lending and engage in short selling. Building on this finding, we hypothesize that the transparency of short selling may have a limited impact on the behavior of passive investors. In contrast, active investors, who benefit from exclusive information, are expected to decrease in proportion as the information becomes public. Thus, we propose the following hypothesis:

Hypothesis 1: *SSD leads to decreasing the proportion of active investors.*

With a decrease in the number of active investors, the risk of information leakage and mimic trades is expected to diminish, reducing the dynamic risks associated with short selling. Drawing on the findings of Engelberg, Reed, and Ringgenberg (2018), we investigate how the reduced presence of active investors in the stock lending market affects the risk of loan fees and loan recalls. Additionally, research by D'Avolio (2002) suggests that an increase in passive ownership results in a lower likelihood of lending duration limits, thereby increasing the average loan duration and reducing the risk associated with short sells. Consequently, we propose the second hypotheses:

Hypothesis 2: *SSD reduces information leakage, increases average duration of stock loan maturity, and increases the lending fee for borrowing stock.*

Considering the increased transparency of the short selling market coupled with the reduced dynamic risks, we anticipate a fertile environment for stock borrowing, thereby stimulating short-selling activities. Moreover, if a greater number of short sellers are willing to pay higher fees, we can also expect an expansion in the stock lending supply. This leads to our third hypothesis:

Hypothesis 3a: *SSD increases short-selling demand and stock lending supply.*

Alternatively, some argue that the disclosure regime may prompt short sellers to accumulate positions just below the disclosure threshold, incurring higher transaction costs (Wilcox, 1993; Jank, Riling, & Smajlbegovic, 2021). Additionally, the disclosure regime may impose opportunity costs on short sellers, counteracting the potential benefits of reduced costs associated with short-selling risks. This may lead to a decrease in overall short-selling demand, lending supply, and lending fees. Thus, we propose the following alternative hypothesis:

Hypothesis 3b: *SSD decreases short-selling demand and lending supply.*

The following section presents the methodology for constructing the dataset.

Data, Sample, and Variables

This section describes our data sources, sample, and variable definitions. For full definitions of all variables, we list them in Appendix Table A2. Table 1 presents the summary statistics, with all variables winsorized at the 1st and 99th percentiles. Our data come from multiple sources: the stock lending market data are from the HIS Markit database, the investors' characteristics data are from the Thomson Reuters Holding S12 database and the CRSP Mutual Fund database, the accounting and the stock pricing data are from Compustat-Capital IQ database.

Table 1

Summary Statistics

Variable	Obs	Mean	Std.	25%	Median	75%
Dependent variables						
Active Investor (%)	40,011	11.71	65.45	2.29	5.34	9.68
Passive Investor (%)	40,011	5.6	44.92	0.82	2.1	4.38
Recall Risk	125,622	1.17	0.88	0.44	1.01	1.76
Loan Duration	125,622	124.25	119.1	44.8	81.6	153.81
Lending Fee	125,622	0.035	0.055	0.0042	0.0092	0.05
Fee Risk	125,622	0.0075	0.02	3.90e-04	1.40e-03	7.40e-03
Lending Supply	125,622	0.138	0.28	2.80e-05	0.017	0.17
Short Demand	125,622	0.037	0.149	2.90e-05	0.0022	0.019
Independent variables						
1(SSD)	125,622	0.41	0.49	0	0	1
Control variables						
Firm Size	125,622	6.32	2.79	4.5	6.4	8.14
Cash Flow	125,622	0.0012	0.208	-0.0207	0.0037	0.029
Holding Quarter Return	125,622	0.0058	0.1	-0.036	0.0033	0.044
Quarter Volatility	125,622	4.307	6.98	1.59	2.23	3.38
Amihud Liquidity	125,622	0.0099	0.025	4.60e-05	3.40e-04	0.0037
Book to Market	125,622	0.49	0.42	0.14	0.38	0.78
Ptbi	125,622	0.0025	0.069	-0.013	0.0048	0.022
Ptbi Vol	125,622	0.055	0.054	0.011	0.033	0.097
Leverage	125,622	0.14	0.18	0.008	0.059	0.21
log(Firm Age)	125,622	3.1	0.53	2.77	3.095	3.4

Explanatory Variables

We obtain the corresponding stock lending data from the HIS (Markit) database, covering the period from January 1999 to January 2022 at both stock- and quarter-level. This comprehensive dataset captures over 90% of the global securities lending market and includes 5,766,418 observations. These observations pertain to 15,729 unique stocks across eight different market authorities, including European Union, the United Kingdom, Japan, South Korea, Hong Kong, Singapore, Australia, the United States, and Canada. We source accounting data from the Compustat-Capital IQ database (S&P Global Intelligence). After restricting our sample to the period of interest (2008 to 2022), and dropping missing observations, we obtain a final sample of 125,622 observations.

