Does Market Transparency Keep the Bear Asleep? Implications of Short Selling Disclosure on the Lending Market and Corporate Behaviors

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Abstract

We examine the impact of the short sell disclosure (SSD) regime on the stock lending market, corporate behaviors, and investor behaviors, employing a staggered difference-in-difference (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. Furthermore, the cost associated with short sell disclosure causes a decline in both lending supply and short demand. Notably, companies respond to increased transparency in short selling by repurchasing shares to mitigate potential public shorting threats. In addition, firms exhibit a tendency to save more cash and issue more debt as a response to heightened transparency regarding short selling activities. This effect is more pronounced for firms with stronger managerial incentives but less prominent for firms with limited financial flexibility.

Keywords: Short Sell Disclosure, Stock Equity, Lending Market, Share Buyback Policy

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1. 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, and 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.

While the SEC has yet to implement the SSD regime, other financial markets have taken steps 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 and 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 and Pagano (2013)).

However, studies indicate that the presence of short sellers can influence the behavior of firm managers in a positive manner. Massa, Zhang, and 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 firms' responses. 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, as well as the stock buyback strategies adopted by corporations?

We employ a quasi-natural experiment approach, relying on variations observed within

the stock lending market and firms' buyback policies at the firm-year-quarter level. This enables us to examine the causal impact of the implemented Short Sell Disclosure (SSD) regime on both corporate and investor behaviors. 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 (IIROC) of Canada, both of which have yet to adopt the disclosure regime.

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 a significant 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), which 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 29.48 months.

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.

Lastly, despite the objective of the Short Sell Disclosure (SSD) regime to alleviate short sell pressure on stocks, our analysis reveals that the disclosure of short sell positions imposes additional challenges on firms. To counteract the potential negative market perception and the exacerbation of information asymmetry among market participants, firms respond proactively by implementing strategic measures. Specifically, they engage in more frequent share repurchases, aiming to reduce the stock float and mitigate the perceived vulnerability to short selling disclosures. Additionally, firms bolster their cash reserves, which serve as a defensive mechanism to protect against potential shorting threats.

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 et al. (2007); Kolasinski, Reed, and Ringgenberg (2013); Porras Prado, Saffi, and Sturgess (2016); Ordóñez-Calafí and Thanassoulis (2020)). Additionally, prior studies (Massa, Zhang, and Zhang (2015); Grullon and Michaely (2002); Grullon, Michenaud, and 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 this existing literature, our study makes a novel contribution by examining the effects of the Short Sell Disclosure (SSD) regime as a regulatory constraint, not only on the dynamics of the stock lending market but also on corporate policies concerning share repurchase strategies.

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 variables construction. Section 4 introduces our empirical strategies and presents the results. Section 6 concludes.

2.   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, and Yu (2005)). Empirical studies have found that market transparency improves liquidity by making order flows' size and direction more apparent to traders (Pagano and Röell (1996); Naik et al. (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, and Yang (2014)). This reduction can limit the availability of underlying information from short sells (Di Maggio and 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 and 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 *The implementation of the SSD regime leads to a decrease in 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 our second and third hypotheses:

Hypothesis 2 *The dynamic risks of short selling linked to information leakage decline after the implementation of the SSD regime.*

Hypothesis 3 *The average duration of stock loan maturity and the lending fee for borrowing stock increase after the SSD regime.*

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 fourth hypothesis:

Hypothesis 4.a *Short-selling demand and stock lending supply increase after the implementation of the SSD regime.*

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, Roling, and 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 hy-

pothesis:

Hypothesis 4.b *Short-selling demand and lending supply, and lending fees decrease after the SSD regime.*

Under Hypothesis 4.b, the disclosure regime may reduce the demand for borrowed stock, resulting in a lower proportion of shorted shares and decreased likelihood of severe stock price effects. Consequently, if firms face less stock price pressure after SSD disclosure, their need for internal or external liquidity for share repurchases may decrease. This leads to formulate Hypothesis 5:

Hypothesis 5.a: *Share repurchases, cash holdings, and debt issuance decrease after the SSD regime.*

Some may argue that making a short sell position public can attract attention from other market participants, potentially leading to short squeezes and coordinated trading strategies against the firm. In contrast, prior to the implementation of SSD, this information was primarily limited to the lender. As a result, firms may respond to this increased scrutiny by accumulating more cash reserves and implementing aggressive corporate repurchase programs to support stock prices and convey positive signals to investors. Consequently, we propose the following competing hypothesis:

Hypothesis 5.b: *Share repurchases, cash holdings, and debt issuance increase after the SSD regime.*

3. 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, stock pricing data, and firms' buyback information are from Compustat-Capital IQ database.

3.1. 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 576,6418 observations. These observations pertain to 15,729 unique stocks across eight different market authorities, including Europe, the United Kingdom, Japan, South Korea, Hong Kong, Singapore, Australia, the United States, and Canada. 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 corresponding to 3.540 unique stocks.

To assess the dynamic risks associated with short selling activities, we follow the methodology proposed by Engelberg, Reed, and Ringgenberg (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 cate-

gories. 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. After dropping missing observations, we obtain a final sample of 40,027 observations corresponding to 1,007 unique stocks.

In order to assess the corporate reactions following the implementation of the disclosure regime, our study focuses on key variables related to a firm's share repurchase program. Firstly, we consider the *Repurchase Ratio*, which represents the ratio of stock repurchases in each quarter, scaled by lagged total assets. This variable allows us to examine the extent of a firm's share repurchases relative to its overall asset base.

Furthermore, we consider a firm's *Cash Holdings* divided by lagged total assets, which allows us to examine the level of cash reserves held by the firm relative to its asset base. This variable provides insights into the firm's liquidity position and its ability to finance various activities.

