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IMPACT OF SHORT SALE DISCLOSURE FREQUENCY

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THE IMPACT OF SHORT SALE DISCLOSURE FREQUENCY ON PRICING EFFICIENCY

A Master's Thesis

by
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To my family



THE IMPACT OF SHORT SALE DISCLOSURE FREQUENCY
ON PRICING EFFICIENCY

The Graduate School of Economics and Social Sciences
of
İhsan Doğramacı Bilkent University
by

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ABSTRACT

THE IMPACT OF SHORT SALE DISCLOSURE FREQUENCY ON PRICING EFFICIENCY

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Short sales are beneficial to markets since they tend to provide liquidity and improve pricing efficiency by revealing new information, given that short sellers are generally accepted as informed investors in the finance literature. After the global financial crisis of 2007-2009, media and policymakers blamed short sellers for distressing share prices and many countries introduced new mandatory short sale disclosure procedures.

While the global trend is to enhance market transparency on short sales, Borsa Istanbul reduced their short sale disclosure frequency from twice a day to once a day on 30th of October 2015. This study aims to investigate the effect of frequency of short sale disclosure on pricing efficiency in short and long period lengths, using the disclosure frequency change in Borsa Istanbul on 30th of October 2015 and its effects on shorting demands, returns, volumes, bid ask spreads, turnover ratios and volatilities.

The most prominent result of this thesis is that the reduced short sale disclosure frequency decreases the short demand significantly in long period length, while the short sales shift to more informed trading and trend chasing behavior of uninformed traders decreases. The volatilities are affected significantly and positively, volumes and turnover ratios are affected significantly and negatively in the short period lengths consistently to existing literature. At the same time, the negative effect on returns is controversial and results of the long period length are mixed and difficult to interpret.

Keywords: Market Transparency, Regression Discontinuity, Short Sale Disclosure

ÖZET

AÇIĞA SATIŞ BİLGİSİ AÇIKLANMA SIKLIĞININ FİYATLANDIRMA VERİMLİLİĞİ ÜSTÜNDEKİ ETKİSİ

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Açığa satışlar piyasa için yeni bilgiler ortaya çıkararak likidite sağlama ve fiyatlandırma etkinliğini geliştirme eğiliminde oldukları için piyasalar için faydalıdır ve açığa satışçılar finans literatüründe genel olarak bilgi sahibi yatırımcılar olarak kabul edilir. 2007-2009 küresel finansal krizinden sonra, medya ve politika belirleyiciler, fiyatların düşmesinin sebebi olarak açığa satışçıları suçlamış ve birçok ülke yeni zorunlu açığa satış açıklama prosedürlerini uygulamaya koymuştur.

Küresel trend, açığa satışlarda piyasa şeffaflığını arttırmak iken, Borsa İstanbul 30 Kasım 2015 tarihinde açığa satış açıklama sıklığını günde ikiden günde bire indirmiştir. Bu çalışma, kısa ve uzun dönemde, 30 Kasım 2015 tarihinde Borsa İstanbul'daki açıklama sıklığı değişimi ve bu değişimin açığa satış talepleri, getiriler, hacimler, alış satış marjları, devir oranları ve oynaklıklar üzerindeki etkilerini kullanarak, açığa satış açıklanma sıklığının fiyatlandırma verimliliği üzerindeki etkisini araştırmayı amaçlamaktadır.

Bu tezin en belirgin sonuçları, azalan açığa satış açıklama sıklığının uzun dönemde açığa satış talebini önemli ölçüde azaltması, açığa satış aktivitesinin daha bilgiye dayalı bir alım satıma dönüşmesi ve bilgi sahibi olmayan yatırımcıların açığa satışlarda trend takip davranışının azalmasıdır. Mevcut literatürle tutarlı olarak, kısa dönem uzunluğunda fiyat oynaklığı önemli ölçüde olumlu, hacimler ve devir hızı oranları önemli ölçüde olumsuz etkilenmiştir. Getiriler üzerindeki olumsuz etki tartışmalı ve uzun dönem analizinin sonuçları karışık ve yorumlanması zordur.

Anahtar Kelimeler: Piyasa Şeffaflığı, Regresyon Süreksizliği, Açığa Satış Açıklanmaları

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CHAPTER 1

INTRODUCTION

The impact of the existence of short sales and short sale disclosure regimes in the financial markets are discussed thoroughly in the finance literature, especially after the media and some financial institutions blame the short sellers for the 2008 financial crisis. The 2008 financial crisis led to many countries react with immediate shorting bans and short sale disclosure regimes. These shorting bans and mandatory short sale disclosure regimes enable finance academicians to investigate the impact of short sales and disclosure policies.

A short sale is simply defined as the sale of a stock which the seller does not own. The seller should borrow the stock from a third party and sell it to the buyer, with the promise of buying the stock from the third party in the future if she wants to short a stock. This arrangement allows investors to invest in their beliefs that the stock price will decrease in the future. Hence, the financial markets which allow shorting make it possible to invest in two opposite directions. While the long positions mean that the investors have the stock, the short positions mean that the investors are in debt of the stock. The finance literature generally accepts that the existence of short sales in a

financial market improves the pricing efficiency because the informed traders can trade using their negative information on stocks.

The short sellers have to hold a percentage of the value of their short positions in their accounts and the third parties such as brokers, market makers and stock exchanges apply a lending fee to the shorted stocks. They may call back the stocks which are shorted if the prices exceed a predetermined margin. In this situation, the short sellers have to deposit more to their accounts or buy the stocks immediately. It creates an additional risk to the short sellers, which is called margin call risk.

Besides, Borsa Istanbul occasionally uses the uptick rule, which means any shorting order cannot be lower than one tick up from the last trade of the shorted stock, in order to decrease shorting demand. The requirement of holding cash on the account, margin call risk, lending fees and occasional use of the uptick rule together create more cost to the short sellers. This is why the short sellers are generally accepted as informed traders because they trade with extra friction costs and additional risk.

Before the 30th of October 2015, Borsa Istanbul published a report which contains how many stocks are shorted in the sessions for every stock listed in the Borsa Istanbul two times a day, for each session in a day. These reports make it possible to follow the short positions, even if they are naked shorts, for uninformed traders and arrange their positions accordingly.

A naked short is a short sale, consisting of one short sale and one buying without borrowing the stocks by the short seller. Naked shorts make it possible to manipulate

uninformed traders who follow Borsa Istanbul's disclosure on short trades after noon. The manipulator might short the stock before noon and create a negative impression on the stock's price. After the trend-chaser uninformed traders, who follow the short sale disclosures, sell the stock and the price declines, the manipulator might buy the stock at a lower price than before.

On the 30th of October 2015, Borsa Istanbul reduced the frequency of short sale disclosures to one, at the end of the day, from two times a day for each session. It might inhibit the manipulative shorting activity. Nevertheless, the markets tend to be more transparent over time. While the decision to reduce the frequency of short sale disclosure of Borsa Istanbul decreases the market transparency for the Turkish stock exchange, it is generally accepted that increasing transparency improves the pricing efficiency in a financial market. The main contribution of this study is the empirical investigation of the impact of decreasing transparency for the financial markets.

In this thesis study, I investigate the impact of the short sale disclosure frequency on the shorting demand, return, volume, bid ask spread, turnover ratio and price volatility in the Borsa Istanbul by utilizing the policy change, which is effective after 30th of October 2015, as the identification strategy. The effects are divided into effects on short and long period lengths. Initially, I use regression discontinuity graphs to analyze whether there are significant jumps in the aforementioned variables or not in both period lengths. Secondly, I use treatment effect analysis, by using the daily control variables, to evaluate whether the effects of the policy change on the variables are significant or not. Finally, I conduct panel data regression analyses,

including the firm fixed effects and monthly control variables, to get a better understanding of the impact of the reduction in the short sale disclosure frequency.

The rest of my thesis is organized as follows: Chapter 2 gives a summary of the literature on the impact of short sale and short sale disclosure regimes in the markets, Chapter 3 explains my hypotheses, Chapter 4 summarizes my sample data and methods which I use in the empirical analyses, Chapter 5 reports the empirical results and discusses them, and Chapter 6 concludes my thesis.

CHAPTER 2

LITERATURE REVIEW

In this chapter, I review the relevant theoretical and empirical literature to this study in two subchapters. The first one is related to the impact of short sale on the market to emphasize the importance of the presence of short sellers for the financial markets. The second one is related to growing literature on the impact of short sale disclosure regimes on the market, especially after the 2008 economic crisis and occurring short sale regulations in Europe.

2.1 Literature Review on Short Sale Impact on Financial Markets

The short sale literature starts with the Miller (1977) paper which theoretically explains the advantages of the presence of short sellers. He argues that when there is a divergence of opinion about a risk of a stock, without short sellers, the price of that stock is unrealistically high compared to the price of the stock when short sellers are present in the market. According to Miller, the inexistence of short sellers also caused greater volatility in stock prices.

In Diamond & Verrecchia's (1987) model, they theorize that even if short selling constraints reduce the trades of informed short sellers, it does not cause an increase in stock prices; it just causes the price adjustment times to increase in the market. The rationale behind their theory is that when there are short selling constraints, the absence of trades on a stock implies informed traders have negative information.

Boehmer, Jones & Zhang's (2008) study investigates if the short sellers are informed during the period between 2000 and 2005. Their results show that the short sale amount is no less than 12.9% of NYSE volume and the short sellers are well informed. The most informed short trades are institutional and not a part of a program (aggregate trade, which includes 15 or more securities and overvalues 1 million dollars) trades.

Diether, Lee & Werner's (2009) study shows that a substantial amount of the trades are short sales (31% for NASDAQ and 24% of NYSE share volume) during 2005 and the short sale activity increases after periods of positive returns, positive buying pressure and high levels of asymmetric information. Their study reports that short sellers accurately predict future negative abnormal returns while they trade on short term overreaction of prices consistent with the Boehmer et al. study.

Beber & Pagano's (2013) paper reports that the short sale ban's impact on European markets' liquidity is destructive, considering the increasing bid ask spreads. The bans were already imposed on the markets which had increasing bid ask spreads due to the 2008 financial crisis. Besides, the bans also slowed down the price discovery process

and were unable to support market prices. Bernal, Henrickx & Szafarz's (2014) study also reports an increase in bid ask spreads and a decrease in volumes after short sale bans after the 2008 crisis. It proves the point of Miller's (1977) theory on the relation between short sales and liquidity, empirically.

Contrasting to Beber & Pagano's (2013) paper, Sifat & Mohamad (2015) report an increase in returns of stocks which are subject to short sale ban in London Stock Exchange around the 2008 crisis.

Wang, Yan & Zheng's (2020) paper documents that lightly shorted stocks outperformed heavily shorted stocks in US markets during the period between 2010 and 2015, meaning that short sellers are informed traders. Their most prominent result is that long term shorting flows are more informative than short term shorting flows, giving an insight into how short sellers behavior changed after the 2008 crisis. Short sellers began trading on long term public information rather than short term private information.

Moosa's (2012) paper investigates the arguments both for and against the existence of short selling. He states the arguments for short selling briefly that "(i) it is an integral component of a free market, (ii) it provides an external governance mechanism, (iii) it prevents or inhibits over-pricing, (iv) it has positive effects on liquidity and volatility, and (v) it provides a hedging mechanism" (Moosa, 2012:216). Whereas the arguments against short selling in this paper are the possibility of the manipulation of stock prices, the creation of inexistent stocks and

the possibility of high volatility and market crashes when panic selling periods emerge. However, Oakley (as cited in Moosa, 2012) finds out that short sale bans almost did not affect the stock prices while causing decreases in volume and liquidity. A similar study, Payne (2012) paper, investigates the arguments for and against short selling regulations. The arguments for short selling are similar to Moosa (2012) paper, such as manipulation risk and falls of prices during the 2008 crisis, where she states these falls are not caused by shorting activity. She also indicates that the disclosure regimes are helpful to efficiency in markets because of the increase in public information.

2.2 Literature Review on Short Sale Disclosure Impact on Financial Markets

In this subchapter, I give a brief summary of theoretical papers that analyze the relation between disclosure rules and market efficiency. And then, I report some empirical works that show how short sale disclosure regimes affect the financial markets.

Wu & Zhang (2002) use a model that includes two types of investors they call informed traders and liquidity investors, assuming that liquidity investors can learn from the information disclosures. In this model, they showed that "the bid ask spread is always higher when trade information is not disclosed" (Wu & Zhang, 2002:21).

In Abreu & Brunnermeier's (2002) model, the informed traders do not act on their information immediately because of the holding costs, and they prefer waiting unless

the other informed traders act. It lengthens the mispricing period of stocks, which decreases the market efficiency.

Georgakopoulos's (1996) paper justifies the existence of disclosure rules by claiming disclosure rules increase the information amount in the markets. According to him, short term traders utilize accurate prices more than long term traders, and their trades are beneficial to market liquidity, meaning the disclosure rules help increasing market liquidity and decreasing volatility.

Senchack & Starks (1993) use the event study methodology to analyze the effect of monthly short interest announcements in American markets during 1980-1986. They report that high short interest information announcement negatively affects returns and the effect is significant around the announcement days. Aitken, Frino, McCorry & Swan (1998) similarly use the event study methodology in the Australian market where the short sales are transparent in real time, and they report a significant negative effect of transparent shorts on the stock prices.

Beber & Pagano (2013) and Bernal et al. (2014) show that disclosure regimes in Europe after the 2008 crisis cause significant decreases in bid ask spreads, meaning a positive effect on liquidity. In both studies, the disclosure impact on returns is insignificant. The Bernal et al. (2014) paper also reports that disclosure requirements cause an increase in volatility and a decrease in volume in European countries.

