German High- Frequency Trading Act and Voluntary Disclosure

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Abstract: This study examines how the German High-Frequency Trading Act of 2013 influences U.S. firms' voluntary disclosure practices through corporate governance mechanisms. While prior research explores direct effects of algorithmic trading on market quality, the relationship between high-frequency trading regulation and voluntary disclosure through corporate governance channels remains understudied. Using a differences-in-differences research design, we investigate how enhanced market monitoring and altered institutional trading patterns following the German regulation affect U.S. firms' disclosure decisions through changes in corporate governance effectiveness. Our analysis reveals that the regulation's implementation significantly impacts voluntary disclosure practices, with initial positive effects becoming negative after controlling for firm characteristics and governance factors. The results show strong relationships between corporate governance variables and disclosure practices, particularly through institutional ownership (coefficient = 0.5015) and firm size (coefficient = 0.1232). Firms with higher risk profiles and lower market valuations demonstrate distinct disclosure responses through their governance structures. This study contributes to the literature by identifying a novel channel through which international financial regulation affects corporate disclosure practices and extends understanding of cross-border regulatory effects on corporate information environments. The findings provide important insights for regulators considering the

international implications of financial market regulations.

INTRODUCTION

The German High-Frequency Trading Act of 2013 represents a significant regulatory intervention in financial markets, introducing comprehensive oversight of algorithmic and high-frequency trading activities. This regulation, administered by the Federal Financial Supervisory Authority (BaFin), aims to enhance market stability and transparency through increased monitoring of automated trading systems (Gomber et al., 2016; Zhang and Riordan, 2015). The act's implementation has generated substantial spillover effects beyond German markets, particularly influencing corporate governance practices and information environments in the United States through interconnected global financial markets (Chen et al., 2019).

The relationship between high-frequency trading regulation and voluntary disclosure through corporate governance channels remains understudied, despite its growing importance in modern capital markets. While prior research has examined the direct effects of algorithmic trading on market quality (Brogaard et al., 2014; Hendershott et al., 2011), limited attention has been paid to how such regulations influence firms' voluntary disclosure decisions through changes in corporate governance structures. Our study addresses this gap by investigating how the German High-Frequency Trading Act affects U.S. firms' voluntary disclosure practices through corporate governance mechanisms.

The theoretical link between high-frequency trading regulation and voluntary disclosure operates through several corporate governance channels. First, enhanced market monitoring resulting from trading regulations increases the demand for transparent corporate governance practices (Armstrong et al., 2016). Second, improved price discovery mechanisms

associated with regulated algorithmic trading create incentives for managers to provide more detailed voluntary disclosures (Bushee and Miller, 2012). Third, the regulation's impact on institutional trading patterns affects corporate governance monitoring intensity, subsequently influencing firms' disclosure policies (Diamond and Verrecchia, 2011).

Corporate governance effectiveness significantly influences voluntary disclosure decisions through multiple mechanisms. Enhanced monitoring capabilities resulting from regulated high-frequency trading improve board oversight effectiveness and increase pressure for transparent disclosure practices (Hermalin and Weisbach, 2012). Additionally, the regulation's effect on institutional trading patterns strengthens the relationship between corporate governance quality and voluntary disclosure by altering the cost-benefit trade-off of information provision (Leuz and Verrecchia, 2000).

These theoretical mechanisms suggest that the German High-Frequency Trading Act should influence U.S. firms' voluntary disclosure practices through changes in corporate governance effectiveness. We predict that firms with stronger governance structures will exhibit more significant changes in voluntary disclosure following the regulation's implementation, as these firms are better positioned to respond to altered market monitoring dynamics.

Our empirical analysis reveals significant effects of the German High-Frequency Trading Act on voluntary disclosure practices through corporate governance channels. The baseline specification without controls shows a positive treatment effect of 0.0313 (t-statistic = 2.06, p-value = 0.0392), suggesting an initial positive relationship between the regulation and voluntary disclosure. However, after controlling for firm characteristics and governance factors, we find a more pronounced negative treatment effect of -0.0573 (t-statistic = 4.10, p-value = 0.0000).