Lastly, we examine the firm's *Debt Issuance*, which is defined as the change in short-term and long-term debt divided by lagged assets. This variable enables us to assess the extent to which firms engage in debt issuance activities following the disclosure regime.

We source the required data from the Compustat-Capital IQ database (S&P Global Intelligence). After dropping missing observations, our sample consists of 103,366 observations, corresponding to 10,489 unique stocks.

3.2. 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 stock repurchase dynamics (Dittmar (2000); Grullon and 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 Prado, Saffi, and Sturgess (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:

$$AmihudIlliquidity_{iy} = \frac{1}{D_{iy}} \sum_{i-1}^{D_{iy}} \frac{|R_{iyd}|}{VOLD_{iyd}} \tag{1}$$

where $D_{i,y}$ 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.

4. Empirical Specifications and Results

4.1. 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:

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

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.

4.2. 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, 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 Repurchase Ratio, Average Debt Issuance, Average Cash Holding, Average Active Investor (%), Average Passive Investor (%), Average Fee Risk, Average Recall Risk, Average Lending Fee, Average Loan Duration, Average Lending Supply, Average Short Demand.*

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 corporate buyback policies.

4.3. Stock Lending Market Dynamism and Stock Ownership

To comprehensively examine the impact of the disclosure regime and evaluate hypotheses 1 to 4, 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, Reed, and Ringgenberg (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 4.b. Nevertheless, we aim to compare the effects between the treated and control groups.

To examine this conjecture, we replace the dependent variables in Equation (2) 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 3) increases on average by roughly 29 months, which enhances loan quality and enhances the safety of short selling. These findings are consistent with prior research by Lamont (2012); Porras Prado, Saffi, and Sturgess (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%.[3] We explain these results with the fact that following the SSD regime, the lending supply (column 5) and the short demand (column 6) becomes less attractive to investors, decreasing by 16.15% and 15.40% respectively.[4] 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.

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, 3 and rejecting hypothesis 4.a in favor of hypothesis 4.b.

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

[2]4.87% = 0.057 / 1.17

[3]14.66% = 0.0011 (coeff) / 0.0075 (mean)

[4]16.15% = 0.0223 (coeff) / 0.138 (mean). 15.40% = 0.0057 (coeff) / 0.037 (mean)

4.4. Corporate and Managerial Policies

To investigate the impact of the disclosure regime on corporate behaviors and address hypotheses 5.a and 5.b, we analyze whether the observed effects on the stock lending market translate into changes in corporate strategies. Specifically, we examine the potential increase in share repurchases as a response to the heightened risk of short selling, taking into consideration the proportion of active investors and the potential reduction in stock manipulation risks. To test these hypotheses, we replace the dependent variables in Equation (2) with *Repurchase Ratio, Debt Issuance, and Cash Holding.*

Table 5 presents the results using the aforementioned variables as dependent variables. Our results demonstrate a statistically significant rise in the volume of share repurchases relative to the firm's total assets following the implementation of the disclosure regime (column 1). More specifically, the ratio of share repurchase exhibits a significant increase of 1.67 times the sample mean.[5] This increase in repurchases suggests that despite the potential reduction in short selling, the enhanced transparency resulting from the disclosure may lead to a more negative perception of the firm's future prospects among market participants. Consequently, firm managers are motivated to take action to mitigate this risk. Furthermore, we observe a notable increase by 36.15% in the percentage change of debt issuance (column 2) and by 10.62% in cash holdings (column 3), which supports our previous findings.[6] This indicates that companies are actively accumulating liquidity or accessing external financing to facilitate their share repurchase initiatives.

This supports our alternative hypothesis 5.b and rejects the main hypothesis 5.a.

5. Effect Heterogeneity Analysis

In this subsection, we investigate the heterogeneous effects of the short sell disclosure regime on both the stock lending market and corporate share repurchase behaviors. We

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[5]1.67 = 0.0015 (coeff) / 0.000897 (mean)

[6]36.15% = 1.037 (coeff) / 2.87 (mean). 10.62% = 0.017 (coeff) / 0.16 (mean).

examine these effects from various perspectives, considering factors such as stock borrowing flexibility, financial constraints, and the sensitivity of CEO wealth-performance to stock prices.

We include an interaction term between the stock characteristics and the short sell disclosure regime indicator ($1SSD$) in Equation (2). The resulting regression model is formulated as follows:

$$Y_{st} = \alpha + \beta_1 1(SSD)_{mt} + \beta_2 1(SSD)_{mt} \times Interact_{st}$$
$$\beta_3 Interact_{st} + \beta_4 X_{s,t-1} + FE_s + FE_m + FE_t + \epsilon_{smt}, \tag{3}$$

To streamline the analysis, we focus on the following Y_{st} variables: *Repurchase Ratio, Debt Issuance, Cash Holding, Loan Duration, Lending Supply, Short Demand, and Recall Risk.*

5.1. Stock Borrowing Flexibility

We begin by examining whether the observed effects are more pronounced or mitigated when considering stocks with different borrowing characteristics as an interaction variable. Specifically, we concentrate on stocks that are deemed more challenging to borrow for short selling due to higher lending fees, greater institutional ownership concentration, and lower stock lending supply. We consider these stocks as "hard-to-borrow" stocks, while the rest are categorized as "easy-to-borrow" stocks, following the approach by D'avolio (2002); Blocher, Reed, and Van Wesep (2013); Kolasinski, Reed, and Ringgenberg (2013). This heterogeneity treatment analysis is supported by Figure 3, which illustrates the differences in investor behavior between Easy-to-Borrow and Hard-to-Borrow Stocks. Panel A demonstrates an upward trend in the proportion of active investors as stocks become easier to borrow, while Panel B indicates a corresponding increase in the share of passive investors as stocks become more difficult to borrow.