An interesting study, Galema & Gerritsen (2019), using the full register of all short sale positions in Netherlands between November 2012 and January 2017, which is accidentally published by Netherlands Authority for the Financial Markets, observes both publicly and confidentially shorted stocks underperform the market. The impact of this accidental disclosure of confidential short positions on returns of the shorted stocks is significantly positive because of the emerging possibility of short squeezes and increasing lending fees.

Jones, Reed & Waller's (2016) study reports significant declines in bid ask spreads, consistent with Beber & Pagano's (2013) and Bernal et al.'s (2014) studies. They also find out that shorting demand is reduced after disclosure regimes and it causes prices to be less informative. Another result they report is that a disclosure increases the possibility of another disclosure, meaning that short sellers behave more trend chasers.

Duong, Huszar & Yamada's (2015) analysis on Tokyo Stock Exchange between 2006 and 2010 shows that after mandatory short sale disclosure policy, pricing efficiency declines, prices are less informative, short term volatility rises and short sales become more trend chasing in the Japanese market.

Jank, Roling & Smajlbegovic (2021) study public and confidential short sale announcements in Frankfurt Stock Exchange between 2012 and 2015. They compare the durations of short sale positions between short sale disclosure thresholds. They state that the significantly longest duration is before exceeding the 0.5% threshold,

where investors should announce their public short sale positions. Their main result is that to cover their trade strategies, informed traders such as institutional investors and hedge funds prefer not publicly disclosing their short positions.



CHAPTER 3

TESTABLE HYPOTHESES

In this chapter, I give the testable hypotheses of this study that emerged after analyzing the relevant short sale disclosure literature. The literature is mainly on the effect of mandatory disclosure regimes, while this study is on the effects of short sale disclosure frequency. While constructing the testable hypotheses, I assume more frequent short sale disclosures work in the same direction of the effects of mandatory disclosure policies, meaning that I assume the reduced short sale disclosure frequency affects the market in the opposite direction of mandatory disclosure policies.

Hypothesis 1: As a result of the decrease in short sale disclosure frequency, shorting demand decrease.

After the reduction of the short sale disclosure frequency, while the informed investors have more opportunity to cover their shorting strategies, this opportunity applies just to naked short trades. Informed traders are inclined to hold their positions

in longer terms than daily trades. The policy change cause decrease in information content in the market. Hence, uninformed traders' ability to chase shorting activity may decrease. I expect a decrease in shorting demand because of the decreasing information content uninformed traders could reach out.

Hypothesis 2: As a result of the decrease in short sale disclosure frequency, the stock returns are affected positively.

Related to hypothesis 1, when shorting activity decreases, the negative signal amount in the market reduces. It creates a more positive atmosphere in the market and negative information may disseminate slower than before. It may cause a positive impact on stock prices.

Hypothesis 3: Decrease in short sale disclosure frequency leads to decrease in volume and liquidity, increase in volatility.

It is generally accepted that the trade activity of short sellers improves the liquidity of markets. Due to decreased shorting activity, I expect the market becomes less liquid. Meaning that I expect bid ask spreads to increase, turnover ratios to decrease and daily volatility of prices to increase. Moreover, both decreasing shorting of informed traders and decreasing trend chasing behavior of uninformed traders may cause a significant decrease in volume.

CHAPTER 4

DATA & METHODOLOGY

In this chapter, I explain how I construct the data set of this study and what methodologies I utilize to analyze the data set and test the hypothesis.

4.1 Construction of Data Set and Data Summary

I construct my data set utilizing daily trade books and order books of the Borsa Istanbul between 1 June 2015 and 23 June 2016. Before the short sale disclosure policy change, Borsa Istanbul reports which trades include short sale order. However, after 30.10.2015, trade books do not include which trades are short trade. For after this date, I utilize the order ids in the trade books and order ids in the order books to match which trades include shorting order. Using these trade-based and order-based data sets, I construct daily data set on stock level. For more meaningful results, I exclude the days which Borsa Istanbul is closed after noon, because they are the days before official holidays. These days are 16 July 2015, 23 September 2015 and 28 October 2015.

As a proxy for market returns, I used Bist100 index returns which I calculate from the Bist100 index prices obtained from Bloomberg Database.

I collected the monthly control variables such as net profit, book to market ratio and market capitalizations, which I use in regression analyses from the monthly reports Borsa Istanbul. As in the commonly used method in the finance literature, I utilized the logarithms of market capitalizations in regression analyses.

As the proxy of shorting demand, I use the ratio of shorted stocks to traded stocks in the stock-day level. I calculated turnover ratios such as daily traded stocks over outstanding shares. The measure to proxy daily volatilities I use is the Garman-Klass volatility formula which utilizes the opening, closing, highest and lowest prices in a day for a stock. The formulas to compute variables are in Appendix.

I use the method which Duong et al. (2015) use to calculate lagged variables. I calculated mean values of the previous five days' values for lagged spreads, lagged turnovers and lagged short ratios. I calculate lagged returns as the total returns of the previous five days.

I create dummy variables for the stocks that are in the lowest quintile of market capitalizations (small), the days after 30th of October 2015 (policy change) and the highest and lowest 30 percentiles of lagged returns similar to Duong et al. (2015) to identify winners and losers.

I omit the day-stock pairs if they do not have any of the aforementioned variables. As a result of the data cleaning process, the data set consists of 102,151 stock day pairs, 270 days and 425 individual stocks. In order to apply short term panel data regression analyses, I use the data set that contains 20 days before and 20 days after the short sale disclosure policy change, a total of 15,240 day-stock pairs.

The summary of the data set and main variables are given in Table 1 and the summary of the data set and main variables for the 20 days before and after disclosure policy change is given in Table 2.

Table 1. Summary Statistics of the Main Variables

Variables	Mean	Mean Before the Change	Mean After the Change
Short Ratio %	3.0677	3.1755	3.0043
Return %	0.0473	0.0842	0.0291
Shares Traded (in millions)	2.0558	1.8531	2.1753
Volatility	0.0115	0.0117	0.0114
Price Spread %	3.2295	3.2801	3.1976
Turnover Ratio	1.0767	1.0215	1.1104
Log Market Cap	8.3130	8.3489	8.2920
Total Days	270	102	168

Table 2. Summary Statistics of the Main Variables (20 days before and after the change)

Variables	Mean	Mean Before the Change	Mean After the Change
Short Ratio %	2.9480	3.0301	2.8709
Return %	0.0799	0.0857	0.0744
Shares Traded (in millions)	2.1209	2.1757	2.0695
Volatility	0.0125	0.0119	0.0132
Price Spread %	3.4792	3.3267	3.6226
Turnover Ratio	1.1254	1.3066	0.9549
Log Market Cap	8.3123	8.3640	8.2637
Total Days	40	20	20

4.2 Methodology

In this subchapter, I explain the methodology of this study. I examine the effect of reduction in the short sale disclosure frequency on several variables such as short demand, return, volatility, volume, bid ask spread and turnover ratio in three methods and two different period lengths.

To analyze the effect in the short term, I set the sample length as 20 days before and 20 days after the policy change and to analyze the effect in the long term, I use the full sample from 1 June 2015 to 23 June 2016.

My first method is to analyze the changes in the variables, utilizing the regression discontinuity design graphs. In this method, the variables are linearly regressed on the dates before and after the policy change without using any other variables and I check if there are any significant jumps on the day which the policy changed.

Regression discontinuity design is a method commonly used in social sciences to analyze whether policies are effective or not. In research discontinuity design graphs, the sample is divided into two subsamples determined by the before and after the date the policy being effective. The two best lines get drawn onto both samples separately. I use the Ordinary Least Squares method to determine intercepts and slopes of the best lines in the regression discontinuity design graphs on the sample and draw confidence intervals of 95% around the best lines. If there is an apart

between the confidence intervals of best lines of before and after the policy change subsamples on the day policy changed, I conclude that there is a significant change in the independent variable in the same direction with the jump on the cutoff line and if the confidence intervals overlap before and after the policy change, I conclude that the change is insignificant.

My second method is the treatment effect analysis which is directly related to regression discontinuity design but is more sophisticated. The slopes and intercepts of the regression lines are determined using the Ordinary Least Squares method. In this method, the independent variables (short demand, return, volume, volatility, turnover ratio and bid ask spread) are regressed on before and after the policy change, utilizing the dependent variables lagged return, lagged spread, lagged short demand, lagged turnover and market return. The linear regressions after the policy change also include the policy change dummy. In this way, I segregate the effects of these control variables on the independent variables' means from the effect of the policy change. I report the population means of the independent variables in the subsample which is before the policy change, and the treatment effect of the policy change.

The treatment effect is the coefficient of the policy change dummy in the linear regression after the policy change, and it could be interpreted as the difference between the population means of the subsamples before and after the policy change. If the treatment effect, which is the difference between subsample population means,

is significantly larger (smaller) than zero, I conclude the policy change has a significantly positive (significantly negative) impact on the independent variable.

I do not use the control variables, log market cap, net profit and market to book ratio in the treatment effect analyses because they are the variables changing monthly. The reason why I do not include the monthly changing control variables is that the policy change happened on the last day of October 2015 and when I use the monthly changing control variables, they absorb the effect of reduction in the short sale disclosure frequency in the jumps in independent variables.

My last method is the panel data regression analysis. To explore the impact of policy change for big and small stocks separately, I apply this method for the full sample and for just big and small stocks separately. In these analyses, firm fixed effects are included into the Ordinary Least Squares regressions but not reported. I do not include firm fixed effects only in the short term analyses for big stocks. The reason why I do not include firm fixed effects for these analyses is that there are fewer observation points; using too many dummy variables on these analyses creates a dummy variable trap. To eliminate the dummy variable trap problem on these linear regressions, I omit the firm fixed effect dummies from these analyses.

In the panel data regression analyses, I use some interaction variables such as policy change dummy and price spread, policy change and loser dummies, policy change and high short demand quintile dummies, policy change and small company

dummies. These interaction variables enable me to analyze the impact of policy change on stocks with specific characteristics.

Besides the daily control variables, I used in the treatment effect analyses, I also used monthly control variables such as return on asset, market to book ratio and logarithm of market capitalization. To get rid of the outliers in the panel data, I winsorised the variables at 90% level. Which means, I assumed the values below the 5th percentile and above the 95th percentile are equal to the threshold values accordingly.



CHAPTER 5

EMPIRICAL RESULTS & DISCUSSION

In this chapter, I report the empirical results obtained from the analyses and interpret them. Each subchapter addresses one independent variable.

5.1 Short Demand

I use the ratio of shorted stocks to traded stocks for every company traded in Borsa Istanbul in the sample periods as the proxy of shorting demand. Looking at Figure 1 and comparing the confidence intervals of the regression lines, the decrease in the short demand seems slightly insignificant in the short term. However, looking at the confidence intervals around the regression lines in Figure 2, the decrease in shorting demand decreased significantly in the long term. Table 3 exhibits that shorting demand decreased significantly after the policy changed in the long term but the effect is insignificant in the short term.

Figure 1. Shorting Demand Regression Discontinuity Graph (-20, +20 days)

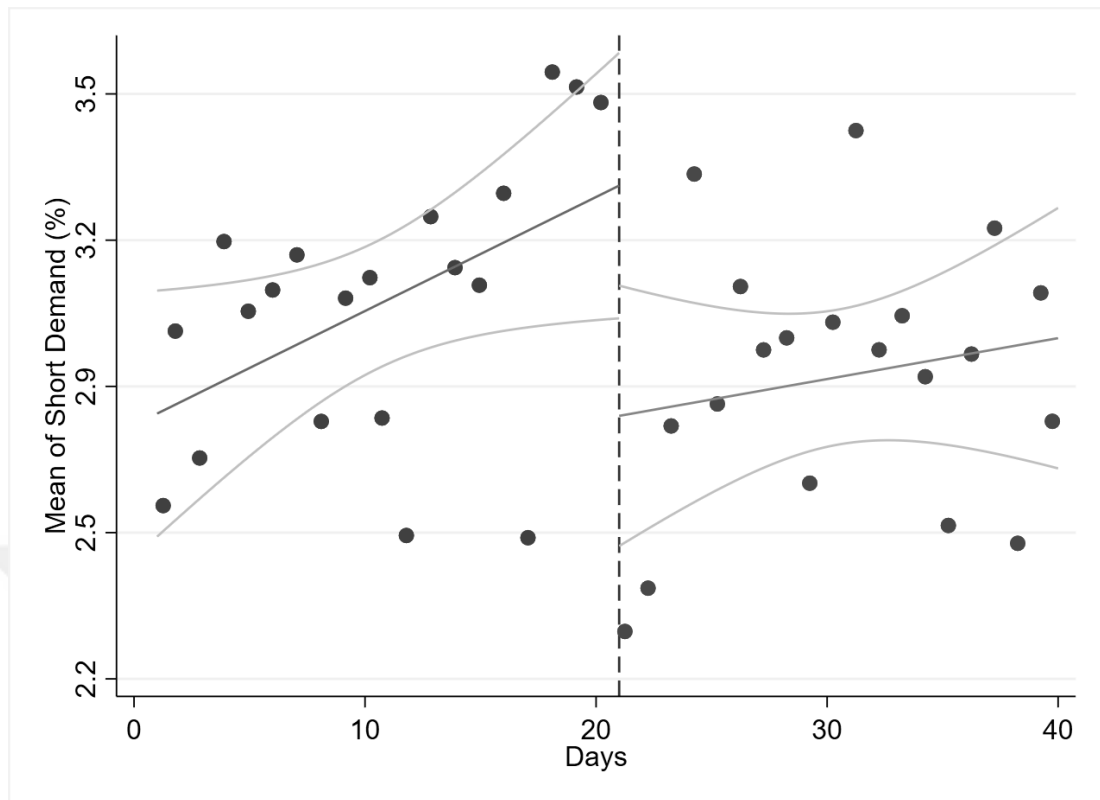


Figure 2. Shorting Demand Regression Discontinuity Graph (Full Period)