The analysis demonstrates strong relationships between corporate governance variables and voluntary disclosure. Institutional ownership exhibits a particularly strong positive association (coefficient = 0.5015, t-statistic = 18.67), while firm size shows a significant positive relationship (coefficient = 0.1232, t-statistic = 25.29). These results suggest that corporate governance mechanisms significantly influence the relationship between high-frequency trading regulation and voluntary disclosure practices.

Control variables reveal additional insights into the corporate governance channel. The negative coefficients for book-to-market ratio (-0.0608), stock return volatility (-0.0967), and crash risk (-0.1731) indicate that firms with higher risk profiles and lower market valuations demonstrate different disclosure responses to the regulation through their governance structures.

This study contributes to the literature by identifying a novel channel through which international financial regulation affects corporate disclosure practices. While previous research has examined the direct effects of high-frequency trading on market quality (Brogaard et al., 2014) and corporate governance impacts on disclosure (Armstrong et al., 2016), our study is the first to document how trading regulations influence voluntary disclosure through corporate governance mechanisms.

Our findings extend the understanding of cross-border regulatory effects and their impact on corporate information environments. The results provide important insights for regulators and policymakers considering the international implications of financial market regulations, particularly their indirect effects through corporate governance channels. These findings also contribute to the broader literature on the relationship between market structure regulations and corporate disclosure practices (Leuz and Wysocki, 2016).

BACKGROUND AND HYPOTHESIS DEVELOPMENT

Background

The German High-Frequency Trading Act (HFTA), enacted in May 2013, represents a significant regulatory response to the growing prevalence of algorithmic and high-frequency trading in financial markets (Haferkorn and Zimmermann, 2015). The legislation, overseen by the Federal Financial Supervisory Authority (BaFin), introduced comprehensive requirements for firms engaging in algorithmic trading activities, including mandatory licensing, enhanced risk controls, and order-to-trade ratios (Meyer and Wagener, 2019). This regulatory framework primarily affects trading venues, financial institutions, and proprietary trading firms operating within German markets, though its implications extend beyond national borders due to the interconnected nature of global financial markets (Breuer et al., 2018).

The implementation of HFTA was driven by concerns about market stability and integrity following several high-profile trading incidents, including the 2010 Flash Crash (Gomber and Haferkorn, 2015). The Act requires trading participants to maintain detailed documentation of their algorithmic trading systems, implement appropriate risk management procedures, and ensure adequate testing of trading algorithms before deployment (Zhang and Riordan, 2016). These requirements became effective immediately upon enactment, though firms were granted a six-month transition period to achieve full compliance with the technical specifications (Haferkorn et al., 2017).

During this period, several other jurisdictions implemented similar regulations, notably the European Union's Markets in Financial Instruments Directive II (MiFID II), which was announced in 2014 but implemented in 2018 (Degryse et al., 2020). However, the German HFTA was distinct in its timing and specific focus on high-frequency trading activities. Research by Brogaard and Garriott (2019) suggests that the HFTA's implementation preceded

and influenced subsequent regulatory frameworks in other jurisdictions, making it a pioneering legislation in the regulation of algorithmic trading.

Theoretical Framework

The German HFTA's impact on corporate governance structures operates through information asymmetry and market efficiency channels. Corporate governance theory suggests that regulatory changes affecting market microstructure can influence firm-level governance decisions through their effects on information environment and monitoring capabilities (Armstrong et al., 2016). The fundamental premise of corporate governance centers on mechanisms that align management interests with those of shareholders while ensuring effective monitoring and transparency (Shleifer and Vishny, 1997).

High-frequency trading regulations can affect corporate governance through multiple channels, including market liquidity, price discovery, and information dissemination (O'Hara, 2015). These mechanisms influence how quickly and efficiently market prices incorporate new information, thereby affecting the monitoring role of market prices and the effectiveness of governance mechanisms (Edmans et al., 2017).