Thus, given the diminished advantages associated with short selling activities following

the implementation of the disclosure regime, it is reasonable to anticipate that short sellers and lenders would redirect their focus towards stocks that are easier to borrow in order to offset their losses. Consequently, we posit that the overall risk related to the dynamism of short selling cannot, on average, be effectively mitigated by the SSD policy. To test this inference, in Equation (3), we replace the interaction term $Interact_{st}$ with the dummy variable $1(EasytoBorrow)_{st}$, which takes a value of zero when the stock lending in a given quarter falls within the top 10% of the fee distribution, and one otherwise.

Results are presented in Table 6. We observe that the easy-to-borrow firms exhibit a higher prevalence of short selling activities, as evidenced by their greater supply (column 1) and demand (column 2). Additionally, the inherent risk associated with short selling is observed to increase, manifested by shorter loan duration (column 3) and an elevated lending fee volatility (column 4). Under the SSD regime, there is a decrease in lending opportunities and an increase in associated costs for short sellers. Consequently, lenders and short sellers tend to disperse their activities across a more diversified range of stocks due to their higher flexibility, mitigating the effect of SSD on those stocks.

5.2.   Financial Constraints

Furthermore, we aim to examine whether the impact of the short sell disclosure regime is consistent among firms facing greater financial constraints, building upon our earlier findings. Our previous analysis reveals that firms significantly increase their liquidity capacity through higher cash holdings and increased debt issuance following the implementation of the disclosure regime. This aligns with the observation that these firms tend to pursue more aggressive share buyback policies. Consequently, we investigate the effect of the disclosure regime on firms that experience greater difficulty in financing their ongoing operations.

On one hand, some arguments suggest that managers of financially constrained firms would be more proactive in undertaking share buybacks to mitigate the potential adverse effects of short selling and address their future difficulties in obtaining external funding. On

the other hand, it may be expected that such financially constrained firms would encounter challenges in sustaining share buyback policies due to limited liquidity and difficulties in issuing debt. We expect firms with more financial constraints to encounter less flexibility to react to short sell disclosure. To test these hypotheses, we proxy for financing constraints using the interaction term in Equation (3) with the variable *KZ Index$_{st}$* (Kaplan and Zingales (1995)), which measures the relative reliance of firms on external financing.[7]

Table 7, presents the results. Consistent with the cost associated with share repurchase policies, we find that firms that face greater financial contraint and have more difficulties accumulating precautionary savings are particularly unlikely to implement share repurchase policies.

5.3. CEO Wealth Performance Sensitivity

Lastly, we put forth the hypothesis that managers are more inclined to engage in share repurchases to support stock prices when their interests are closely aligned with those of the firm shareholders. A higher degree of managerial incentive may enhance their capacity to execute stock buybacks, thereby offsetting selling pressure resulting from an increase in short selling activities following the disclosure regime. To measure the alignment of managerial incentives, we adopt the executive wealth-performance sensitivity measure, *ExecWPS*, as suggested by Edmans, Gabaix, and Jenter (2017). It is defined as the change in executive wealth for a one-percent change in firm value, divided by annual flow compensations. We compile our dataset by gathering relevant data for treated firms from the BoardEx database, accessible via the WRDS platform. We subsequently test our final hypothesis by replacing the interaction term in Equation (3) with the variable *ExecWPS$_{st}$*.

Our test evaluates the impact of *Repurchase Ratio*, and liquidity measures vary with managerial wealth sensitivity to stock prices. The significant estimated coefficients at 0.1% for the *1(SSD) × ExecWPS* in columns (1), (2), and (3) of Table 8 are quite revealing.

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[7]We construct the Kaplan-Zingales Index following the methodology outlined in Lamont, Polk, and Saaá-Requejo (2001)

These findings suggest that the implementation of the SSD regime influences managerial decisions regarding stock repurchase programs and liquidity management, particularly when the disclosure of short selling poses a potential threat to the value of managerial incentives.

6. 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. However, there is a discernible trend of short sellers gravitating towards stocks that are easier to borrow. Furthermore, the disclosure of short sell information is perceived as a greater threat by executive managers, leading to an increase in stock buyback policies following the implementation of the regime. This effect is more pronounced for firms with stronger managerial incentives but less prominent for firms with limited financial flexibility.

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Tables and Figures

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.