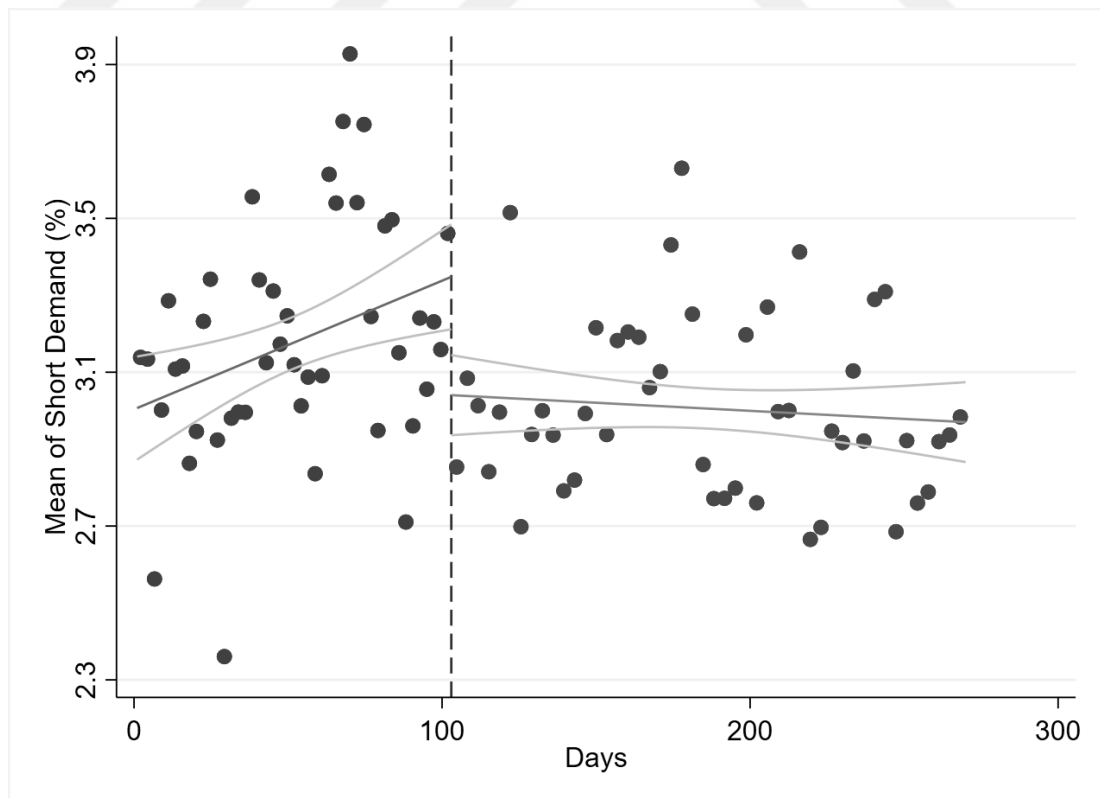


Table 3. Treatment Effect Analysis Results on Shorting Demand**Panel A: Full Sample Analysis**

Short Demand (%)	Coefficient	Robust Std. Error	z	P> z	[95% Conf. Interval]	
Average Treatment Effect	-0.1445	0.0279	-5.18	0.00	-0.1992	-0.0899
Population Mean	3.1444	0.0264	119.26	0.00	3.0927	3.1961

Panel B: [-20,+20] Days Around Policy Change Analysis

Short Demand (%)	Coefficient	Robust Std. Error	z	P> z	[95% Conf. Interval]	
Average Treatment Effect	-0.0478	0.0701	-0.68	0.50	-0.1851	0.0896
Population Mean	2.9713	0.0641	46.34	0.00	2.8456	3.0969

While evaluating the results of both treatment effect and regression discontinuity analyses, it is beneficial to emphasize that the number of observations is 14.92% of the number of observations in the full sample. Therefore, the confidence intervals are larger for the short term analyses.

To get deeper understanding of how the reduction in short sale disclosure frequency affects the shorting demand, I examine Table 4 and Table 5. The results are consistent with the results of regression discontinuity and treatment effect analyses. The impact of policy change on the shorting demand is significantly negative for the long term and insignificant for the short term.

The significant negative effect of the policy change is consistent with the short sale disclosure literature. It confirms that the first hypothesis is true, the information content about informed investors' shorting activity reduced and it leads to a decline in the trend chasing shorting activity of the uninformed traders. The negative effect for the long term is significant for the big stocks that are more on the radar of uninformed traders, while it is insignificant for the small stocks.

Table 4. Panel Data Regression Analyses on Short Demand (Full Period)

	Short Demand Full Sample (1)	Short Demand Full Sample (2)	Short Demand Small Stocks (3)	Short Demand Small Stocks (4)	Short Demand Big Stocks (5)	Short Demand Big Stocks (6)
(Intercept)	2.1116 [1.6208]	2.1418* [1.6500]	-1.3998 [-0.9396]	-1.5393 [-1.0348]	-22.0002*** [-18.5345]	-21.9336*** [-18.4784]
Lagged Return	0.0621 [0.1890]		0.8021*** [3.0710]		-4.3085*** [-3.7265]	
Winners		-0.0055 [-0.1597]		0.0783*** [2.5905]		-0.4871*** [-4.2944]
Losers		-0.0276 [-0.8302]		-0.0044 [-0.1611]		-0.2819** [-2.4493]
Policy Change	-0.1491*** [-4.8107]	-0.1485*** [-4.7896]	-0.0152 [-0.5581]	-0.0155 [-0.5697]	-0.9105*** [-6.7313]	-0.8853*** [-6.5437]
Lagged Turnover	0.2174*** [10.3808]	0.2176*** [10.4497]	0.0547*** [3.6655]	0.0557*** [3.7446]	1.3154*** [22.3107]	1.3102*** [22.2516]
Lagged Spread	-0.2659 [-0.2224]	-0.1864 [-0.1527]	0.9812 [1.1349]	0.6111 [0.6966]	-32.0733*** [-7.3382]	-28.1787*** [-6.2581]
ROA (%)	-0.0001 [-0.1781]	-0.0001 [-0.1745]	0.0002 [0.6779]	0.0002 [0.7093]	-0.0058* [-1.8414]	-0.0055* [-1.7521]
M/B Ratio	0.0909*** [3.3878]	0.0905*** [3.3726]	0.0151 [0.9202]	0.0152 [0.9262]	-0.1920*** [-7.2295]	-0.1955*** [-7.3630]
Log(MarketCap)	-0.3283* [-1.9172]	-0.3307* [-1.9381]	0.1041 [0.7272]	0.1189 [0.8320]	2.5789*** [20.6315]	2.5834*** [20.6658]
Lagged Short Ratio	0.6073*** [70.2271]	0.6073*** [70.2236]	0.3956*** [23.1682]	0.3963*** [23.2056]	1.2176*** [74.9849]	1.2179*** [75.0073]
BIST100 Return	-0.0379*** [-3.9534]	-0.0379*** [-3.9551]	0.0261*** [3.2622]	0.0252*** [3.1460]	-0.2249*** [-6.7747]	-0.2195*** [-6.6142]
High Short Demand Quintile	-0.9550*** [-11.4308]	-0.9541*** [-11.4204]	0.3501** [2.1925]	0.3418** [2.1407]	-3.6501*** [-17.8089]	-3.6232*** [-17.6682]
Policy Change x High Short Demand	0.6611*** [9.6339]	0.6601*** [9.6182]	0.6288*** [3.8449]	0.6299*** [3.8513]	1.4162*** [7.5863]	1.3876*** [7.4319]
Adj. R-sq	0.6009	0.6009	0.2497	0.2497	0.6167	0.6167
Number of Observations	102151	102151	19154	19154	21224	21224

*:10%, **:5%, ***: 1% Significance Level

Looking at the interaction between policy change dummy and the highest short demand quintile in Table 4 and Table 5, the effect is significantly positive, meaning that after the policy change, the shorting demand shifted to more shorted stocks, consistently to hypothesis 1. Uninformed traders might prefer shorting the stocks which are already highly shorted after the policy change.

Table 5. Panel Data Regression Analyses on Short Demand (-20, +20 Days)

	Short Demand Full Sample	Short Demand Full Sample	Short Demand Small Stocks	Short Demand Small Stocks	Short Demand Big Stocks	Short Demand Big Stocks
	(1)	(2)	(3)	(4)	(5)	(6)
(Intercept)	2.4329 [0.4037]	1.8890 [0.3172]	-2.5414 [-0.6268]	-3.4423 [-0.8539]	-18.3705*** [-6.3094]	-18.3347*** [-6.2764]
Lagged Return	0.5964 [0.7645]		1.9310*** [3.5756]		-3.0839 [-1.1476]	
Winners		0.0915 [1.0399]		0.1086 [1.6415]		-0.0413 [-0.1401]
Losers		0.0548 [0.6461]		-0.0867 [-1.4511]		0.2344 [0.8338]
Policy Change	-0.0619 [-0.7660]	-0.0634 [-0.7834]	-0.0590 [-0.9886]	-0.0691 [-1.1504]	0.5185 [1.4898]	0.5445 [1.5684]
Lagged Turnover	0.1545** [2.1933]	0.1537** [2.1830]	0.0426 [1.0095]	0.0428 [1.0027]	1.1593*** [8.2586]	1.1481*** [8.2020]
Lagged Spread	0.9528 [0.2710]	0.3981 [0.1123]	0.6639 [0.3327]	0.2089 [0.1045]	-28.5253*** [-2.6113]	-29.3455*** [-2.6321]
ROA (%)	0.0081 [0.3231]	0.0083 [0.3313]	0.0052 [0.5252]	0.0049 [0.4916]	-0.0053 [-0.5811]	-0.0052 [-0.5766]
M/B Ratio	0.1327 [0.5773]	0.1408 [0.6125]	0.2742 [0.7023]	0.2956 [0.7568]	-0.0958 [-1.4660]	-0.0962 [-1.4690]
Log(MarketCap)	-0.3251 [-0.4098]	-0.2626 [-0.3346]	0.2093 [0.3813]	0.3218 [0.5888]	2.0122*** [6.5737]	2.0047*** [6.5311]
Lagged Short Ratio	0.3388*** [13.1971]	0.3387*** [13.1909]	0.0941** [2.0971]	0.0989** [2.2011]	1.2745*** [31.3759]	1.2758*** [31.4215]
BIST100 Return	-0.0214 [-1.1227]	-0.0228 [-1.2018]	0.0344** [2.5693]	0.0294** [2.2001]	-0.1483** [-2.2028]	-0.1378** [-2.0586]
High Short Demand Quintile	-0.5720*** [-2.7634]	-0.5734*** [-2.7702]	1.1695*** [3.7766]	1.1576*** [3.7324]	-2.8852*** [-5.8213]	-2.8884*** [-5.8247]
Policy Change x High Short Demand	0.6557*** [3.8805]	0.6599*** [3.9046]	1.1568*** [3.3370]	1.1514*** [3.3190]	0.6196 [1.3224]	0.6223 [1.3275]
Adj. R-sq	0.6113	0.6113	0.3789	0.3779	0.5678	0.5676
Number of Observations	15240	15240	2898	2898	3148	3148

*:10%, **:5%, ***: 1% Significance Level

Comparing models 5 and 6 in Tables 6 and 7, I interpret the change in significances in the interaction variable of the policy change and losers as shifting behavior of short sellers to trading on public information from trend chasing. It supports hypothesis 1 that the proportion of informed short sales increased in time while the short demand decreases.

Table 6. Panel Data Regression Analyses on Short Demand Related to The High Short Demand Before the Change and Losers Dummies (Full Period)

	Short Demand (1)	Short Demand (2)	Short Demand (3)	Short Demand (4)	Short Demand (5)	Short Demand (6)
(Intercept)	2.1832* [1.6750]	2.2045* [1.6974]	2.3580* [1.8105]	2.3810* [1.8348]	2.1184 [1.6250]	1.9903 [1.5315]
Lagged Return	0.1254 [0.3817]		0.1090 [0.3320]		0.5826 [1.5579]	
Winners		-0.0054 [-0.1561]		-0.0031 [-0.0888]		-0.0028 [-0.0825]
Losers		-0.0348 [-1.0441]		-0.0302 [-0.9092]		-0.1797*** [-3.8106]
Policy Change	-0.0226 [-0.8221]	-0.0221 [-0.8058]	-0.2201*** [-7.0225]	-0.2196*** [-7.0046]	-0.0562* [-1.8461]	-0.0966*** [-2.9816]
Lagged Turnover	0.2149*** [10.2545]	0.2154*** [10.3415]	0.2155*** [10.2934]	0.2159*** [10.3712]	0.2121*** [10.1067]	0.2146*** [10.3013]
Lagged Spread	-0.1911 [-0.1598]	-0.0994 [-0.0814]	-0.0851 [-0.0712]	-0.0157 [-0.0129]	-0.2766 [-0.2312]	-0.0548 [-0.0449]
ROA (%)	-0.0000 [-0.0866]	-0.0000 [-0.0836]	-0.0001 [-0.1130]	-0.0001 [-0.1099]	-0.0000 [-0.0825]	-0.0000 [-0.0749]
M/B Ratio	0.0895*** [3.3302]	0.0890*** [3.3125]	0.0856*** [3.1878]	0.0851*** [3.1717]	0.0911*** [3.3888]	0.0909*** [3.3846]
Log(MarketCap)	-0.3442** [-2.0091]	-0.3452** [-2.0220]	-0.3510** [-2.0506]	-0.3525** [-2.0662]	-0.3367** [-1.9652]	-0.3138* [-1.8364]
Lagged Short Ratio	0.5570*** [91.5643]	0.5571*** [91.5649]	0.5466*** [89.1561]	0.5466*** [89.1550]	0.5571*** [91.5758]	0.5574*** [91.6150]
BIST100 Return	-0.0377*** [-3.9315]	-0.0377*** [-3.9379]	-0.0373*** [-3.8947]	-0.0373*** [-3.9005]	-0.0371*** [-3.8715]	-0.0371*** [-3.8751]
Pol. Change x High Short Demand (Before Change)			0.8491*** [13.0415]	0.8486*** [13.0329]		
Policy Change x Losers					0.1149** [2.5578]	0.2582*** [4.3395]
Adj. R-sq	0.6003	0.6003	0.6009	0.6009	0.6003	0.6004
Number of Observations	102151	102151	102151	102151	102151	102151

*:10%, **:5%, ***: 1% Significance Level

Analyzing Tables 8 and 9, the average impact of the policy change on shorting demand of small stocks seems negative in the short term and positive in the long term but the effect is insignificant in both period lengths. However, looking at the interaction variable of the policy change price spreads, the change in the short sale disclosure frequency significantly reduced the shorting demand of illiquid stocks in the short term and significantly raised in the long term. It is parallel to the shift in the distribution of short sales.