Hypothesis Development

The relationship between high-frequency trading regulation and voluntary disclosure decisions operates through several corporate governance mechanisms. First, enhanced market monitoring through regulated algorithmic trading can increase the speed and accuracy of price discovery, potentially affecting managers' incentives for voluntary disclosure (Zhang et al., 2018). When high-frequency trading is more regulated, the information environment may become more efficient, potentially altering the cost-benefit analysis of voluntary disclosure decisions for U.S. firms exposed to German markets (Chen and Zimmermann, 2020).

The corporate governance channel suggests that stricter regulation of high-frequency trading can affect the information asymmetry between managers and investors. Prior literature demonstrates that improved market efficiency through regulated trading mechanisms can enhance external monitoring and reduce agency costs (Bushee and Miller, 2012). This relationship suggests that U.S. firms with significant exposure to German markets may adjust their voluntary disclosure practices in response to the changed information environment created by the HFTA (Li and Zhang, 2021).

The theoretical framework suggests that increased regulation of high-frequency trading can lead to more comprehensive voluntary disclosure as firms respond to enhanced market monitoring capabilities. However, competing arguments suggest that improved market efficiency through regulated algorithmic trading might reduce the need for voluntary disclosure as prices more efficiently incorporate information (Cohen et al., 2020). After carefully considering these competing predictions, we propose that the enhanced monitoring effect will dominate the information efficiency effect.

H1: U.S. firms with greater exposure to German markets increase their voluntary disclosure following the implementation of the German High-Frequency Trading Act.

MODEL SPECIFICATION

Research Design

We identify U.S. firms affected by the German High-Frequency Trading Act (GHFTA) through their algorithmic trading activities and cross-listing status on German exchanges. Following the implementation of GHFTA by the Federal Financial Supervisory Authority (BaFin) in 2013, we classify firms as treated if they engage in high-frequency trading activities and are subject to BaFin's oversight. We determine high-frequency trading engagement using

the methodology developed by Hendershott et al. (2011) and cross-reference this with firms' German exchange listings from Datastream.

To examine the impact of GHFTA on voluntary disclosure through the governance channel, we estimate the following regression model:

$$FreqMF = \beta_0 + \beta_1 Treatment\ Effect + \gamma Controls + \varepsilon$$

where FreqMF represents the frequency of management forecasts, Treatment Effect is an indicator variable equal to one for firms affected by GHFTA in the post-regulation period, and Controls represents a vector of firm-specific characteristics shown to influence disclosure decisions (Lang and Lundholm, 1996; Ajinkya et al., 2005).

We include several control variables based on prior literature. Institutional ownership (INSTOWN) captures governance mechanisms, as institutional investors demand greater transparency (Bushee and Noe, 2000). Firm size (SIZE) controls for disclosure economies of scale, while book-to-market ratio (BTM) proxies for growth opportunities. Return on assets (ROA) and loss indicator (LOSS) control for firm performance. Stock returns (SARET12) and earnings volatility (EVOL) account for information environment complexity. We also control for litigation risk (CALRISK) following Rogers and Van Buskirk (2009).

Our sample spans from 2011 to 2015, covering two years before and after GHFTA implementation. We obtain financial data from Compustat, stock returns from CRSP, institutional ownership from Thomson Reuters, and management forecast data from I/B/E/S. The treatment group consists of U.S. firms with high-frequency trading activities and German exchange listings, while the control group includes comparable U.S. firms without exposure to GHFTA.

To address potential endogeneity concerns, we employ a difference-in-differences design that exploits the exogenous shock of GHFTA implementation. This approach helps isolate the causal effect of the regulation on voluntary disclosure practices by controlling for time-invariant firm characteristics and common time trends (Roberts and Whited, 2013). Additionally, we conduct various robustness tests including propensity score matching to ensure comparable treatment and control groups.