Panel A. Short Sell Disclosed Density
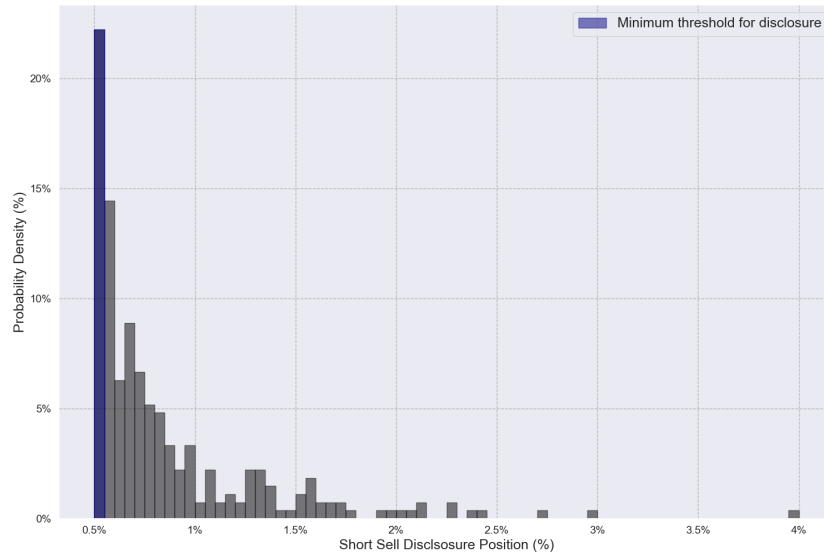
Panel B. Short Sell Disclosure Frequency
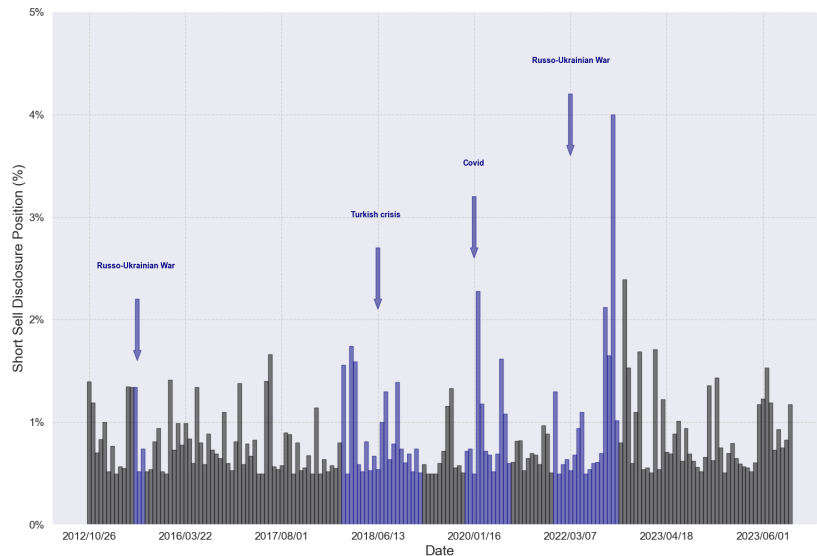
Figure 2. Analysis of Stock Lending Market Dynamics following Staggered SSD Disclosure

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.

Panel A. Lending Supply
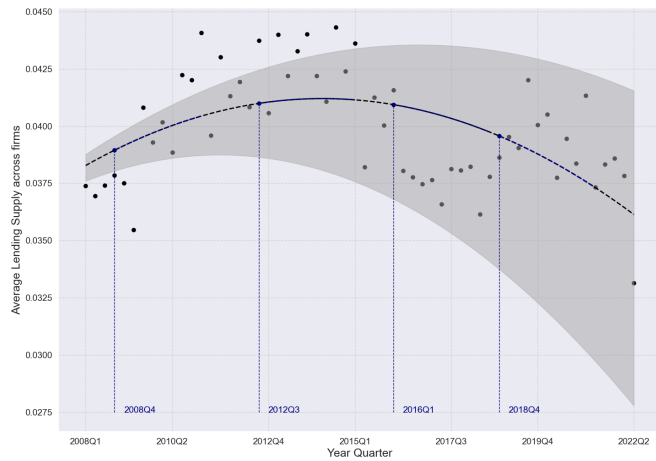
Panel B. Short Demand
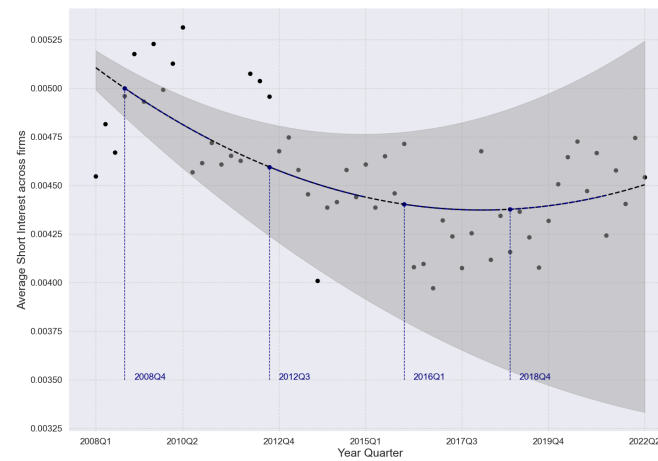
Panel C. Fee Risk
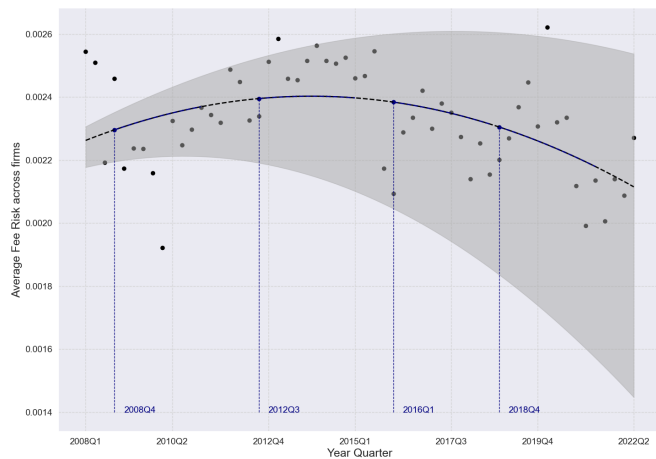
Panel D. Recall Risk
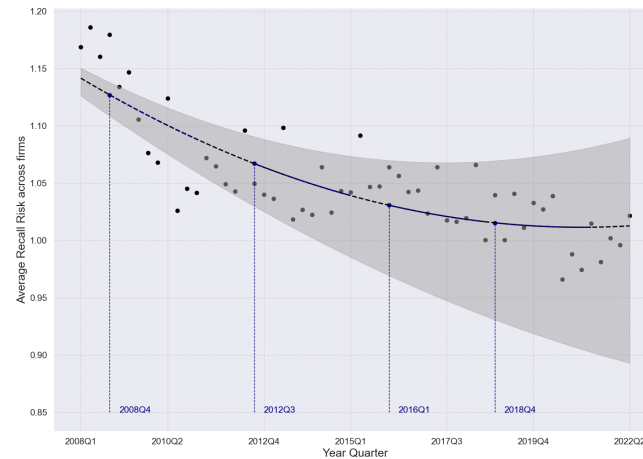
Figure 3. Investor Behavior Analysis: A Comparison between Easy-to-Borrow and Hard-to-Borrow Stocks

This figure provides a comparative analysis of the distribution of active and passive investors' proportions based on the ease of borrowing the stock for short selling. Panel A displays the density distribution of active investors' share for both easy-to-borrow stocks (represented by black bars) and hard-to-borrow stocks (represented by blue bars). The mean density increases as the stock becomes more readily borrowable. Panel B presents the density distribution of passive investors' share for easy-to-borrow stocks (black bars) and hard-to-borrow stocks (blue bars). We observe that the mean density rises as the stock becomes more challenging to borrow.