Table 7. Panel Data Regression Analyses on Short Demand Related to The High Short Demand Before the Change and Losers Dummies (-20, +20 Days)

	Short Demand (1)	Short Demand (2)	Short Demand (3)	Short Demand (4)	Short Demand (5)	Short Demand (6)
(Intercept)	3.7971 [0.6310]	3.2300 [0.5431]	1.3285 [0.2207]	0.8583 [0.1443]	2.8402 [0.4702]	2.0394 [0.3405]
Lagged Return	0.6212 [0.7960]		0.6082 [0.7805]		1.2426 [1.4553]	
Winners		0.0869 [0.9871]		0.1008 [1.1466]		0.0877 [0.9968]
Losers		0.0484 [0.5697]		0.0560 [0.6602]		-0.0835 [-0.7259]
Policy Change	0.0680 [0.9330]	0.0673 [0.9222]	-0.1736** [-2.1382]	-0.1755** [-2.1592]	0.0147 [0.1868]	-0.0039 [-0.0460]
Lagged Turnover	0.1566** [2.2221]	0.1563** [2.2185]	0.1545** [2.1964]	0.1530** [2.1749]	0.1522** [2.1589]	0.1536** [2.1798]
Lagged Spread	1.2249 [0.3483]	0.7017 [0.1978]	0.5849 [0.1665]	-0.0128 [-0.0036]	0.9176 [0.2606]	0.5359 [0.1510]
ROA (%)	0.0057 [0.2264]	0.0059 [0.2328]	0.0109 [0.4326]	0.0111 [0.4416]	0.0058 [0.2313]	0.0053 [0.2120]
M/B Ratio	0.1004 [0.4379]	0.1084 [0.4726]	0.0552 [0.2411]	0.0615 [0.2683]	0.1163 [0.5067]	0.1193 [0.5200]
Log(MarketCap)	-0.5000 [-0.6311]	-0.4343 [-0.5540]	-0.1357 [-0.1711]	-0.0819 [-0.1044]	-0.3824 [-0.4811]	-0.2783 [-0.3526]
Lagged Short Ratio	0.3207*** [16.3684]	0.3207*** [16.3633]	0.3077*** [15.6493]	0.3075*** [15.6396]	0.3216*** [16.4083]	0.3214*** [16.3996]
BIST100 Return	-0.0216 [-1.1306]	-0.0230 [-1.2136]	-0.0208 [-1.0910]	-0.0222 [-1.1710]	-0.0196 [-1.0259]	-0.0227 [-1.1946]
Pol. Change x High Short Demand (Before Change)			1.0749*** [6.7084]	1.0796*** [6.7361]		
Policy Change x Losers					0.2083* [1.7929]	0.2563* [1.6989]
Adj. R-sq	0.6109	0.6109	0.6120	0.6120	0.6109	0.6109
Number of Observations	15240	15240	15240	15240	15240	15240

*:10%, **:5%, ***: 1% Significance Level

Table 8. Panel Data Regression Analyses on Short Demand Related to Small Size Dummy and Price Spread (Full Period)

	Short Demand (1)	Short Demand (2)	Short Demand (3)	Short Demand (4)
(Intercept)	2.6552* [1.8971]	2.6785* [1.9201]	2.2787* [1.7476]	2.2980* [1.7688]
Lagged Return	0.1277 [0.3886]		0.1387 [0.4221]	
Winners		-0.0054 [-0.1555]		-0.0015 [-0.0435]
Losers		-0.0350 [-1.0500]		-0.0324 [-0.9737]
Policy Change	-0.0297 [-0.9769]	-0.0293 [-0.9622]	-0.1621*** [-2.6311]	-0.1608*** [-2.6057]
Lagged Turnover	0.2155*** [10.2794]	0.2161*** [10.3672]	0.2139*** [10.2058]	0.2144*** [10.2883]
Lagged Spread	-0.2207 [-0.1844]	-0.1289 [-0.1055]	-2.6306* [-1.7123]	-2.5494 [-1.6307]
ROA (%)	-0.0000 [-0.0471]	-0.0000 [-0.0440]	-0.0000 [-0.0396]	-0.0000 [-0.0369]
M/B Ratio	0.0899*** [3.3428]	0.0894*** [3.3250]	0.0917*** [3.4120]	0.0912*** [3.3941]
Log(MarketCap)	-0.4049** [-2.2061]	-0.4062** [-2.2201]	-0.3486** [-2.0350]	-0.3497** [-2.0477]
Lagged Short Ratio	0.5570*** [91.5645]	0.5571*** [91.5652]	0.5576*** [91.5967]	0.5576*** [91.5971]
BIST100 Return	-0.0378*** [-3.9398]	-0.0378*** [-3.9464]	-0.0372*** [-3.8829]	-0.0373*** [-3.8916]
Small	-0.1053 [-1.0773]	-0.1057 [-1.0815]		
Policy Change x Small	0.0171 [0.2236]	0.0170 [0.2223]		
Policy Change x Price Spread			4.4928** [2.5299]	4.4605** [2.5094]
Adj. R-sq	0.6003	0.6003	0.6003	0.6003
Number of Observations	102151	102151	102151	102151

*:10%, **:5%, ***: 1% Significance Level

Table 9. Panel Data Regression Analyses on Short Demand Related to Small Size Dummy and Price Spread (-20, +20 Days)

	Short Demand (1)	Short Demand (2)	Short Demand (3)	Short Demand (4)
(Intercept)	4.8265 [0.7770]	4.2908 [0.6983]	3.3734 [0.5609]	3.0048 [0.5055]
Lagged Return	0.6192 [0.7933]		0.4314 [0.5523]	
Winners		0.0880 [0.9993]		0.0734 [0.8344]
Losers		0.0499 [0.5882]		0.0462 [0.5448]
Policy Change	0.0705 [0.8851]	0.0700 [0.8779]	0.7188*** [4.3505]	0.7190*** [4.3518]
Lagged Turnover	0.1555** [2.2009]	0.1551** [2.1955]	0.1237* [1.7477]	0.1227* [1.7328]
Lagged Spread	1.2412 [0.3528]	0.7108 [0.2003]	12.6436*** [2.8912]	12.2088*** [2.7707]
ROA (%)	0.0057 [0.2262]	0.0059 [0.2329]	0.0106 [0.4195]	0.0107 [0.4265]
M/B Ratio	0.0911 [0.3966]	0.0988 [0.4303]	0.0262 [0.1142]	0.0317 [0.1379]
Log(MarketCap)	-0.6276 [-0.7698]	-0.5659 [-0.7010]	-0.4409 [-0.5568]	-0.3992 [-0.5094]
Lagged Short Ratio	0.3208*** [16.3716]	0.3208*** [16.3668]	0.3168*** [16.1646]	0.3168*** [16.1599]
BIST100 Return	-0.0218 [-1.1414]	-0.0232 [-1.2244]	-0.0213 [-1.1169]	-0.0223 [-1.1751]
Small	-0.1348 [-0.4838]	-0.1386 [-0.4975]		
Policy Change x Small	-0.0829 [-0.4424]	-0.0858 [-0.4575]		
Policy Change x Price Spread			-19.7653*** [-4.3885]	-19.7819*** [-4.3959]
Adj. R-sq	0.6109	0.6108	0.6114	0.6114
Number of Observations	15240	15240	15240	15240

*:10%, **:5%, ***: 1% Significance Level

5.2 Return

At first glance, looking at Figure 3 the returns look like to be increased in the short and long terms after the policy change. Looking at Table 10, the decrease in the returns after the policy change is significant in the long term, and the effect of the policy change seems negative on the returns while it is insignificant in the short term.

In Tables 11 and 12, the effect of policy change is significantly negative on returns in both the short and long terms. The significant negative effect of the policy change on the returns is in the opposite direction of what I expect in hypothesis 2, while the returns of highly shorted big stocks in both period lengths are affected positively, which is consistent with hypothesis 2. It could be explained by the declined trend-chasing behavior of the uninformed short sellers. The significant negative effect on the returns may be explained by Diamond & Verrecchia (1987)'s theory that when uninformed traders could not reach out the information from short sales, the lower volumes imply that informed traders have negative information.

Table 10. Treatment Effect Analysis Results on Return

Panel A: Full Sample Analysis

Return (%)	Coefficient	Robust Std. Error	z	P> z	[95% Conf. Interval]	
Average Treatment Effect	-0.1039	0.0184	-5.65	0.00	-0.1400	-0.0679
Population Mean	0.1068	0.0136	7.84	0.00	0.0801	0.1336

Panel B: [-20,+20] Days Around Policy Change Analysis

Return (%)	Coefficient	Robust Std. Error	z	P> z	[95% Conf. Interval]	
Average Treatment Effect	-0.0798	0.0586	-1.36	0.17	-0.1946	0.0351
Population Mean	0.1055	0.0416	2.54	0.01	0.0241	0.1869

Figure 3. Return Regression Discontinuity Graph (-20, +20 days)

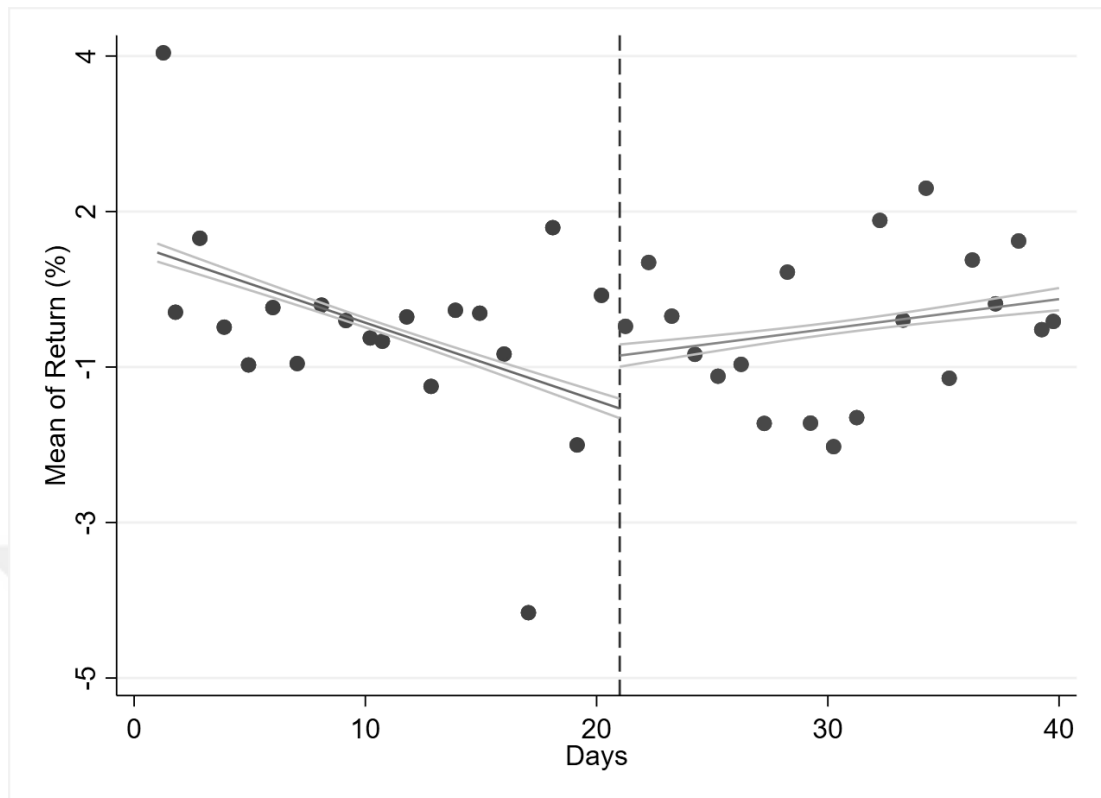


Figure 4. Return Regression Discontinuity Graph (Full Period)