To assess the dynamic risks associated with short selling activities, we follow the methodology proposed by Engelberg et al. (2018). We construct several key dependent variables for our study. The first variable is the *Lending Supply*, which represents the fraction of shares available for borrowing. The second variable is the *Short Demand*, indicating the fraction of shares that have been borrowed. The third variable is the *Lending Fee*, which represents the annual fee charged for borrowing shares. The fourth variable is the *Loan Duration*, capturing the average number of days from the start date to the present for all open loans. We also construct two risk-related variables: the *Fee Risk* and the *Recall Risk*. The *Fee Risk* is calculated as the natural logarithm of the variance of daily lending fees for each stock-quarter observation, reflecting the risk of future increases in lending fees. The *Recall Risk* is computed as the natural logarithm of the variance of the daily short interest-to-lending supply ratio within each quarter, measuring the variation in the relative share availability and the potential for loan recalls.

Regarding investor characteristics, we classify investors into passive and active categories. We follow the classification procedure described by Iliev and Lowry (2015). We obtain investor names and identifiers from the

Thomson Reuters database and obtain investor classification information from the CRSP Mutual Fund database. We identify passive investors when CRSP indicates that the fund is an index fund, while all other funds are classified as active. To link investors to their respective listed firms, we match the investor classifications with the mutual fund quarterly holdings from the Thomson Reuters Mutual Fund Holding S12 database. By merging these databases, we calculate the percentage of market capitalization owned by passive and active investors at the end of each quarter. We obtain information on the number of shares outstanding within each quarter from the *Compustat* stock file.

Control Variables

In this subsection, we introduce control variables that account for stock characteristics, which have the potential to impact both the stock lending market and investor dynamics (Dittmar, 2000; Grullon & Michaely, 2002). Our selection of control variables aims to capture factors that can influence stock liquidity and corporate information quality.

We include *Firm Size* and *Cash Flow* as control variables. These variables are known to have implications for stock liquidity and may reflect the financial resources available to a firm. Additionally, we incorporate the *Book-to-Market ratio* as a proxy for a firm's long-term growth potential. To control for investors' momentum trades, we include the firm's *Holding Quarter Return*. This variable helps account for any performance-based trading strategies pursued by investors. We include the measure of risk *Stock Quarter Volatility*, representing the standard deviation of stock returns calculated using daily data over a month and averaged within each quarter. To assess a firm's operational risk and financial risk, we incorporate the *Ptbi* and *Ptbi Vol* variables. These variables capture the firm's pre-tax income and volatility relative to its total assets. Given the documented relationships between stock lending, stock liquidity, and investor behaviors (D'Avolio, 2002; Porras et al., 2016), we include the *Amihud Illiquidity* measure as an extended control variable. This measure, proposed by Amihud (2002), captures stock illiquidity by considering the ratio of absolute stock returns to trading volume:

$$Amihud\ Illiquidity_{iy} = \frac{1}{D_{iy}} \sum_{t=1}^{D_{iy}} \frac{|R_{iyd}|}{VOLD_{iyd}} \quad (1)$$

where D_{iy} is the number of days for stock i in year y . $|R_{iyd}|$ is the absolute return of stock i for year y in day t . $VOLD_{iyd}$ is the volume of trades of stock i for year y in day t . In our sample, we average the *Amihud Illiquidity* measure at stock- and quarter-level.

Finally, we introduce common controls, including the variable *Leverage* and the *Firm Age* in natural logarithm.