Panel A. (%) Active Investors
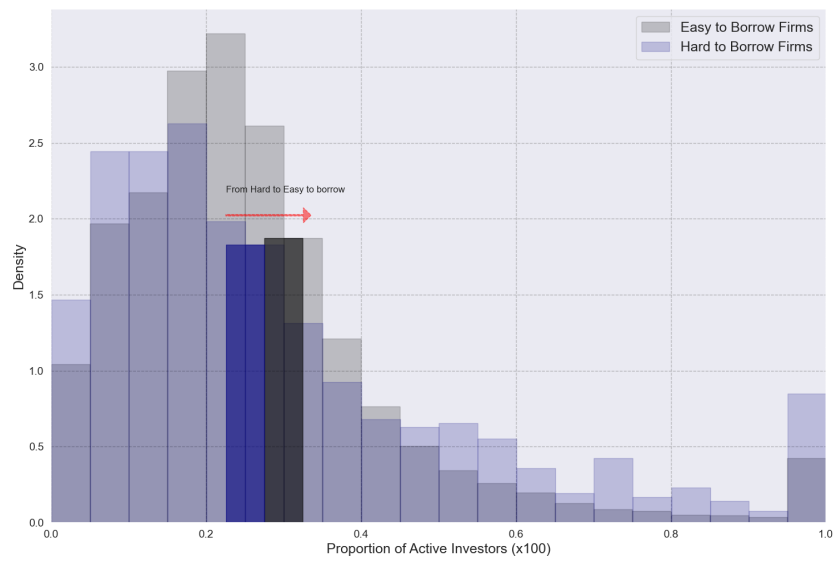
Panel B. (%) Passive Investors
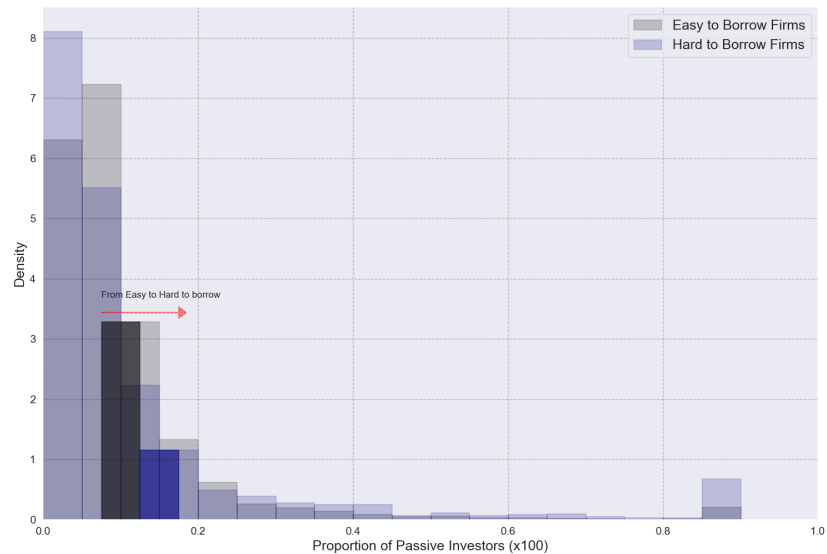
Table 1. Summary Statistics

Variable	Obs	Mean	Std	25%	Median	75%

Panel A. Corporate Behavior

Variable	Obs	Mean	Std	25%	Median	75%
Dependent Variables						
Repurchase Ratio	41,017	0.897e-3	0.0109	0.00	0.00	0.00
Debt Issuance	80,561	2.87	24.54	-6.86	0.00	8.06
Cash Holding	80,561	0.16	0.18	0.041	0.101	0.210
Independent Variables						
1(SSD)	103,366	0.38	0.48	0	0	1
Control Variables						
Firm Size	103,366	6.08	2.78	4.23	6.15	8.00
Cash Flow	103,366	0.0029	0.207	-0.024	0.0041	0.0317
Holding Quarter Return	103,366	0.0047	0.098	-0.043	-0.0025	0.039
Quarter Volatility	103,366	4.73	7.71	1.77	2.59	4.078
Amihud Liquidity	103,366	0.062	2.44	0.97e-4	0.69e-3	0.0059
Book to Market	103,366	0.48	0.41	0.13	0.36	0.73
Ptbi	103,366	0.0042	0.066	-0.015	0.0058	0.023
Ptbi Vol	103,366	0.060	0.054	0.015	0.040	0.10
Leverage	103,366	0.13	0.18	0.0075	0.054	0.20
log(Firm Age)	103,366	2.86	0.67	2.57	2.89	3.26

Panel B. Investor Behavior

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	2.10	4.38
Independent Variables						
1(SSD)	40,011	0.117	0.32	0	0	0
Control Variables						
Firm Size	40,011	6.38	2.33	4.85	6.41	7.77
Cash Flow	40,011	0.45e-3	0.11	-0.011	0.0055	0.028
Holding Quarter Return	40,011	0.0024	0.10	-0.039	0.0028	0.045
Quarter Volatility	40,011	6.36	20.029	1.68	2.48	3.88