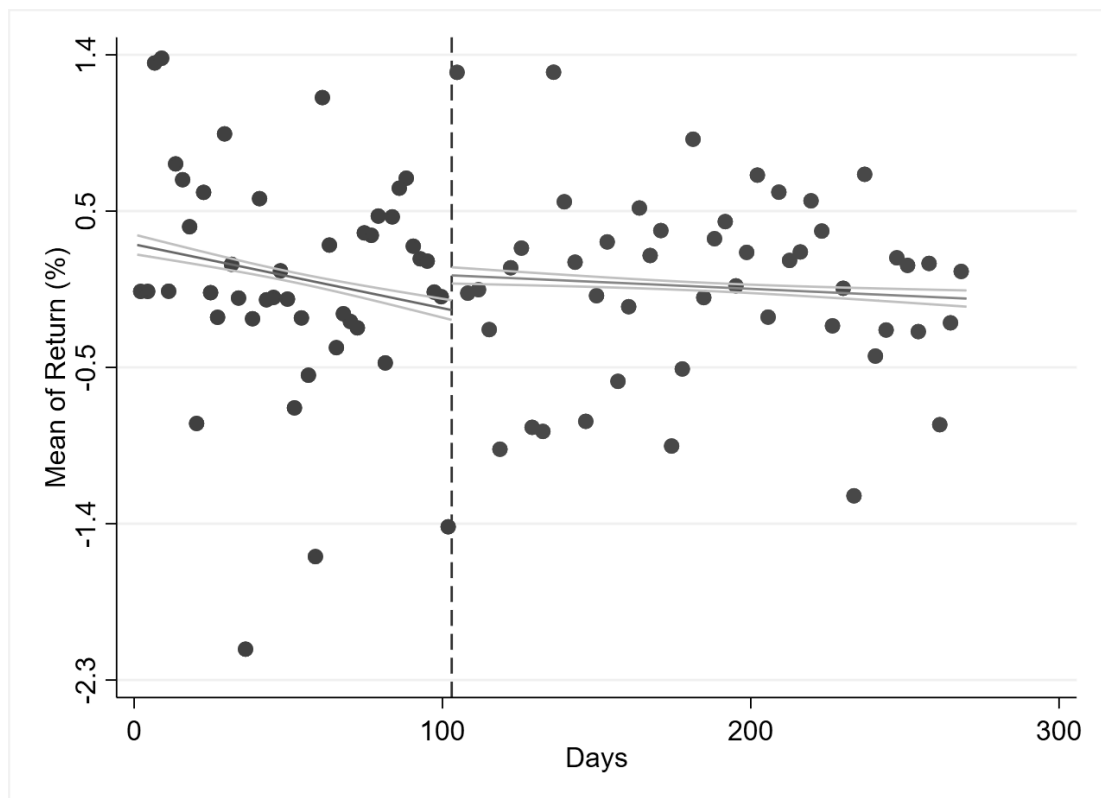


Table 11. Panel Data Regression Analyses on Return (Full Period)

	Return Full Sample (1)	Return Full Sample (2)	Return Small Stocks (3)	Return Small Stocks (4)	Return Big Stocks (5)	Return Big Stocks (6)
(Intercept)	5.8542*** [11.1144]	6.0887*** [11.6036]	0.9049 [0.4668]	1.4053 [0.7265]	14.6583*** [7.2938]	15.0889*** [7.5570]
Lagged Return	-1.8607*** [-14.0184]		-3.9075*** [-11.4972]		-0.9334*** [-3.5218]	
Winners		-0.1301*** [-9.3484]		-0.2038*** [-5.1840]		-0.1243*** [-4.8444]
Losers		0.0888*** [6.5981]		0.2607*** [7.2925]		-0.0371 [-1.4338]
Policy Change	-0.1190*** [-9.4974]	-0.1174*** [-9.3650]	-0.0902** [-2.5533]	-0.0902** [-2.5552]	-0.1427*** [-4.3538]	-0.1385*** [-4.2270]
Lagged Turnover	-0.0501*** [-5.9194]	-0.0560*** [-6.6476]	-0.0357* [-1.8379]	-0.0488** [-2.5225]	-0.0170 [-0.6891]	-0.0182 [-0.7411]
Lagged Spread	-1.3158*** [-2.7222]	-0.6777 [-1.3735]	0.2385 [0.2120]	1.0622 [0.9312]	-3.6435*** [-3.0920]	-2.6035** [-2.1663]
ROA (%)	0.0008*** [3.7701]	0.0008*** [3.7969]	0.0001 [0.4508]	0.0001 [0.3447]	-0.0031*** [-2.6658]	-0.0030*** [-2.6029]
M/B Ratio	0.1750*** [16.1254]	0.1762*** [16.2326]	0.1238*** [5.8071]	0.1257*** [5.8996]	0.1971*** [7.3265]	0.1964*** [7.3003]
Log(MarketCap)	-0.8351*** [-12.0644]	-0.8663*** [-12.5585]	-0.6796*** [-3.6483]	-0.7425*** [-3.9975]	-1.5835*** [-8.1759]	-1.6123*** [-8.3784]
Lagged Short Ratio	-0.0125*** [-3.5737]	-0.0123*** [-3.5182]	-0.0749*** [-3.3732]	-0.0765*** [-3.4442]	-0.0083* [-1.7944]	-0.0079* [-1.7049]
BIST100 Return	0.4790*** [123.6910]	0.4806*** [124.2045]	0.2861*** [27.4548]	0.2894*** [27.7919]	0.6584*** [88.9632]	0.6596*** [89.1805]
High Short Demand Quintile	-0.0820** [-2.4288]	-0.0827** [-2.4479]	0.2683 [1.2915]	0.2901 [1.3971]	-0.1131** [-2.2549]	-0.1121** [-2.2362]
Policy Change x High Short Demand	0.1531*** [5.5189]	0.1535*** [5.5314]	-0.3004 [-1.4119]	-0.3044 [-1.4313]	0.1907*** [4.2644]	0.1871*** [4.1830]
Adj. R-sq	0.1387	0.1390	0.0536	0.0547	0.2771	0.2775
Number of Observations	102151	102151	19154	19154	21224	21224

*:10%, **:5%, ***: 1% Significance Level

Table 12. Panel Data Regression Analyses on Return (-20, +20 Days)

	Return Full Sample (1)	Return Full Sample (2)	Return Small Stocks (3)	Return Small Stocks (4)	Return Big Stocks (5)	Return Big Stocks (6)
(Intercept)	21.3629*** [8.1021]	19.8680*** [7.6434]	15.2289** [2.2207]	16.9847** [2.4952]	1.6142** [2.4656]	1.8124*** [2.7651]
Lagged Return	-1.6472*** [-4.8260]		-5.7442*** [-6.2881]		-1.4679** [-2.4294]	
Winners		-0.2098*** [-5.4639]		-0.2712** [-2.4275]		-0.2557*** [-3.8666]
Losers		0.1955*** [5.2793]		0.4346*** [4.3098]		0.0179 [0.2842]
Policy Change	-0.2812*** [-7.9485]	-0.2665*** [-7.5439]	-0.2217** [-2.1943]	-0.1902* [-1.8760]	-0.2388*** [-3.0511]	-0.2376*** [-3.0499]
Lagged Turnover	-0.1900*** [-6.1669]	-0.1782*** [-5.7985]	-0.0613 [-0.8588]	-0.0634 [-0.8780]	-0.0100 [-0.3165]	-0.0084 [-0.2688]
Lagged Spread	1.1967 [0.7779]	1.7737 [1.1461]	-1.9059 [-0.5646]	-1.0495 [-0.3108]	1.0992 [0.4475]	2.5638 [1.0249]
ROA (%)	0.0050 [0.4518]	0.0059 [0.5377]	0.0282* [1.6902]	0.0302* [1.8140]	-0.0006 [-0.2922]	-0.0004 [-0.1939]
M/B Ratio	0.8807*** [8.7569]	0.9228*** [9.1994]	2.9326*** [4.4405]	2.9024*** [4.4005]	0.0491*** [3.3395]	0.0517*** [3.5163]
Log(MarketCap)	-3.1473*** [-9.0694]	-2.9834*** [-8.7094]	-4.0034*** [-4.3111]	-4.2379*** [-4.5921]	-0.1620** [-2.3534]	-0.1807*** [-2.6243]
Lagged Short Ratio	-0.0105 [-0.9386]	-0.0095 [-0.8516]	-0.0703 [-0.9266]	-0.0789 [-1.0403]	-0.0029 [-0.3178]	-0.0021 [-0.2330]
BIST100 Return	0.5471*** [65.5914]	0.5513*** [66.6168]	0.3199*** [14.1201]	0.3346*** [14.8443]	0.7013*** [46.3310]	0.7053*** [46.9606]
High Short Demand Quintile	-0.1268 [-1.4005]	-0.1269 [-1.4047]	0.3988 [0.7615]	0.4100 [0.7829]	-0.2171* [-1.9478]	-0.2240** [-2.0133]
Policy Change x High Short Demand	0.1669** [2.2574]	0.1681** [2.2796]	-0.9967* [-1.6999]	-0.9976* [-1.7030]	0.3486*** [3.3095]	0.3461*** [3.2900]
Adj. R-sq	0.2422	0.2460	0.1143	0.1160	0.4173	0.4195
Number of Observations	15240	15240	2898	2898	3148	3148

*:10%, **:5%, ***: 1% Significance Level

5.3 Volume

As the proxy of volumes, I use the logarithm of the number of the traded stocks. The adjusted R squares are higher with the logarithms than using the number of traded stocks. The models, which I use the number of traded stocks directly, are not reported. Looking at Figures 5 and 6, the volumes seem to decrease significantly in the short term without using control variables, while the positive effect in the long term seems insignificant. These results are consistent with what Table 13 exhibits.

Examining Tables 14 and 15, the volumes are affected significantly and negatively by the policy change in the short term, consistent with the decreased short sales. The effect of the policy change is also significantly negative for the volumes of small stocks in the long term. However, the effect is significantly positive for the full sample in the long term after the policy changed. The volumes of highly shorted stocks are affected significantly and positively after the policy change in the short term except for small stocks.

Table 13. Treatment Effect Analysis Results on Volume

Panel A: Full Sample Analysis

Log(Shares Traded)	Coefficient	Robust Std. Error	z	P> z	[95% Conf. Interval]	
Average Treatment Effect	-0.0034	0.0052	-0.66	0.51	-0.0137	0.0060
Population Mean	5.2307	0.0043	1204	0.00	5.2222	5.2393

Panel B: [-20,+20] Days Around Policy Change Analysis

Log(Shares Traded)	Coefficient	Robust Std. Error	z	P> z	[95% Conf. Interval]	
Average Treatment Effect	-0.1289	0.0137	-9.42	0.00	-0.1557	-0.1021
Population Mean	5.3219	0.0113	468.96	0.00	5.2996	5.3441

Figure 5. Log (Shares Traded) Regression Discontinuity Graph (-20, +20 days)

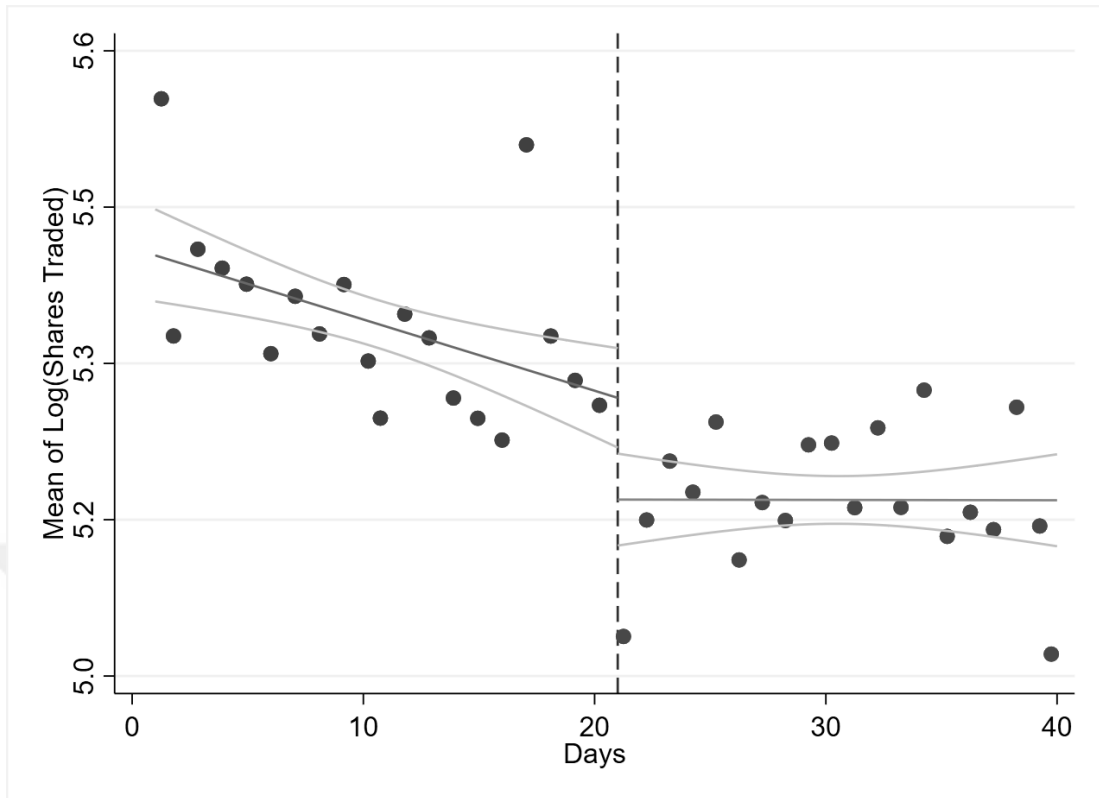


Figure 6. Log (Shares Traded) Regression Discontinuity Graph (Full Period)