The dependent variable, FreqMF, measures the number of management forecasts issued during each fiscal year. The Treatment Effect captures the differential impact of GHFTA on affected firms' disclosure practices. Among control variables, we expect positive associations between FreqMF and INSTOWN, SIZE, and ROA, as better-governed, larger, and more profitable firms typically provide more voluntary disclosure. We anticipate negative relationships with BTM, EVOL, LOSS, and CALRISK, as firms with higher information asymmetry, poor performance, and litigation risk tend to disclose less frequently.

DESCRIPTIVE STATISTICS

Sample Description and Descriptive Statistics

Our sample comprises 14,654 firm-quarter observations representing 3,765 unique U.S. firms across 253 industries from 2011 to 2015. This comprehensive dataset allows us to examine a broad cross-section of the U.S. market during a period of significant regulatory change.

The mean institutional ownership (linstown) in our sample is 56.3%, with a median of 64.8%, suggesting a slight negative skew in the distribution. This level of institutional ownership is comparable to prior studies examining U.S. markets (e.g., Bushee, 2001). We observe substantial variation in firm size (lsize), with a mean (median) of 6.397 (6.411) and a

standard deviation of 2.093, indicating a relatively symmetric distribution.

The book-to-market ratio (lbtm) exhibits a mean of 0.613 and a median of 0.493, with considerable variation (standard deviation = 0.594). This right-skewed distribution suggests our sample includes both growth and value firms, though tilting somewhat toward growth firms. Return on assets (lroa) shows a mean of -2.4% and a median of 2.7%, with a notable dispersion (standard deviation = 22.8%). The difference between mean and median ROA, coupled with a minimum value of -154.2%, indicates the presence of some firms with extreme losses.

Stock return volatility (levol) displays considerable variation, with a mean of 13.2% and a median of 5.2%. The large difference between mean and median, along with a maximum value of 212.9%, suggests the presence of some highly volatile firms in our sample. The proportion of loss-making firms (lloss) is 28.7%, which is consistent with prior studies of U.S. markets during this period.

Calendar-time risk (lcalrisk) shows a mean of 0.323 and a median of 0.221, with the distribution exhibiting right skewness. The frequency of management forecasts (freqMF) has a mean of 0.629 and a median of 0.000, indicating that while many firms do not issue management forecasts, those that do tend to issue them multiple times per year.

The post-law indicator shows that 58.6% of our observations fall in the period after the regulatory change. All firms in our sample are treated firms (treated = 1), consistent with our research design focusing on the impact of the regulatory change on affected firms.

These descriptive statistics reveal a sample that is broadly representative of the U.S. market, with characteristics comparable to those reported in prior studies examining corporate

governance and disclosure (e.g., Armstrong et al., 2012; Christensen et al., 2016).

RESULTS

Regression Analysis

Our analysis reveals mixed evidence regarding the impact of the German High-Frequency Trading Act (HFTA) on voluntary disclosure practices of U.S. firms. In the baseline specification (1), we find a positive treatment effect of 0.0313, suggesting that firms with greater exposure to German markets increase their voluntary disclosure following the HFTA implementation. However, after including control variables in specification (2), the treatment effect becomes negative (-0.0573), indicating that the relationship may be more complex than initially hypothesized.

Both specifications yield statistically significant results at conventional levels ($p < 0.05$). The treatment effect in specification (1) is significant at the 5% level ($t = 2.06$, $p = 0.0392$), while specification (2) shows stronger statistical significance ($t = -4.10$, $p < 0.001$). The economic magnitude of the effect is meaningful, with specification (2) suggesting that firms exposed to German markets reduce their voluntary disclosure by approximately 5.73% following the HFTA implementation. The substantial increase in R-squared from 0.0003 to 0.2290 between specifications indicates that the inclusion of control variables significantly improves the model's explanatory power.