Table 1. Summary Statistics - Continued

Amihud Liquidity	40,011	0.018	0.047	0.47e-4	0.39e-3	0.0061
Book to Market	40,011	0.51	0.40	0.18	0.42	0.79
Ptbi	40,011	0.59e-3	0.060	-0.013	0.0042	0.022
Ptbi Vol	40,011	0.037	0.046	0.0058	0.016	0.049
Leverage	40,011	0.16	0.20	0.0063	0.066	0.26
log(Firm Age)	40,011	2.98	0.47	2.71	3.049	3.26

Panel C. The Stock Lending Market Behavior

Dependent Variables						
Recall Risk	125,622	1.17	0.88	0.44	1.01	1.76
Loan Duration	125,622	124.25	119.1	44.80	81.60	153.81
Lending Fee	125,622	0.035	0.055	0.0042	0.0092	0.05
Fee Risk	125,622	0.0075	0.020	0.39e-3	0.14e-2	0.74e-2
Lending Supply	125,622	0.138	0.28	0.28e-4	0.017	0.17
Short Demand	125,622	0.037	0.149	0.29e-4	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	4.50	6.40	8.14
Cash Flow	125,622	0.0012	0.208	-0.0207	0.0037	0.029
Holding Quarter Return	125,622	0.0058	0.10	-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	0.46e-4	0.34e-3	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	3.10	0.53	2.77	3.095	3.40

Table 2. Timing of Short Sell Disclosure: Weibull Hazard Model

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 Regime event, which equals one in years the legalization becomes effective and zero otherwise. The independent variables of interest are *Average Repurchase Ratio, Average Debt Issuance, Average Cash Holding, 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 firms in a given exchange market and in a given year. All independent variables are at the exchange-market-year level. Variables definitions are provided in Table A2. The t-values clustered at the state (province) level are in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
						SSD Regime					
Average Repurchase Ratio	-0.32										
	(-0.10)										
Average Debt Issuance		-0.0047									
		(-0.11)									
Average Cash Holding			-0.263								
			(-0.26)								
(%) Active Investor				-0.12e-3							
				(-0.35)							
(%) Passive Investor					-0.0010						
					(-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									0.15e-3		
									(0.39)		
Average Lending Supply										0.15e-3	
										(0.39)	
Average Short Demand											0.08

											(0.56)
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	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	Exchange Market	Exchange Market	Exchange Market
Observations	161	184	184	372	372	464	464	464	464	464	464
R-squared	0.2550	0.1741	0.1500	0.3188	0.3164	0.0717	0.0772	0.0703	0.0728	0.0719	0.0706

Table 3. Impact of SSD on Investors Behaviors

This firm-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 firm, stock, Stock Exchange, and Time fixed effects. Variable definitions are provided in Table A2. The t-values clustered at the firm level are in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)
Dependent variables:	Active Investor (%)	Passive Investor (%)
1(SSD)	-3.84**	2.42
	(-2.03)	(1.44)
Firm Size	-0.33**	-0.027
	(-2.15)	(-0.20)
Cash Flow	0.585	0.678
	(0.62)	(0.75)
Holding Quarter Return	0.63	-4.71
	(0.54)	(-1.16)
Quarter Volatility	-0.0064	0.09
	(-0.93)	(1.05)
Amihud Liquidity	-1.23	-9.01
	(-0.27)	(-1.26)
Book to Market	0.765*	0.704
	(1.89)	(1.41)
Ptbi	-1.09	-2.23
	(-0.24)	(-1.01)
Ptbi Vol	-9.506	5.28
	(-1.57)	(0.96)
Leverage	1.921	4.37
	(1.40)	(0.98)
log(Firm Age)	0.077	-1.68
	(0.01)	(-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

Table 4. Impact of SSD on the Stock Lending Market

This firm-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 *1(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 firm, stock, Stock Exchange, and Time fixed effects. Variable definitions are provided in Table A2. The t-values clustered at the firm level are in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variables:	Recall Risk	Loan Duration	Lending Fee	Fee Risk	Lending Supply	Short Demand
1(SSD)	-0.057***	29.48***	-0.58e-3	0.0011***	-0.0223***	-0.0057**
	(-3.60)	(11.16)	(-0.66)	(4.82)	(-6.98)	(-2.36)
Firm Size	-0.0033***	0.23**	-0.13e-3***	-0.68e-4***	0.39e-3**	0.96e-4
	(-3.53)	(2.01)	(-2.83)	(-3.99)	(1.89)	(0.70)
Cash Flow	-.006	-0.304	-0.14e-2**	-0.98e-3***	0.31	-0.736e-4
	(-0.55)	(-0.23)	(-2.58)	(-3.63)	(1.61)	(-0.05)
Holding Quarter Return	-.143***	2.41	-0.59e-2*	0.184e-4	0.71e-3	-0.025***
	(-4.12)	(0.69)	(-1.69)	(0.01)	(0.13)	(-5.69)
Quarter Volatility	.0077***	-.315***	0.461e-3***	0.14e-3***	-0.37e-3**	0.18e-3**
	(7.72)	(-3.16)	(5.23)	(4.51)	(-2.90)	(2.25)
Amihud Liquidity	0.206	40.12**	0.0336***	0.0115**	-0.0763***	-0.0141
	(0.92)	(2.41)	(2.72)	(2.53)	(-3.16)	(-0.99)
Book to Market	-0.019**	3.58***	-0.13e-3	-0.206e-3	-0.00289**	0.25e-3
	(-2.63)	(3.98)	(-0.30)	(-1.24)	(-2.34)	(0.34)
Ptbi	-.031	-1.67	-0.012***	-0.22e-2**	0.015***	-0.771e-3
	(-0.90)	(-0.38)	(-5.96)	(-2.55)	(2.68)	(-0.21)
Ptbi Vol	.1054	-22.36**	0.13e-3	0.21e-2	0.63e-2	0.236e-2
	(1.61)	(-2.36)	(0.03)	(1.48)	(0.38)	(0.23)
Leverage	.019	.146	0.23	0.13e-2**	0.88e-2*	0.58e-2**
	(0.92)	(0.06)	(1.64*)	(2.52)	(1.94)	(2.27)
log(Firm Age)	-0.15***	-1.02	0.0021	-0.541	0.051***	-0.47e-2
	(-3.22)	(-0.13)	(0.72)	(-0.75)	(3.98)	(-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