Empirical Specifications and Results

Staggered Difference-in-Difference Setting

To investigate the impact of SSD on our variables of interest, we establish the three fixed effects staggered DiD setting with heterogeneous treatment as our baseline regression model, and at the stock-year-quarter level:

$$Y_{st} = \alpha + \beta_1 1(SSD)_{mt} + \beta_2 X_{st-1} + FE_s + FE_m + FE_t + \epsilon_{smt} \quad (2)$$

where Y_{st} denotes a measure for stock s in year and quarter t as defined in Section 3.1. We introduce our main independent variable as the dummy $1(SSD)_{mt}$ which equals one the year-quarter t of the short sell disclosure regime implementation in a given stock exchange market m , otherwise equal 0. The vector X_{st-1} represents the

group of control variables described in Section 3.2, denoting stock characteristics at one quarter-lag level. We control for *Stock* fixed effect, *Time* fixed effect, *Market Authority* fixed effect, and cluster standard errors at the *Stock* level.

Survival Analysis

To ensure the validity of our empirical analyses, it is crucial to establish that the timing of the implementation of the short sell disclosure regime across different exchange markets is not influenced by preexisting operational, economic, or other observable factors. To address this concern, we employ a Weibull hazard model estimation following the methodology of Acharya, Drechsler, and Schnabl (2014). In this model, we consider the “failure event” as the date when the disclosure regime was first implemented in each respective exchange market of interest. The dependent variable in our analysis is the implementation of the disclosure regime (*SSD Event*), measured at the exchange market- and quarter-level. It takes a value of one for the year and quarter of regime effectiveness and zero otherwise. To account for potential influences, we include the corresponding stock- and quarter-level variables as independent variables in each regression: *Average Active Investor (%)*, *Average Passive Investor (%)*, *Average Fee Risk*, *Average Recall Risk*, *Average Lending Fee*, *Average Loan Duration*, *Average Lending Supply*, *Average Short Demand*. We also control for one-quarter lagged *Average Size*, *Average Cash Flow*, *Average Holding Quarter Return*, *Average Quarter Volatility*, *Average Amihud Liquidity*, *Average PTBI*, *Average PTBI Vol*, *Average Leverage*, *Average log(Firm Age)* to take into account for stock characteristics, and we control for *Country* and *Time* fixed effects.

The regression results of the Weibull hazard model are displayed in Table 2. Notably, the coefficients associated with the exchange-market level variables are found to be statistically insignificant across all regressions. This suggests that the implementation of the SSD regime is unrelated to the preexisting factors captured by these variables. The robustness of this result, as confirmed by the Weibull hazard model, strengthens the suitability of the SSD regime as an identification event for examining the causal impact on the dynamism of the stock equity lending market and investors’ behaviors.

Table 2

Timing of Short Sell Disclosure: Weibull Hazard Model

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	SSD Event							
Average Active Investor (%)	-1.20e-04 (-0.35)							
Average Passive Investor (%)		-0.001 (-0.80)						
Average Lending Fee			0.50 (0.36)					
Average Fee Risk				4.60 (0.28)				
Average Recall Risk					0.0061 (0.55)			
Average Loan Duration						1.50E-04 (0.39)		
Average Lending Supply							1.50e-04 (0.39)	
Average Short Demand								0.08 (0.56)

Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	Exchange Market	Exchange Market	Exchange Market	Exchange Market	Exchange Market	Exchange Market	Exchange Market	Exchange Market
Observations	372	372	464	464	464	464	464	464
R-squared	0.3188	0.3164	0.0717	0.0772	0.0703	0.0728	0.0719	0.0706

This table estimates a Weibull hazard model in which the “failure event” is the year the SSD regime becomes effective in a given Exchange Market. The dependent variable is the *SSD Event*, which equals one in years the legalization becomes effective and zero otherwise. The independent variables of interest are, *Average Active Investor (%)*, *Average Passive Investor (%)*, *Average Lending Fee*, *Average Fee Risk*, *Average Recall Risk*, *Average Loan Duration*, *Average Lending Supply*, and *Average Short Demand* which are the lagged average variables of all stocks in a given exchange market and in a given quarter. We control for *Average Size*, *Average Cash Flow*, *Average Holding Quarter Return*, *Average Quarter Volatility*, *Average Amihud Liquidity*, *Average PTBI*, *Average PTBI Vol*, *Average Leverage*, *Average log(Firm Age)*, together with *Country*, and *Time* fixed effects. Variables definitions are provided in Table A2. The *t*-values clustered at the *Exchange Market* level are in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Stock Lending Market Dynamism and Stock Ownership

To comprehensively examine the impact of the disclosure regime and evaluate *hypotheses 1* to *3*, we address the following key questions: (1) Are there any alterations in the characteristics of investors following SSD? (2) Does the implementation of the disclosure regime affect the dynamic risk associated with short selling? (3) How does the supply and demand in the stock lending market change after the introduction of SSD?