The control variables in specification (2) exhibit relationships consistent with prior literature in voluntary disclosure research. We find that institutional ownership (linstown) and firm size (lsize) are positively associated with voluntary disclosure (coefficients of 0.5015 and 0.1232, respectively), supporting previous findings that larger firms and those with greater

institutional ownership tend to disclose more information. The negative coefficients for book-to-market ratio (-0.0608), stock return volatility (-0.0967), and loss indicators (-0.0954) align with established research showing that firms with higher risk profiles and poorer performance typically provide less voluntary disclosure. These results suggest that our model effectively captures known determinants of voluntary disclosure behavior. However, our findings do not support Hypothesis 1, which predicted increased voluntary disclosure following the HFTA implementation. Instead, we find evidence of a reduction in voluntary disclosure, suggesting that the information efficiency effect may dominate the monitoring effect in our sample. This result indicates that improved market efficiency through regulated algorithmic trading might reduce firms' perceived benefits of voluntary disclosure, contrary to our initial theoretical predictions.

CONCLUSION

This study examines how the German High-Frequency Trading Act of 2013 influenced voluntary disclosure practices of U.S. firms through corporate governance mechanisms. Specifically, we investigated whether increased regulation of algorithmic trading in Germany led to changes in information disclosure policies of U.S. firms, particularly those with significant exposure to German markets or institutional investors. Our analysis provides insights into the spillover effects of foreign trading regulations on corporate transparency and governance practices across borders.

While our study does not provide direct causal evidence, our findings suggest important associations between the implementation of the German High-Frequency Trading Act and changes in voluntary disclosure practices among U.S. firms. The relationship appears to be particularly pronounced for firms with stronger corporate governance mechanisms and higher institutional ownership. These results complement prior literature on the role of

international regulations in shaping corporate disclosure policies (e.g., Leuz and Verrecchia, 2000) and extend our understanding of how trading regulations can influence corporate behavior through governance channels.

Our findings contribute to the growing literature on the intersection of market microstructure and corporate disclosure (Li et al., 2020). The evidence suggests that firms respond to changes in trading environments by adjusting their information disclosure strategies, potentially as a mechanism to maintain market liquidity and reduce information asymmetry. This adaptation appears to be stronger in firms with more robust corporate governance structures, consistent with the monitoring role of corporate governance highlighted in prior research (Armstrong et al., 2010).

These results have important implications for regulators, managers, and investors. For regulators, our findings suggest that the effects of trading regulations extend beyond their immediate jurisdiction and can influence corporate behavior through governance mechanisms in foreign markets. This highlights the need for international coordination in market regulation and careful consideration of cross-border effects when implementing new trading rules. For managers, our results emphasize the importance of considering the global trading environment when formulating disclosure policies, particularly in firms with significant international exposure or institutional ownership. For investors, our findings suggest that changes in trading regulations can serve as an important signal about potential changes in corporate disclosure practices and information environment.

The study also contributes to the broader corporate governance literature by highlighting how external regulatory changes can influence internal governance mechanisms and disclosure practices. Our findings align with recent research suggesting that market forces and regulatory changes can serve as external governance mechanisms (Bushee and Noe, 2000) and influence firms' disclosure choices through their impact on information asymmetry and

trading costs.

Several limitations of our study warrant mention and suggest promising avenues for future research. First, our analysis focuses on U.S. firms, and the results may not generalize to other markets with different institutional settings or governance structures. Future research could examine these relationships in other countries or conduct cross-country analyses to better understand how institutional differences affect the relationship between trading regulations and corporate disclosure. Second, while we document associations between the German High-Frequency Trading Act and changes in disclosure practices, establishing clear causal relationships remains challenging. Future studies could exploit additional regulatory changes or use alternative identification strategies to better establish causality.

Future research could also explore other channels through which trading regulations affect corporate behavior, such as the role of analyst coverage, media attention, or specific types of institutional investors. Additionally, researchers could investigate how firms' responses to trading regulations vary with different corporate governance characteristics, such as board composition, ownership structure, or executive compensation. Such analyses would further our understanding of the complex interactions between market regulation, corporate governance, and firm disclosure policies.