Table 5. Impact of SSD on Corporate Behaviors

This firm-year level table examines the impact of the SSD regime on Corporate Behaviors: *Repurchase Ratio, (%) Debt Issuance*, and *Cash Holding*. 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 firm, stock, Stock Exchange, and Time fixed effects. Variable definitions are provided in Table A2. The t-values clustered at the firm level are in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variables:	(1) Repurchase Ratio	(2) (%) Debt Issuance	(3) Cash Holding
1(SSD)	0.0015***	1.037***	0.017***
	(2.59)	(2.42)	(5.59)
Firm Size	3.21e-06	-0.021	-0.00081***
	(0.17)	(-0.60)	(-4.41)
Cash Flow	-0.00038	-0.731*	-0.0065**
	(-1.11)	(-1.66)	(-2.35)
Holding Quarter Return	0.0018	-6.01***	0.059***
	(1.29)	(-4.33)	(6.30)
Quarter Volatility	0.27e-4	-0.041	-0.247e-3
	(1.52)	(-1.48)	(-0.77)
Amihud Liquidity	4.11e-06	0.874	-0.0032
	(1.52)	(0.93)	(-0.88)
Book to Market	0.208e-4	0.225	-0.00824***
	(0.11)	(0.93)	(-4.25)
Ptbi	-0.263e-4	-8.04***	-0.0056
	(-0.02)	(-5.13)	(-0.62)
Ptbi Vol	-0.637e-3	1.34	-0.0353***
	(-0.62)	(0.72)	(-5.88)
Leverage	-0.00117	-7.79***	-0.0041
	(-1.06)	(-9.77)	(-0.34)
log(Firm Age)	0.463e-3	-1.086	0.181***
	(0.80)	(-1.20)	(5.06)
Constant	Yes	Yes	Yes
Stock FE	Yes	Yes	Yes
Stock Exchange FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Cluster	Stock	Stock	Stock
Observations	41,017	80,561	80,561
R-squared	0.1743	0.3817	0.6863

Table 6. Effect Heterogeneity on Easy to Borrow Stock

This table presents the different impacts of the SSD regime on the Lending Market considering the borrowing flexibility disparities between firms for heterogeneous treatment groups. The dependent variables are *Repurchase Ratio, (%) Debt Issuance*, and *Cash Holding*. The independent variable of interest is *1(SSD)* and its interaction term *1(EasyToBorrow)*. 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 firm, stock, Stock Exchange, and Time fixed effects. Variable definitions are provided in Table A2. The t-values clustered at the firm level are in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)
Dependent variables:	Lending Supply	Short Demand	Loan Duration	Fee Risk
1(SSD)	-0.050***	-0.012***	44.73***	0.0013**
	(-8.54)	(-3.28)	(10.97)	(2.04)
1(SSD) * 1(EasytoBorrow)	0.0303***	0.0075**	-17.77***	0.0014**
	(4.92)	(2.05)	(-4.88)	(2.05)
1(EasytoBorrow)	0.0082***	-0.0031**	13.88***	-0.0125***
	(4.02)	(-2.32)	(5.65)	(-20.49)
Stock Control	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes
Stock FE	Yes	Yes	Yes	Yes
Stock Exchange FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Cluster	Stock	Stock	Stock	Stock
Observations	122,478	122,478	122,478	122,478
R-squared	0.8357	0.7237	0.4878	0.3346

Table 7. Effect Heterogeneity on Financial Constraints

This table presents the different impacts of the SSD regime on corporate behaviors considering the difference in financial constraints between firms for heterogeneous treatment groups. The dependent variables are *Repurchase Ratio, (%) Debt Issuance*, and *Cash Holding*. The independent variable of interest is *1(SSD)* and its interaction term *KZ Index*. 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 firm, stock, Stock Exchange, and Time fixed effects. Variable definitions are provided in Table A2. The t-values clustered at the firm level are in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)
Dependent variables:	Repurchase Ratio	(%) Debt Issuance	Cash Holding
1(SSD)	0.00137***	-0.0156***	0.0171***
	(2.74)	(-3.49)	(6.36)
1(SSD) * KZ Index	0.284e-4***	-0.797e-3**	0.74**
	(2.72)	(-2.31)	(2.41)
KZ Index	-0.196e-4	0.0052***	-0.010***
	(-1.18)	(10.15)	(-18.19)
Stock Control	Yes	Yes	Yes
Constant	Yes	Yes	Yes
Stock FE	Yes	Yes	Yes
Stock Exchange FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Cluster	Stock	Stock	Stock
Observations	26,215	73,759	73,759
R-squared	0.1397	0.784	0.7533