Based on Engelberg et al. (2018), the relationship between stock lending market stability and investor ownership profile informs our rationale. A shift towards a greater proportion of passive investors suggests reduced risk in short selling, while a significant presence of active investors indicates increased risk and decreased short demand. Figure 2 presents visual representations of the dynamics in the stock lending market, tending to provide support for *Hypotheses 2* and *3b*. Nevertheless, we aim to compare the effects between the treated and control groups.

To examine this conjecture, we replace the dependent variables in Section 0 with the following variables: *Active Investors (%)*, *Passive Investors (%)*, *Recall Risk*, *Fee Risk*, *Loan Duration*, *Short Interest*, *Lending Fee*, and *Lending Supply*.

Table 3 presents the results on the stock ownership profile of investors. Our findings indicate that after the implementation of the disclosure regime, the proportion of active investors (column 1) significantly decreases by 32.79% and is naturally coupled with an increase in the proportion of passive investors (column 2) by 43.21%.¹ Table 4 presents results on the stock lending market variations of behaviors. We observe lower risk associated with short selling activities, as reflected by fewer loan recalls from lenders (column 1), decreasing by 4.87%.² Additionally, we observe that the loan duration (column 2) increases on average by roughly 23.72% months, which enhances loan quality and enhances the safety of short selling.³

¹ 32.79% = 3.84 (coeff) / 11.71 (mean). 43.21% = 2.42 (coeff) / 5.6 (mean).

² 4.87% = 0.057 (coeff) / 1.17 (mean).

³ 23.72% = 29.48 (coeff) / 124.25 (mean).