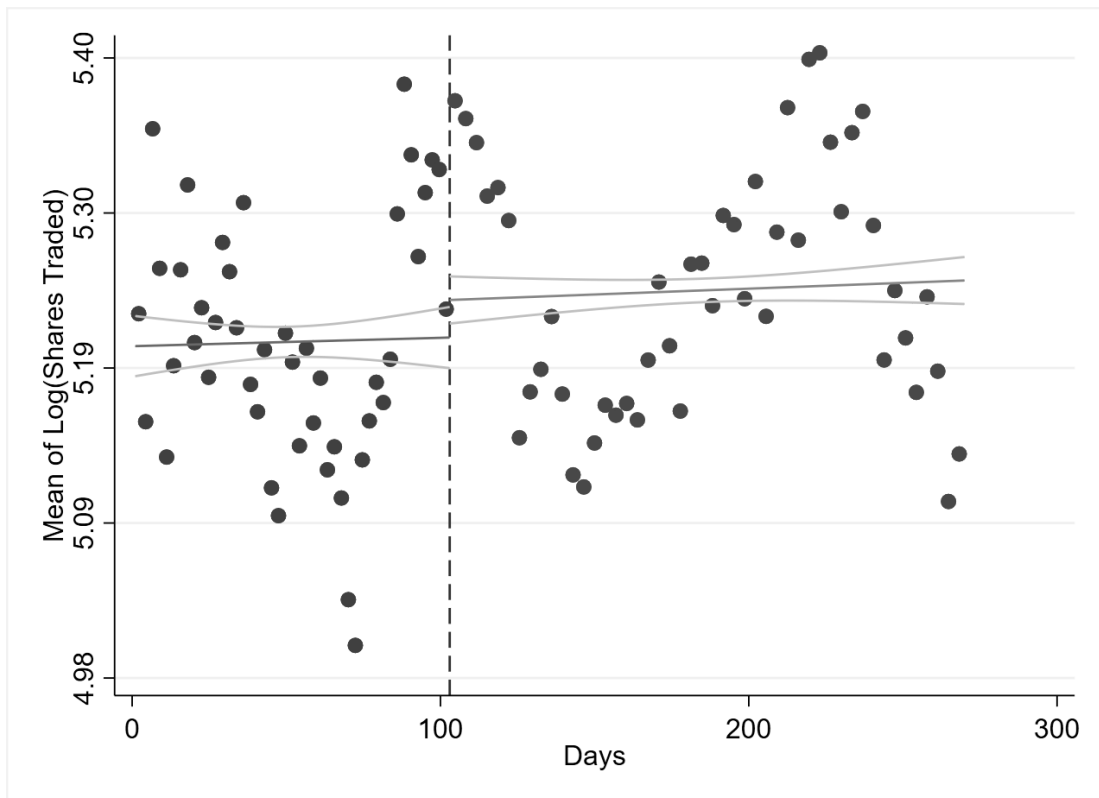


Table 14. Panel Data Regression Analyses on Volume (Full Period)

	Log(Shares Traded) Full Sample (1)	Log(Shares Traded) Full Sample (2)	Log(Shares Traded) Small Stocks (3)	Log(Shares Traded) Small Stocks (4)	Log(Shares Traded) Big Stocks (5)	Log(Shares Traded) Big Stocks (6)
(Intercept)	2.8062*** [24.4856]	2.5889*** [22.6430]	0.1223 [0.3062]	-0.0326 [-0.0817]	7.3305*** [19.1583]	6.8948*** [18.1058]
Lagged Return	0.8372*** [28.9880]		0.6383*** [9.1191]		0.6558*** [12.5568]	
Winners		0.0711*** [23.4346]		0.0674*** [8.3171]		0.0493*** [9.7280]
Losers		0.0152*** [5.1829]		0.0192*** [2.6049]		0.0061 [1.1993]
Policy Change	0.0149*** [5.4749]	0.0128*** [4.7036]	-0.0251*** [-3.4461]	-0.0253*** [-3.4744]	0.0101 [1.5697]	0.0080 [1.2302]
Lagged Turnover	0.2406*** [130.5635]	0.2439*** [132.9951]	0.2407*** [60.2001]	0.2416*** [60.5594]	0.1475*** [30.4177]	0.1510*** [31.2377]
Lagged Spread	1.9701*** [18.7316]	1.5177*** [14.1175]	0.7769*** [3.3529]	0.4431* [1.8842]	4.2032*** [18.1020]	3.8299*** [16.1477]
ROA (%)	0.0002*** [4.6217]	0.0002*** [4.4275]	0.0003*** [4.8069]	0.0003*** [4.8751]	-0.0013*** [-5.7374]	-0.0014*** [-6.0020]
M/B Ratio	-0.0202*** [-8.5727]	-0.0198*** [-8.3925]	0.0015 [0.3309]	0.0020 [0.4465]	0.0182*** [3.4267]	0.0186*** [3.5076]
Log(MarketCap)	0.1853*** [12.3049]	0.2106*** [14.0122]	0.6216*** [16.2017]	0.6376*** [16.6510]	-0.1505*** [-3.9440]	-0.1125*** [-2.9612]
Lagged Short Ratio	0.0023*** [2.9885]	0.0022*** [2.8391]	-0.0069 [-1.5175]	-0.0063 [-1.3773]	-0.0002 [-0.2660]	-0.0004 [-0.4003]
BIST100 Return	0.0058*** [6.8548]	0.0049*** [5.8158]	0.0015 [0.6898]	0.0007 [0.3087]	0.0081*** [5.5800]	0.0074*** [5.0951]
High Short Demand Quintile	-0.0059 [-0.8016]	-0.0078 [-1.0549]	0.0082 [0.1908]	-0.0000 [-0.0005]	0.0375*** [3.7943]	0.0363*** [3.6670]
Policy Change x High Short Demand	-0.0047 [-0.7772]	-0.0026 [-0.4344]	0.0523 [1.1924]	0.0521 [1.1894]	0.0115 [1.3066]	0.0138 [1.5665]
Adj. R-sq	0.8330	0.8326	0.6878	0.6876	0.9018	0.9015
Number of Observations	102151	102151	19154	19154	21224	21224

*:10%, **:5%, ***: 1% Significance Level

Table 15. Panel Data Regression Analyses on Volume (-20, +20 Days)

	Log(Shares Traded) Full Sample (1)	Log(Shares Traded) Full Sample (2)	Log(Shares Traded) Small Stocks (3)	Log(Shares Traded) Small Stocks (4)	Log(Shares Traded) Big Stocks (5)	Log(Shares Traded) Big Stocks (6)
(Intercept)	2.6619*** [5.5342]	2.4038*** [5.0663]	-0.0449 [-0.0370]	-0.1789 [-0.1488]	3.1417*** [11.7340]	3.1435*** [11.7072]
Lagged Return	0.6169*** [9.9080]		0.6594*** [4.0806]		-0.1121 [-0.4536]	
Winners		0.0848*** [12.1016]		0.1055*** [5.3452]		-0.0115 [-0.4230]
Losers		0.0152** [2.2485]		0.0318* [1.7874]		-0.0397 [-1.5343]
Policy Change	-0.1266*** [-19.6205]	-0.1293*** [-20.0504]	-0.1080*** [-6.0448]	-0.1157*** [-6.4630]	-0.1339*** [-4.1832]	-0.1322*** [-4.1429]
Lagged Turnover	0.1405*** [25.0013]	0.1391*** [24.7919]	0.1431*** [11.3362]	0.1357*** [10.6462]	0.1973*** [15.2886]	0.1965*** [15.2684]
Lagged Spread	2.8683*** [10.2211]	2.4276*** [8.5938]	0.8144 [1.3641]	0.4385 [0.7350]	0.0454 [0.0452]	0.1490 [0.1454]
ROA (%)	-0.0058*** [-2.8898]	-0.0058*** [-2.8796]	-0.0107*** [-3.6459]	-0.0106*** [-3.6151]	-0.0047*** [-5.6483]	-0.0048*** [-5.6908]
M/B Ratio	-0.0885*** [-4.8212]	-0.0869*** [-4.7435]	-0.1520 [-1.3010]	-0.1524 [-1.3077]	-0.1425*** [-23.7056]	-0.1434*** [-23.8161]
Log(MarketCap)	0.2647*** [4.1810]	0.2955*** [4.7258]	0.7907*** [4.8137]	0.8064*** [4.9456]	0.2623*** [9.3199]	0.2635*** [9.3404]
Lagged Short Ratio	0.0028 [1.3790]	0.0026 [1.2817]	-0.0154 [-1.1504]	-0.0111 [-0.8281]	0.0534*** [14.2967]	0.0535*** [14.3465]
BIST100 Return	0.0060*** [3.9676]	0.0046*** [3.0184]	0.0049 [1.2326]	0.0029 [0.7175]	0.0035 [0.5663]	0.0035 [0.5703]
High Short Demand Quintile	-0.0516*** [-3.1255]	-0.0526*** [-3.1886]	0.1261 [1.3605]	0.1072 [1.1583]	0.1501*** [3.2930]	0.1522*** [3.3389]
Policy Change x High Short Demand	0.0724*** [5.3695]	0.0752*** [5.5839]	-0.0267 [-0.2579]	-0.0267 [-0.2576]	0.1118*** [2.5940]	0.1090** [2.5295]
Adj. R-sq	0.8733	0.8738	0.7666	0.7676	0.5875	0.5877
Number of Observations	15240	15240	2898	2898	3148	3148

*:10%, **:5%, ***: 1% Significance Level

5.4 Bid Ask Spread

Looking at Figures 7 and 8, the bid ask spreads seem increased in both the long and short terms, which means liquidities declined, consistently to my third hypothesis but the effect is insignificant in the short term. However, Table 16 exhibits that the effect of policy change on the bid ask spreads in the long term is significantly negative when using daily control variables. At this point, I would like to remind that the policy change dummy includes a seven months period. Interpreting the results for the entire period is harder and could be misleading because of the fact that Borsa Istanbul is affected by the Turkish economy.

Looking at Tables 17 and 18, the bid ask spreads are affected significantly and positively in both period lengths for the highly shorted stocks which means liquidities got hurt by the reduction in short sale disclosure frequency for the highly shorted stocks. However, the effect on spreads of the policy change dummy is significantly negative in the long term.

Table 16. Treatment Effect Analysis Results on Bid Ask Spread

Panel A: Full Sample Analysis

Price Spread (%)	Coefficient	Robust Std. Error	z	P> z	[95% Conf. Interval]	
Average Treatment Effect	-0.1563	0.0152	-10.27	0.00	-0.1861	-0.1265
Population Mean	3.3171	0.0117	283.49	0.00	3.2941	3.3400

Panel B: [-20,+20] Days Around Policy Change Analysis

Price Spread (%)	Coefficient	Robust Std. Error	z	P> z	[95% Conf. Interval]	
Average Treatment Effect	0.0852	0.0545	1.56	0.12	-0.2164	0.1920
Population Mean	3.5307	0.0457	77.19	0.00	3.4410	3.6205

Figure 7. Bid Ask Spread Regression Discontinuity Graph (-20, +20 days)

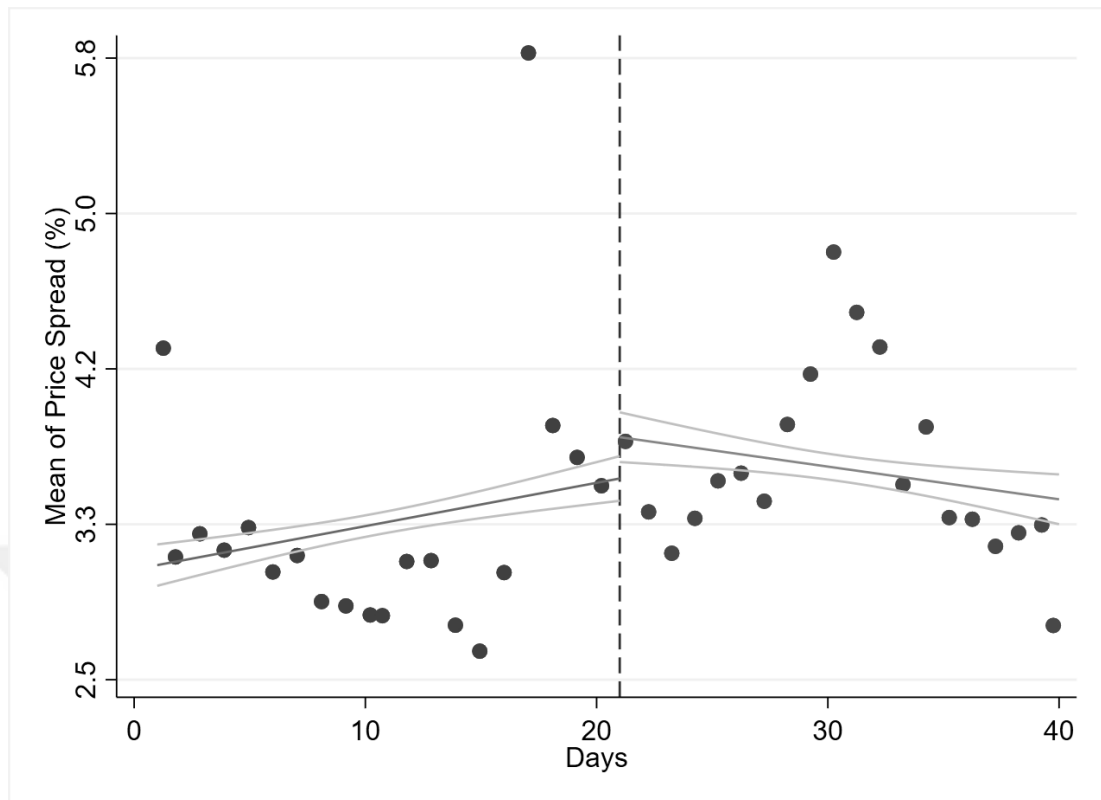


Figure 8. Bid Ask Spread Regression Discontinuity Graph (Full Period)