Table 8. Effect Heterogeneity on CEO Wealth Performance

This table presents the different impacts of the SSD regime on corporate behaviors considering the difference in managerial incentives policies between firms for heterogeneous treatment groups. The dependent variables are *Repurchase Ratio, (%) Debt Issuance*, and *Cash Holding.* The independent variable of interest is *1(SSD)* and its interaction term *ExecWPS*. 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 firm, stock, Stock Exchange, and Time fixed effects. Variable definitions are provided in Table A2. The t-values clustered at the firm level are in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)
Dependent variables:	Repurchase Ratio	(%) Debt Issuance	Cash Holding
1(SSD)	0.0123**	0.75**	0.11**
	(2.15)	(2.28)	(2.22)
1(SSD) * ExecWPS	0.102e-3	0.017**	0.0033**
	(2.22)	(2.34)	(2.15)
ExecWPS	-0.51e-4**	-0.24e-2	-0.13e-3
	(-2.14)	(-0.79)	(-1.13)
Stock Control	Yes	Yes	Yes
Constant	Yes	Yes	Yes
Stock FE	Yes	Yes	Yes
Stock Exchange FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Cluster	Stock	Stock	Stock
Observations	2,081	3,177	3,177
R-squared	0.2362	0.1348	0.5734

The Appendix

Table A1. Detailed on Short Sell Disclosure Enactment

Market Zone	Market Place Authority	Effected Period	Public Disclosure Threshold
Europe	European Securities and Market Authority (ESMA)	July 5th 2012	≥ 0.5%
UK	The United Kingdom Financial Conduct Authority (FCA)	July 5th 2012	≥ 0.5%
Japan	Tokyo Stock Exchange (TSE)	October 14th 2008	≥ 0.5%
Australia	Australian Securities and Investments Commission (ASIC)	December 4th 2008	≥ 0.01%
China - Hong Kong	Hong Kong Securities and Futures Commission (SFC)	June 18th 2012	≥ 0.02%
South Korea	Financial Services Commission (FSC)	March 29th 2016	≥ 0.5%
Singapore	The Monetary Authority of Singapore (MAS)	May 28th 2018	≥ 0.2%

Table A2. Variable Definitions

Variable	Panel Level	Definition	Source
Dependent Variables			
Repurchase Ratio	Stock-Quarter Level	Purchase of Common and Preferred Stock (PRSTKC) / lagged TOTAL ASSETS (ATQ)	*CRSP - Compustat's*
(%) Debt Issuance	Stock-Quarter Level	(Debt in Current Liabilities (DLCQ) +Long-Term Debt - Total (DLTTQ)) / lagged TOTAL ASSETS (ATQ)	*CRSP - Compustat's*
Cash Holding	Stock-Quarter Level	Share of Electricity production from Nuclear Power Plants over Total Electricity Production (Low carbon source) in previous year.	*BP Statistical Review of World Energy & Ember*
(%)Gas Elec	Country-Year	Cash and Short-Term Investments (CHEQ) / lagged TOTAL ASSETS (ATQ)	*CRSP - Compustat's*
Active Investor (%)	Stock-Quarter Level	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 Level	(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 Level	log(1 + Std(Utilization))	*IHS-Markit*
Loan Duration	Stock-Quarter Level	Average Tenure	*IHS-Markit*

Table A2. Variable Definitions - Continued

Lending Fee	Stock-Quarter Level	Indicative Fee	*IHS-Markit*
Fee Risk	Stock-Quarter Level	log(1 + Std(Indicative Fee))	*IHS-Markit*
Lending Supply	Stock-Quarter Level	Active Lendable Quantity / Total Number Outstanding Shares	*IHS-Markit, CRSP Database*
Short Demand	Stock-Quarter Level	Quantity On Loan / Total Number Outstanding Shares	*IHS-Markit, CRSP Database*
Independent Variables			
1(SSD)	Stock-Quarter Level	Dummy a variable equal 1 from and after SSD implementation year, otherwise equal 0.	*Financial Regulators*
1(Easy-to-Borrow)	Stock-Quarter Level	Stock with lending fees inferior to the top 10% of fee distribution in a given quarter.	*IHS-Markit*
KZ Index	Stock-Quarter Level	The KZ-Index (Kaplan-Zingales Index) is a relative measurement of reliance on external financing.	*Kaplan and Zingales (1995)*
ExecWPS	Stock-Quarter Level		*Boardex - CRSP - Compustat's*
Control Variables			
Firm Size	Stock-Quarter Level	Natural logarithm of Total Assets (ITEM7230) in USD.	*CRSP - Compustat's*
Cash Flow	Stock-Quarter Level	(Income Before Extraordinary Items (IBQ) + Depreciation and Amortization (DPQ)) / lagged TOTAL ASSETS (ATQ)	*CRSP - Compustat's*
Holding Quarter Return	Stock-Quarter Level	log(stock price end of quarter) - log(stock price begining of quarter)	*CRSP - Compustat's*

Table A2. Variable Definitions - Continued

Quarter Volatility	Stock-Quarter Level	std(monthly returns in each quarter)	*CRSP - Compustat's*
Amihud Liquidity	Stock-Quarter Level	Absolute return to dollar trading volume	*CRSP - Compustat's*
Book to Market	Stock-Quarter Level	Common/Ordinary Equity (CEQQ)) / ((Price Close (PRCCQ) * Common Shares Outstanding (CSHOQ))	*CRSP - Compustat's*
Ptbi	Stock-Quarter Level	Pretax Income (PIQ) / lagged Total Assets (ATQ).	*CRSP - Compustat'ss*
Ptbi Vol	Stock-Quarter Level	Standard deviation of (Pretax Income (PIQ) / lagged Total Assets (ATQ). over the last 4 quarters.	*CRSP - Compustat's*
Leverage	Stock-Quarter Level	Long-Term Debt (DLTTQ) / lagged Total Assets (ATQ).	*CRSP - Compustat'ss*
log(Firm Age)	Stock-Quarter Level	log(1 + Current year - Firm incorporation year)	*CRSP - Compustat's*