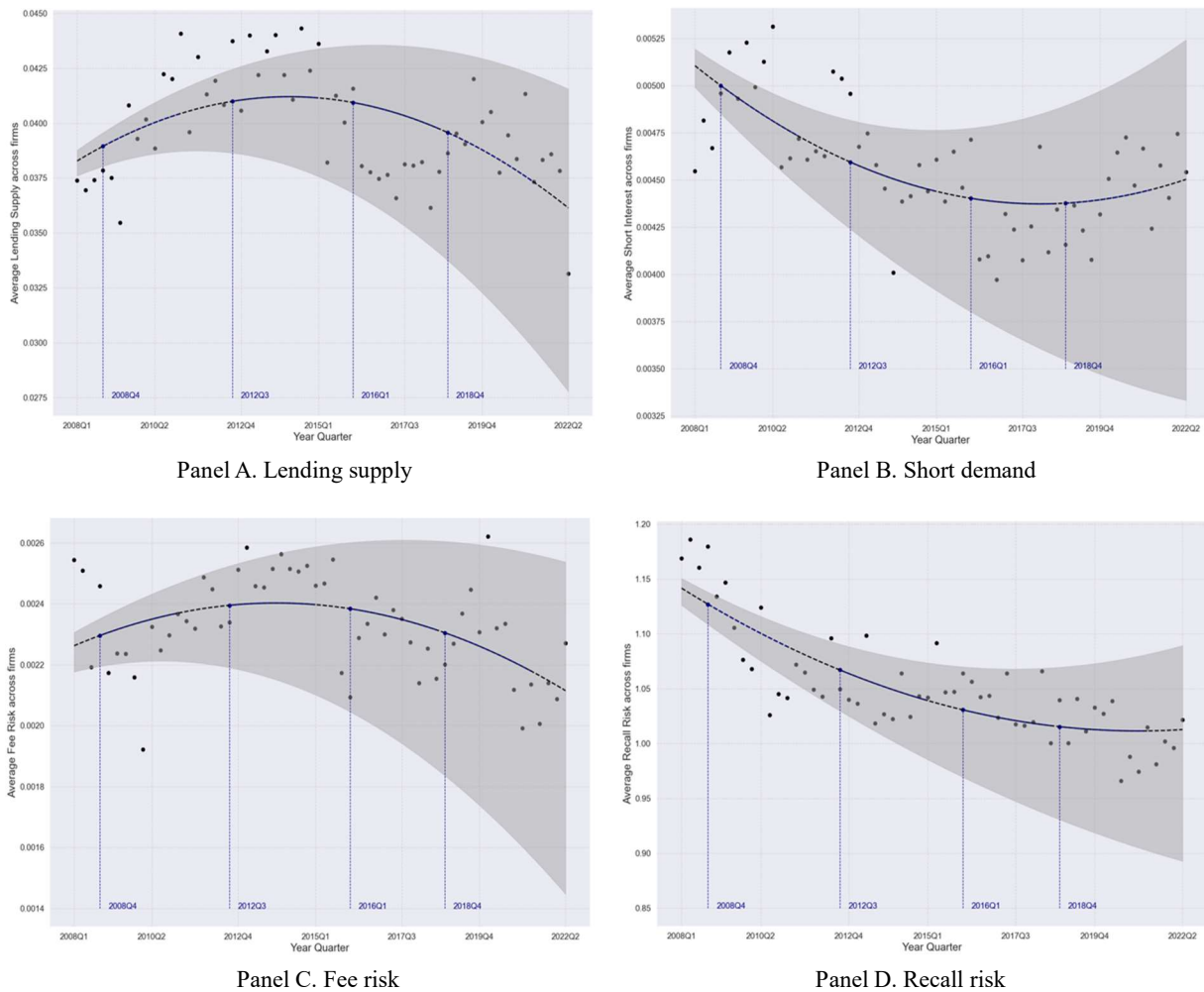


Figure 2. Analysis of stock lending market dynamics following staggered SSD disclosure.

This figure presents an analysis of the stock lending market dynamics subsequent to the implementation of the staggered SSD disclosure. Panel A illustrates the variations in lending supply, while Panel B showcases the changes in short demand. Additionally, Panel C and Panel D evaluate the shifts in risks commonly associated with short selling, specifically fee risk and recall risk, respectively.

These findings are consistent with prior research by Lamont (2012); Porras Prado et al. (2016), demonstrating the positive impact of passive investors on short selling and stock price efficiency. Surprisingly, despite the longer loan duration and the presence of more reliable lenders, we do not observe a substantial increase in lending fees (column 3). The fee risk increases (column 4) by 14.66%.⁴ We explain these results with the fact that following the SSD regime, the lending supply (column 5) and the short demand (column 6) become less attractive to investors, decreasing by 16.15% and 15.40% respectively.⁵ Therefore, on one hand, lenders do not increase fees to remain attractive; and on the other hand, the change in demand dynamics and the short sell regulatory on more transparency may affect the perceived risk associated with short selling and therefore influence the lending fees volatility.

⁴ 14.66% = 0.0011 (coeff) / 0.0075 (mean).

⁵ 16.15% = 0.0223 (coeff) / 0.138 (mean). 15.40% = 0.0057 (coeff) / 0.037 (mean).

These findings shed light on the multifaceted effects of the disclosure regime on short selling dynamics, investor characteristics, and the stock lending market, thereby substantiating our *hypotheses 1, 2* and rejecting *hypothesis 3a* in favor of *hypothesis 3b*.

Table 3

Impact of SSD on Investors Behaviors

Dep vars.	(1) Active investors (%)	(2) Passive investors (%)
1(SSD)	-3.84** (-2.03)	2.42 (-1.44)
Firm Size	-0.33** (-2.15)	-0.027 (-0.20)
Cash Flow	0.585 (-0.62)	0.678 (-0.75)
Holding Quarter Return	0.63 (-0.54)	-4.71 (-1.16)
Quarter Volatility	-0.0064 (-0.93)	0.09 (-1.05)
Amihud Liquidity	-1.23 (-0.27)	-9.01 (-1.26)
Book to Market	0.765* (-1.89)	0.704 (-1.41)
Ptbi	-1.09 (-0.24)	-2.23 (-1.01)
Ptbi Vol	-9.506 (-1.57)	5.28 (0.96)
Leverage	1.921 (-1.4)	4.37 (-0.98)
log(Firm Age)	0.077 (-0.01)	-1.68 (-0.68)
Constant	Yes	Yes
Stock FE	Yes	Yes
Stock Exchange FE	Yes	Yes
Time FE	Yes	Yes
Cluster	Stock	Stock
Observations	40,011	40,011
R-squared	0.8388	0.3817