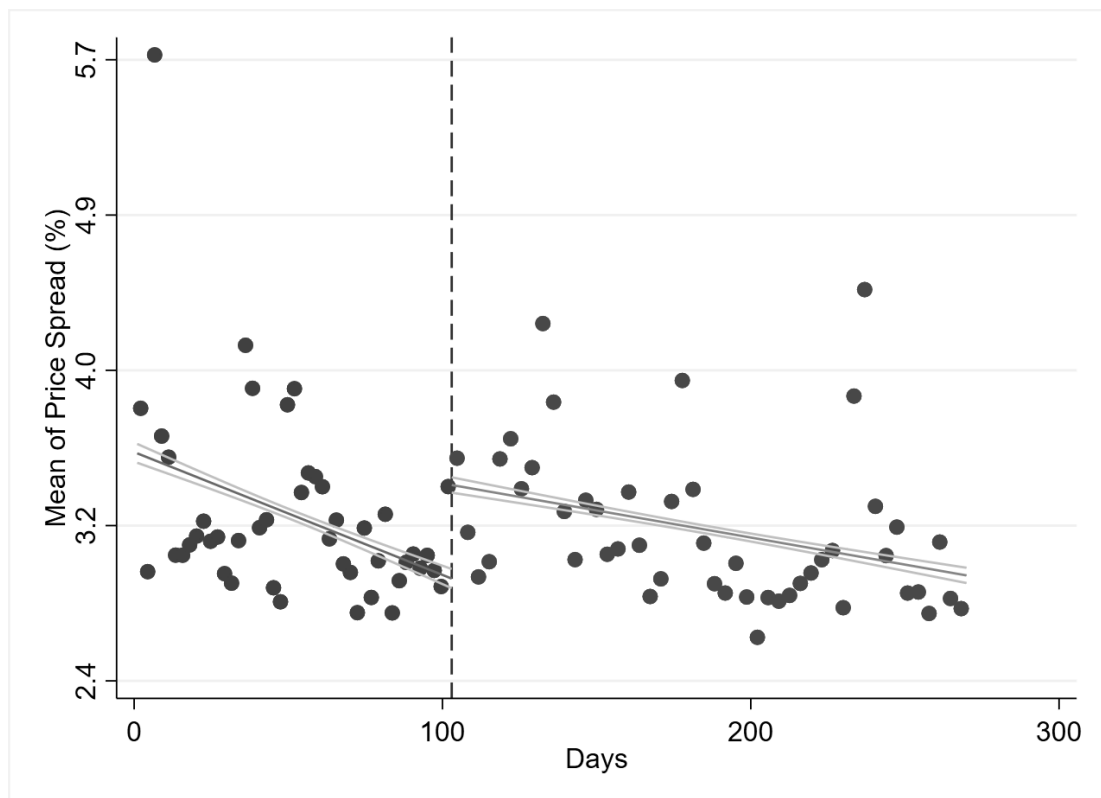


Table 17. Panel Data Regression Analyses on Bid Ask Spread (Full Period)

	Price Spread Full Sample	Price Spread Full Sample	Price Spread Small Stockcs	Price Spread Small Stockcs	Price Spread Big Stockcs	Price Spread Big Stockcs
	(1)	(2)	(3)	(4)	(5)	(6)
(Intercept)	-4.2651*** [-8.1417]	-3.9583*** [-7.5969]	-6.2346*** [-3.2123]	-6.1874*** [-3.2017]	3.9116** [2.1637]	5.2745*** [2.9370]
Lagged Return	0.7640*** [5.7873]		2.0050*** [5.8922]		-1.0646*** [-4.3975]	
Winners		0.2579*** [18.6593]		0.4236*** [10.7852]		0.0685*** [2.9235]
Losers		0.0289** [2.1598]		0.0392 [1.0985]		-0.0307 [-1.2990]
Policy Change	-0.1592*** [-12.7703]	-0.1635*** [-13.1379]	-0.0765** [-2.1630]	-0.0806** [-2.2843]	-0.2321*** [-7.7543]	-0.2271*** [-7.5871]
Lagged Turnover	0.1197*** [14.2154]	0.1088*** [13.0190]	0.2092*** [10.7648]	0.1962*** [10.1443]	0.0397* [1.7677]	0.0218 [0.9749]
Lagged Spread	38.8395*** 0.0007***	37.1801*** 0.0007***	30.0968*** 0.0009***	28.0977*** 0.0010***	37.7609*** -0.0034***	37.0900*** -0.0032***
ROA (%)	0.0007*** [3.3119]	0.0007*** [3.4187]	0.0009*** [3.0242]	0.0010*** [3.1902]	-0.0034*** [-3.2437]	-0.0032*** [-3.0069]
M/B Ratio	0.0462*** [4.2811]	0.0444*** [4.1246]	0.0327 [1.5335]	0.0303 [1.4231]	0.1394*** [5.6730]	0.1366*** [5.5585]
Log(MarketCap)	0.8154*** [11.8444]	0.7738*** [11.2969]	1.6231*** [8.7024]	1.6069*** [8.6585]	-0.2407 [-1.3607]	-0.4382** [-2.4920]
Lagged Short Ratio	-0.0066* [-1.8869]	-0.0074** [-2.1300]	-0.0306 [-1.3770]	-0.0271 [-1.2212]	-0.0093** [-2.2114]	-0.0099** [-2.3380]
BIST100 Return	-0.1054*** [-27.3627]	-0.1062*** [-27.6415]	-0.0835*** [-8.0051]	-0.0868*** [-8.3472]	-0.1025*** [-15.1667]	-0.1017*** [-15.0559]
High Short Demand Quintile	-0.0700** [-2.0823]	-0.0663** [-1.9773]	0.1940 [0.9324]	0.1668 [0.8040]	-0.1225*** [-2.6757]	-0.1116** [-2.4369]
Policy Change x High Short Demand	0.1745*** [6.3235]	0.1763*** [6.3998]	-0.0737 [-0.3459]	-0.0530 [-0.2497]	0.2877*** [7.0421]	0.2776*** [6.7935]
Adj. R-sq	0.2609	0.2636	0.2301	0.2344	0.1989	0.1987
Number of Observations	102151	102151	19154	19154	21224	21224

*:10%, **:5%, ***: 1% Significance Level

Table 18. Panel Data Regression Analyses on Bid Ask Spread (-20, +20 days)

	Price Spread Full Sample	Price Spread Full Sample	Price Spread Small Stocks	Price Spread Small Stocks	Price Spread Big Stocks	Price Spread Big Stocks
	(1)	(2)	(3)	(4)	(5)	(6)
(Intercept)	-5.1404** [-2.0168]	0.1788 [0.0710]	-25.5936*** [-3.8240]	-21.5556*** [-3.2462]	2.9366*** [4.4449]	2.8302*** [4.2461]
Lagged Return	-1.6918*** [-5.1276]		-1.0930 [-1.2260]		-3.7151*** [-6.0929]	
Winners		0.2468*** [6.6349]		0.3438*** [3.1546]		0.0743 [1.1045]
Losers		0.0503 [1.4027]		0.1047 [1.0640]		-0.0084 [-0.1304]
Policy Change	0.0534 [1.5606]	0.0475 [1.3874]	0.1581 [1.6032]	0.1264 [1.2782]	-0.0051 [-0.0651]	0.0413 [0.5212]
Lagged Turnover	0.1667*** [5.5969]	0.1256*** [4.2190]	0.2489*** [3.5744]	0.1944*** [2.7621]	-0.0065 [-0.2049]	-0.0295 [-0.9245]
Lagged Spread	23.2622*** [15.6430]	22.3350*** [14.9019]	10.9374*** [3.3202]	10.6691*** [3.2390]	55.9655*** [22.5788]	54.4268*** [21.3949]
ROA (%)	0.0194* [1.8170]	0.0200* [1.8815]	0.0349** [2.1451]	0.0342** [2.1043]	-0.0048** [-2.3291]	-0.0052** [-2.5098]
M/B Ratio	-0.1475 [-1.5171]	-0.2288** [-2.3556]	1.5219** [2.3612]	1.3709** [2.1307]	0.0595*** [4.0079]	0.0501*** [3.3540]
Log(MarketCap)	1.2121*** [3.6133]	0.5691* [1.7155]	3.7156*** [4.0998]	3.2394*** [3.5983]	-0.2022*** [-2.9117]	-0.1871*** [-2.6709]
Lagged Short Ratio	0.0111 [1.0234]	0.0105 [0.9687]	-0.1534** [-2.0724]	-0.1488** [-2.0117]	0.0083 [0.9032]	0.0105 [1.1327]
BIST100 Return	-0.0730*** [-9.0543]	-0.0685*** [-8.5411]	-0.0530** [-2.3968]	-0.0522** [-2.3754]	-0.1056*** [-6.9125]	-0.0950*** [-6.2221]
High Short Demand Quintile	-0.1603* [-1.8310]	-0.1653* [-1.8894]	0.9879* [1.9327]	0.9376* [1.8352]	0.0185 [0.1642]	0.0364 [0.3214]
Policy Change x High Short Demand	0.2387*** [3.3400]	0.2389*** [3.3442]	0.2622 [0.4582]	0.3199 [0.5597]	-0.0256 [-0.2412]	-0.0410 [-0.3837]
Adj. R-sq	0.3090	0.3099	0.2368	0.2389	0.1809	0.1714
Number of Observations	15240	15240	2898	2898	3148	3148

*:10%, **:5%, ***: 1% Significance Level

5.5 Turnover Ratio

As another proxy of market liquidity, I use turnover ratios of the stocks. In the short term, the turnover ratios decrease after the change in Figure 9. However, the effect is unclear in Figure 10 for the entire period.

Table 19 indicates that the turnover ratios in both the short and long terms decreased significantly after the policy change. The results of Table 20 and Table 21 show that the effect of policy change is significantly negative except for the insignificant results for big stocks in the short term and small stocks in the long term. The significant negative effects are consistent with my hypothesis 3.

For the highly shorted stocks except for small stocks, the effect of the policy change dummy is significantly positive in the long term. It shows that the reduction in the signals of bad news may positively affect the turnover ratios of the highly shorted stocks. However, the effects in the short term are harmful in the short term and significant for the small stocks.

Table 19. Treatment Effect Analysis Results on Turnover Ratio

Panel A: Full Sample Analysis

Turnover Ratio (%)	Coefficient	Robust Std. Error	z	P> z	[95% Conf. Interval]	
Average Treatment Effect	-0.0415	0.0145	-2.87	0.00	-0.0699	-0.0132
Population Mean	1.0986	0.0135	81.40	0.00	1.0722	1.1251

Panel B: [-20,+20] Days Around Policy Change Analysis

Turnover Ratio (%)	Coefficient	Robust Std. Error	z	P> z	[95% Conf. Interval]	
Average Treatment Effect	-0.1116	0.0344	-3.24	0.00	-0.1790	-0.0442
Population Mean	1.1898	0.0310	38.36	0.00	1.1290	1.2506

Figure 9. Turnover Ratio Regression Discontinuity Graph (-20, +20 days)

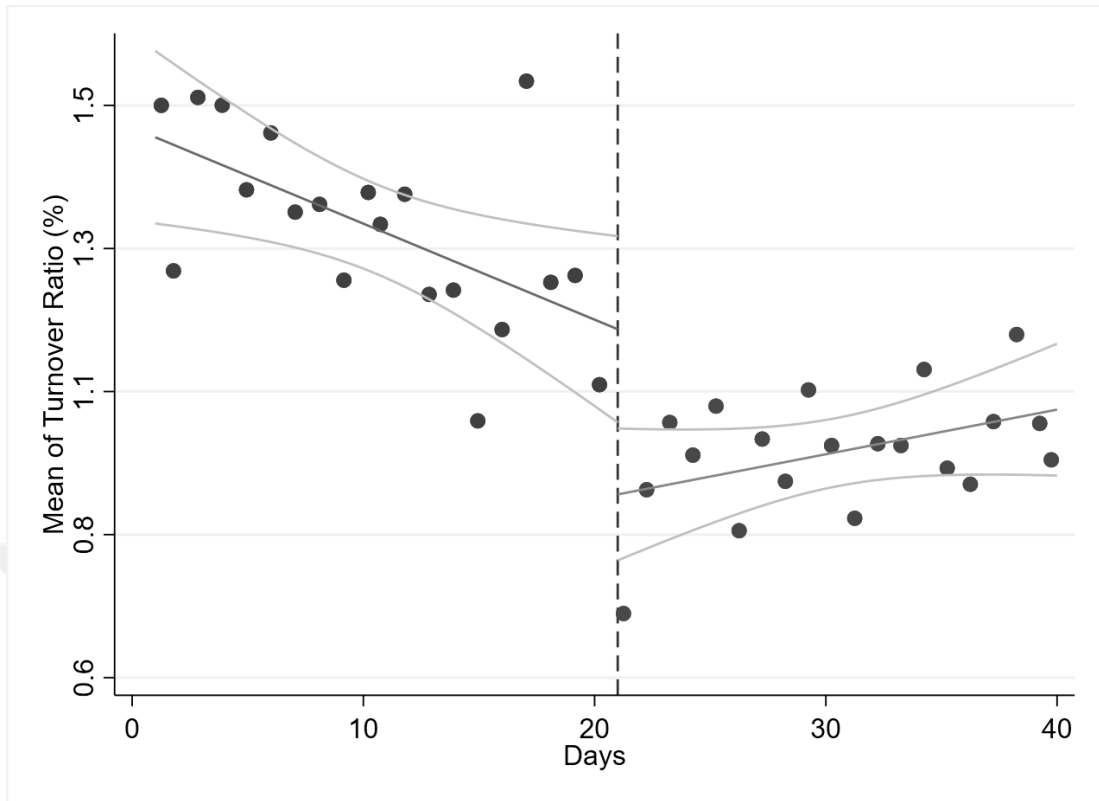


Figure 10. Turnover Ratio Regression Discontinuity Graph (Full Period)