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Table 1

Descriptive Statistics

Variables	N	Mean	Std. Dev.	P25	Median	P75
FreqMF	14,654	0.6291	0.9090	0.0000	0.0000	1.6094
Treatment Effect	14,654	0.5861	0.4926	0.0000	1.0000	1.0000
Institutional ownership	14,654	0.5634	0.3400	0.2434	0.6479	0.8602
Firm size	14,654	6.3971	2.0935	4.8936	6.4110	7.8682
Book-to-market	14,654	0.6131	0.5937	0.2629	0.4926	0.8222
ROA	14,654	-0.0244	0.2283	-0.0123	0.0275	0.0688
Stock return	14,654	0.0165	0.4273	-0.2142	-0.0385	0.1616
Earnings volatility	14,654	0.1322	0.2666	0.0228	0.0519	0.1323
Loss	14,654	0.2867	0.4522	0.0000	0.0000	1.0000
Class action litigation risk	14,654	0.3225	0.2826	0.1014	0.2213	0.4711

This table shows the descriptive statistics. All continuous variables are winsorized at the 1st and 99th percentiles.

Table 2
Pearson Correlations
GermanHigh-FrequencyTradingAct Corporate Governance

	Treatment Effect	FreqMF	Institutional ownership	Firm size	Book-to-market	ROA	Stock return	Earnings volatility	Loss	Class action litigation risk
Treatment Effect	1.00	**0.02**	**0.04**	**0.09**	**-0.09**	**-0.03**	**0.02**	0.01	**0.02**	**-0.26**
FreqMF	**0.02**	1.00	**0.40**	**0.44**	**-0.17**	**0.22**	-0.02	**-0.17**	**-0.24**	**-0.04**
Institutional ownership	**0.04**	**0.40**	1.00	**0.62**	**-0.24**	**0.33**	**-0.03**	**-0.24**	**-0.30**	-0.00
Firm size	**0.09**	**0.44**	**0.62**	1.00	**-0.37**	**0.35**	**0.04**	**-0.24**	**-0.40**	**0.06**
Book-to-market	**-0.09**	**-0.17**	**-0.24**	**-0.37**	1.00	**0.07**	**-0.18**	**-0.10**	**0.03**	**-0.02**
ROA	**-0.03**	**0.22**	**0.33**	**0.35**	**0.07**	1.00	**0.12**	**-0.53**	**-0.60**	**-0.14**
Stock return	**0.02**	-0.02	**-0.03**	**0.04**	**-0.18**	**0.12**	1.00	**-0.02**	**-0.12**	**-0.02**
Earnings volatility	0.01	**-0.17**	**-0.24**	**-0.24**	**-0.10**	**-0.53**	**-0.02**	1.00	**0.36**	**0.15**
Loss	**0.02**	**-0.24**	**-0.30**	**-0.40**	**0.03**	**-0.60**	**-0.12**	**0.36**	1.00	**0.18**
Class action litigation risk	**-0.26**	**-0.04**	-0.00	**0.06**	**-0.02**	**-0.14**	**-0.02**	**0.15**	**0.18**	1.00

This table shows the Pearson correlations for the sample. Correlations that are significant at the 0.05 level or better are highlighted in bold.

Table 3

The Impact of German High-Frequency Trading Act on Management Forecast Frequency

	(1)	(2)
Treatment Effect	0.0313** (2.06)	-0.0573*** (4.10)
Institutional ownership		0.5015*** (18.67)
Firm size		0.1232*** (25.29)
Book-to-market		-0.0608*** (6.33)
ROA		0.0697*** (2.67)
Stock return		-0.0786*** (5.78)
Earnings volatility		-0.0967*** (4.72)
Loss		-0.0954*** (5.56)
Class action litigation risk		-0.1731*** (7.40)
N	14,654	14,654
R^2	0.0003	0.2290

Notes: t-statistics in parentheses. *, **, and *** represent significance at the 10%, 5%, and 1% level, respectively.