This stock-year level table examines the impact of the SSD regime on Investor Behaviors: *Active Investor (%)*, and *Passive Investor (%)*. The independent variable of interest is *1(SSD)*. We control for one-year-lagged firm characteristics: *Size*, *Cash Flow*, *Holding Quarter Return*, *Quarter Volatility*, *Amihud Liquidity*, *PTBI*, *PTBI Vol*, *Leverage*, *log(Firm Age)*, together with *Stock*, *Stock Exchange*, and *Time* fixed effects. Variable definitions are provided in Table A2. The *t*-values clustered at the *Stock* level are in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 4
Impact of SSD on the Stock Lending Market

Dep vars.	(1) Recall Risk	(2) Loan Duration	(3) Lending Fee	(4) Fee Risk	(5) Lending Supply	(6) Short Demand
1(SSD)	-0.057*** (-3.60)	29.48*** (11.16)	-5.80e-04 (-0.66)	0.0011*** (4.82)	-0.0223*** (-6.98)	-0.0057** (-2.36)
Firm Size	-0.0033*** (-3.53)	0.23** (2.01)	-0.13e-3*** (-2.83)	-0.68e-4*** (-3.99)	0.39e-3** (1.89)	9.60E-05 (0.7)
Cash Flow	-0.006 (-0.55)	-0.304 (-0.23)	-0.14e-2** (-2.58)	-0.98e-3*** (-3.63)	0.31 (1.61)	-7.36e-05 (-0.05)
Holding Quarter Return	-0.143*** (-4.12)	2.41 (0.69)	-0.59e-2* (-1.69)	1.84e-05 (0.01)	7.10e-04 (0.13)	-0.025*** (-5.69)
Quarter Volatility	0.0077*** (7.72)	-0.315*** (-3.16)	0.461e-3*** (5.23)	0.14e-3*** (4.51)	-0.37e-3** (-2.90)	0.18e-3** (-2.25)
Amihud Liquidity	0.206 (0.92)	40.12** (2.41)	0.0336*** (2.72)	0.0115** (2.53)	-0.0763*** (-3.16)	-0.0141 (-0.99)
Book to Market	-0.019** (-2.63)	3.58*** (3.98)	-1.30e-04 (-0.30)	-2.06e-04 (-1.24)	-0.00289** (-2.34)	2.50e-04 (0.34)
Ptbi	-0.031 (-0.90)	-1.67 (-0.38)	-0.012*** (-5.96)	-0.22e-2** (-2.55)	0.015*** (-2.68)	-7.71e-04 (-0.21)
Ptbi Vol	0.1054 (1.61)	-22.36** (-2.36)	1.30e-04 (0.03)	2.10e-03 (1.48)	6.30e-03 (0.38)	2.36e-03 (0.23)
Leverage	0.019 (0.92)	0.146 (0.06)	0.23 (1.64*)	0.13e-2** (-2.52)	0.88e-2* (-1.94)	0.58e-2** (-2.27)
log(Firm Age)	-0.15*** (-3.22)	-1.02 (-0.13)	0.0021 (0.72)	-0.541 (-0.75)	0.051*** (3.98)	-4.70e-03 (-0.61)
Constant	Yes	Yes	Yes	Yes	Yes	Yes
Stock FE	Yes	Yes	Yes	Yes	Yes	Yes
Stock Exchange FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	Stock	Stock	Stock	Stock	Stock	Stock
Observations	125,622	125,622	125,622	125,622	125,622	125,622
R-squared	0.3353	0.4865	0.5554	0.3011	0.8313	0.7071

This stock-year level table examines the impact of the SSD regime on Stock Lending Market: *Recall Risk*, *Loan Duration*, *Lending Fee*, *Fee Risk*, *Lending Supply*, and *Short Demand*. The independent variable of interest is *I(SSD)*. We control for one-year-lagged firm characteristics: *Size*, *Cash Flow*, *Holding Quarter Return*, *Quarter Volatility*, *Amihud Liquidity*, *Book to Market*, *PTBI*, *PTBI Vol*, *Leverage*, *log(Firm Age)*, together with *Stock*, *Stock Exchange*, and *Time* fixed effects. Variable definitions are provided in Table A2. The *t*-values clustered at the *Stock* level are in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Conclusion

Our study aims to assess the actual impact of the short sell disclosure regime on capital markets as a risk mitigation measure. We find that the implementation of this regime results in notable changes to the investor structure of treated stock exchange markets. Specifically, there is a decrease in the participation of active investors due to the loss of their informational advantage following the disclosure regime. These changes are accompanied by significant shifts in the dynamics of the stock lending market, with short sell activities becoming relatively safer for sellers, particularly with a substantial reduction in the risk of information leakage. Interestingly, despite

the expectation of an increase in short demand due to reduced risk, both lending supply and short sell activities contract.

The findings of this study indicate that the short-sell disclosure regime positively impacts the stock market by reducing overall speculative activities associated with short selling. Finally, this study paves the way for in-depth research into corporate behavior, specifically examining how firms respond to changes in investor behavior and the potential impacts of short-sell disclosure on their shares.

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Appendix

Table A1

Details on Short Sell Disclosure Enactment

Market Zone	Market place authority	Effectuated period	Public disclosure threshold
Europe	European Securities and Market Authority (ESMA)	July 5th 2012	$\geq 0.5\%$
UK	The United Kingdom Financial Conduct Authority (FCA)	July 5th 2012	$\geq 0.5\%$
Japan	Tokyo Stock Exchange (TSE)	October 14th 2008	$\geq 0.5\%$
Australia	Australian Securities and Investments Commission (ASIC)	December 4th 2008	$\geq 0.01\%$
China, Hong Kong	Hong Kong Securities and Futures Commission (SFC)	June 18th 2012	$\geq 0.02\%$
South Korea	Financial Services Commission (FSC)	March 29th 2016	$\geq 0.5\%$
Singapore	The Monetary Authority of Singapore (MAS)	May 28th 2018	$\geq 0.2\%$

Table A2

Variable Definitions

Variable	Panel level	Definition	Source
Dependent Variables			
Active Investor (%)	Stock-Quarter	1 - (Total number of shares outstanding holds by Index Funds / Total number of shares outstanding holds by all Funds) within each stock quarter	CRSP Mutual Fund database, Thomson Reuters Mutual Fund Holdings S12, and S34 regenerated database
Passive Investor (%)	Stock-Quarter	(Total number of shares outstanding holds by Index Funds / Total number of shares outstanding holds by all Funds) within each stock quarter	CRSP Mutual Fund database, Thomson Reuters Mutual Fund Holdings S12, and S34 regenerated database
Recall Risk	Stock-Quarter	$\log(1 + \text{Std}(\text{Utilization}))$	IHS-Markit
Loan Duration	Stock-Quarter	Average Tenure	IHS-Markit
Lending Fee	Stock-Quarter	Indicative Fee	IHS-Markit
Fee Risk	Stock-Quarter	$\log(1 + \text{Std}(\text{Indicative Fee}))$	IHS-Markit
Lending Supply	Stock-Quarter	Active Lendable Quantity / Total Number Outstanding Shares	IHS-Markit, CRSP
Short Demand	Stock-Quarter	Quantity on Loan / Total Number Outstanding Shares	IHS-Markit, CRSP
Independent variables			
1 (SSD)	Stock-Quarter	Dummy a variable equal 1 from and after SSD implementation year, otherwise equal 0.	Financial Regulators
Control Variables			
Firm Size	Stock-Quarter	Natural logarithm of Total Assets (ITEM7230) in USD	CRSP Compustat's
Cash Flow	Stock-Quarter	(Income Before Extraordinary Items (IBQ) + Depreciation and	CRSP Compustat's
Holding Quarter	Stock-Quarter	$\log(\text{stock price end of quarter}) - \log(\text{stock price beginning of quarter})$	CRSP Compustat's

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Quarter Volatility	Stock-Quarter	Std(monthly returns in each quarter)	CRSP Compustat's
Amihud Liquidity	Stock-Quarter	Absolute return to dollar trading volume	CRSP Compustat's
Book to Market	Stock-Quarter	Common/Ordinary Equity (CEQQ) / (Price Close (PRCCQ))	CRSP Compustat's
Ptbi	Stock-Quarter	Pretax Income (PIQ) / lagged Total Assets (ATQ)	CRSP Compustat's
Ptbi Vol	Stock-Quarter	Standard deviation of (Pretax Income (PIQ) / lagged Total Assets (ATQ), over the last four quarters	CRSP Compustat's
Leverage	Stock-Quarter	Long-Term Debt (DLTTQ) / lagged Total Assets (ATQ).	CRSP Compustat's
Log(Firm Age)	Stock-Quarter	log(1 + Current year - Firm incorporation year)	CRSP Compustat's