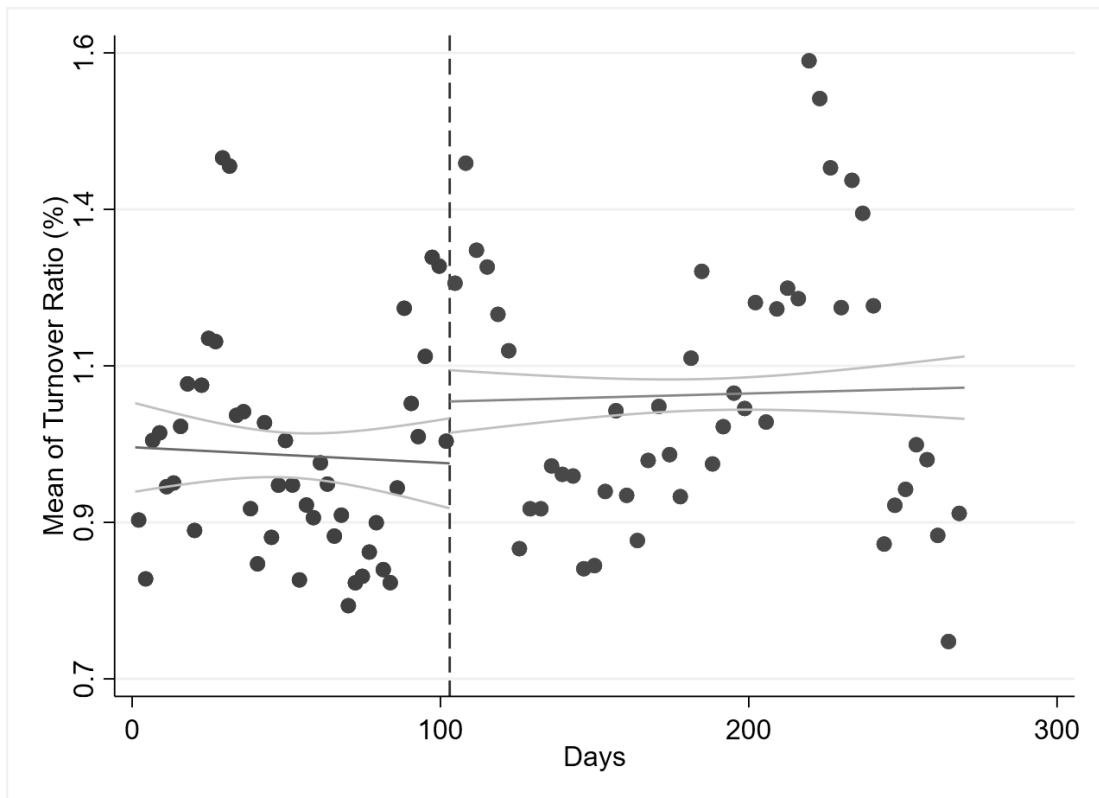


Table 20. Panel Data Regression Analyses on Turnover Ratio (Full Period)

	Turnover Ratio Full Sample	Turnover Ratio Full Sample	Turnover Ratio Small Stockcs	Turnover Ratio Small Stockcs	Turnover Ratio Big Stockcs	Turnover Ratio Big Stockcs
	(1)	(2)	(3)	(4)	(5)	(6)
(Intercept)	-1.0887*** [-5.3524]	-1.4302*** [-7.0451]	-2.2509*** [-2.7715]	-2.6578*** [-3.2742]	1.3539** [2.0548]	1.0202 [1.5573]
Lagged Return	1.4169*** [27.6439]		1.8880*** [13.2595]		0.4094*** [5.7132]	
Winners		0.0913*** [16.9631]		0.1745*** [10.5790]		0.0238*** [3.4228]
Losers		-0.0148*** [-2.8343]		0.0127 [0.8447]		-0.0076 [-1.0882]
Policy Change	-0.0217*** [-4.4782]	-0.0240*** [-4.9464]	-0.0283* [-1.9143]	-0.0288* [-1.9443]	-0.0456*** [-5.1501]	-0.0465*** [-5.2474]
Lagged Turnover	0.6286*** [192.2436]	0.6353*** [195.0750]	0.5774*** [70.9910]	0.5811*** [71.5396]	0.6330*** [95.1321]	0.6356*** [95.8941]
Lagged Spread	-2.0080*** [-10.7576]	-2.5272*** [-13.2401]	-1.2822*** [-2.7205]	-2.1250*** [-4.4393]	-1.0349*** [-3.2482]	-1.1930*** [-3.6693]
ROA (%)	0.0002** [2.3608]	0.0002** [2.1937]	-0.0000 [-0.0254]	0.0000 [0.0811]	-0.0007** [-2.2581]	-0.0007** [-2.3582]
M/B Ratio	-0.0185*** [-4.4247]	-0.0183*** [-4.3581]	-0.0223** [-2.5004]	-0.0214** [-2.3940]	0.0263*** [3.6132]	0.0264*** [3.6245]
Log(MarketCap)	0.2214*** [8.2828]	0.2630*** [9.8548]	0.6007*** [7.6968]	0.6441*** [8.2626]	-0.0964* [-1.8412]	-0.0746 [-1.4332]
Lagged Short Ratio	0.0000 [0.0206]	-0.0001 [-0.0497]	-0.0104 [-1.1156]	-0.0088 [-0.9416]	-0.0046*** [-3.6892]	-0.0047*** [-3.7290]
BIST100 Return	0.0092*** [6.1309]	0.0078*** [5.2032]	0.0071 [1.6226]	0.0049 [1.1137]	0.0083*** [4.1284]	0.0078*** [3.9224]
High Short Demand Quintile	-0.0324** [-2.4856]	-0.0346*** [-2.6500]	0.1103 [1.2669]	0.0894 [1.0258]	-0.0293** [-2.1612]	-0.0296** [-2.1829]
Policy Change x High Short Demand	0.0605*** [5.6469]	0.0624*** [5.8171]	-0.0175 [-0.1966]	-0.0174 [-0.1945]	0.0850*** [7.0318]	0.0859*** [7.0957]
Adj. R-sq	0.6473	0.6461	0.5543	0.5534	0.8112	0.8110
Number of Observations	102151	102151	19154	19154	21224	21224

*:10%, **:5%, ***: 1% Significance Level

Table 21. Panel Data Regression Analyses on Turnover Ratio (-20, +20 days)

	Turnover Ratio Full Sample (1)	Turnover Ratio Full Sample (2)	Turnover Ratio Small Stocks (3)	Turnover Ratio Small Stocks (4)	Turnover Ratio Big Stocks (5)	Turnover Ratio Big Stocks (6)
(Intercept)	-0.6643 [-0.7131]	-1.6072* [-1.7438]	-7.2150*** [-2.7896]	-7.6510*** [-2.9812]	0.3314* [1.6919]	0.3172 [1.6149]
Lagged Return	1.3597*** [11.2761]		1.3643*** [3.9601]		-0.1647 [-0.9114]	
Winners		0.1159*** [8.5130]		0.2025*** [4.8084]		0.0103 [0.5190]
Losers		-0.0109 [-0.8295]		0.0664* [1.7456]		-0.0230 [-1.2185]
Policy Change	-0.1037*** [-8.2994]	-0.1087*** [-8.6781]	-0.1738*** [-4.5628]	-0.1883*** [-4.9265]	-0.0031 [-0.1340]	-0.0001 [-0.0023]
Lagged Turnover	0.4496*** [41.2949]	0.4518*** [41.4615]	0.3863*** [14.3564]	0.3733*** [13.7220]	0.8920*** [94.4645]	0.8903*** [94.5853]
Lagged Spread	0.4049 [0.7450]	-0.1805 [-0.3289]	-0.9999 [-0.7854]	-1.7639 [-1.3855]	-1.3738* [-1.8697]	-1.4653* [-1.9546]
ROA (%)	-0.0006 [-0.1626]	-0.0008 [-0.2074]	-0.0036 [-0.5785]	-0.0034 [-0.5350]	-0.0003 [-0.4429]	-0.0003 [-0.5242]
M/B Ratio	-0.1679*** [-4.7247]	-0.1594*** [-4.4822]	-0.1201 [-0.4820]	-0.1147 [-0.4612]	0.0015 [0.3459]	0.0005 [0.1065]
Log(MarketCap)	0.3271*** [2.6680]	0.4427*** [3.6451]	1.4623*** [4.1755]	1.5132*** [4.3490]	-0.0289 [-1.4033]	-0.0266 [-1.2868]
Lagged Short Ratio	0.0103*** [2.6042]	0.0100** [2.5147]	0.0063 [0.2185]	0.0150 [0.5254]	0.0041 [1.5085]	0.0043 [1.5616]
BIST100 Return	0.0134*** [4.5550]	0.0101*** [3.4298]	0.0077 [0.9026]	0.0035 [0.4101]	0.0082* [1.8144]	0.0085* [1.8926]
High Short Demand Quintile	-0.0783** [-2.4465]	-0.0789** [-2.4640]	0.3035 [1.5366]	0.2664 [1.3494]	0.0200 [0.5989]	0.0223 [0.6698]
Policy Change x High Short Demand	0.0581** [2.2233]	0.0619** [2.3671]	-0.1258 [-0.5687]	-0.1281 [-0.5799]	-0.0379 [-1.2029]	-0.0400 [-1.2699]
Adj. R-sq	0.7048	0.7041	0.6096	0.6106	0.8038	0.8038
Number of Observations	15240	15240	2898	2898	3148	3148

*:10%, **:5%, ***: 1% Significance Level

5.6 Volatility

As the proxy of market volatility, I apply the Garman Klass volatility formula, utilizing daily high, low, opening and closing prices. The volatility seems like raised after the policy change in both Figures 11 and 12. The treatment effect is not significant for the short term but it is significantly negative for the long term in Table 22.

Examining Tables 23 and 24, volatilities are significantly and positively affected for the highly shorted stocks in the whole sample in both long and short terms. The policy change effect on the volatilities is significantly positive in the short term for the total sample, which is consistent with my third hypothesis. However, in the long term, the effect seems negatively significant. It may be explained by the decline in trend chasing behavior of uninformed traders for the short sales. The increasing proportion of informed short sales may lead to decreasing volatilities in time. Again, I would like to point out that the policy change dummy covers a seven months long period and the Turkish economy directly affects Borsa Istanbul.

Table 22. Treatment Effect Analysis Results on Volatility

Panel A: Full Sample Analysis						
GK Volatility	Coefficient	Robust Std. Error	z	P> z	[95% Conf. Interval]	
Average Treatment Effect	-0.0005	0.0001	-8.69	0.00	-0.0006	-0.0004
Population Mean	0.0118	0.0000	263.01	0.00	0.0117	0.0119
Panel B: [-20,+20] Days Around Policy Change Analysis						
GK Volatility	Coefficient	Robust Std. Error	z	P> z	[95% Conf. Interval]	
Average Treatment Effect	0.0005	0.0002	2.32	0.02	0.0001	0.0009
Population Mean	0.0126	0.0002	73.26	0.00	0.0123	0.1296

Figure 11. Volatility Regression Discontinuity Graph (-20, +20 days)

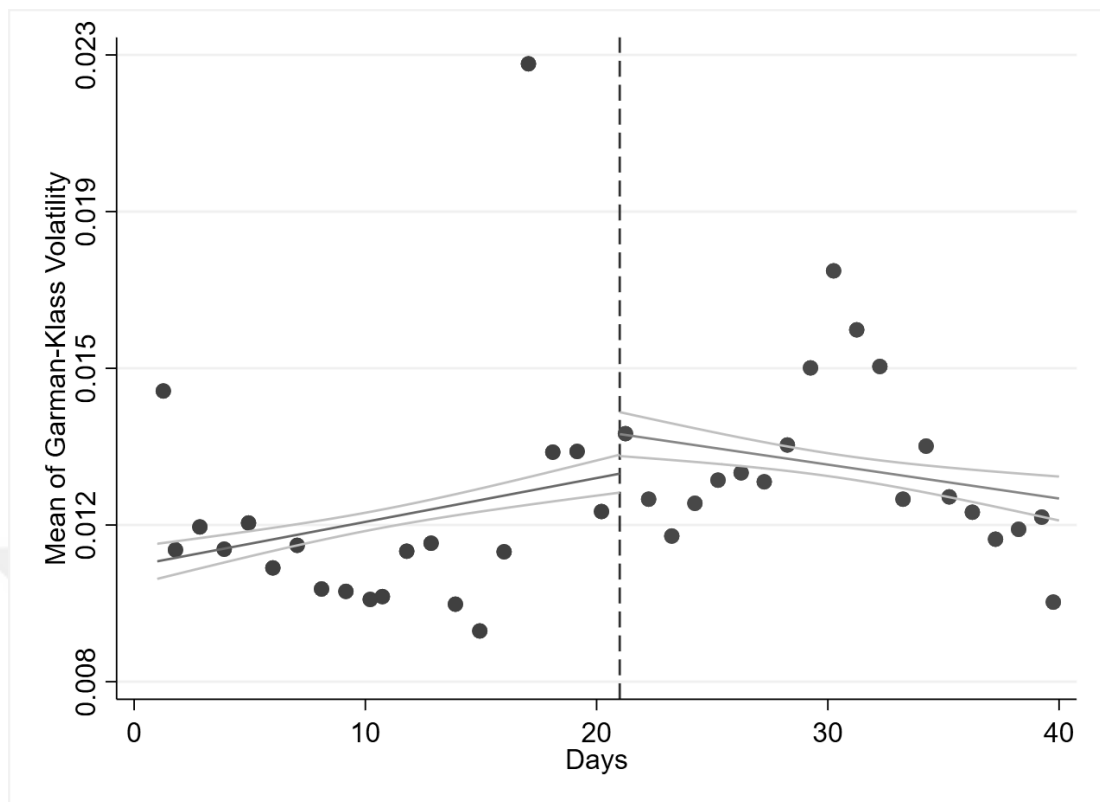


Figure 12. Volatility Regression Discontinuity Graph (Full Period)

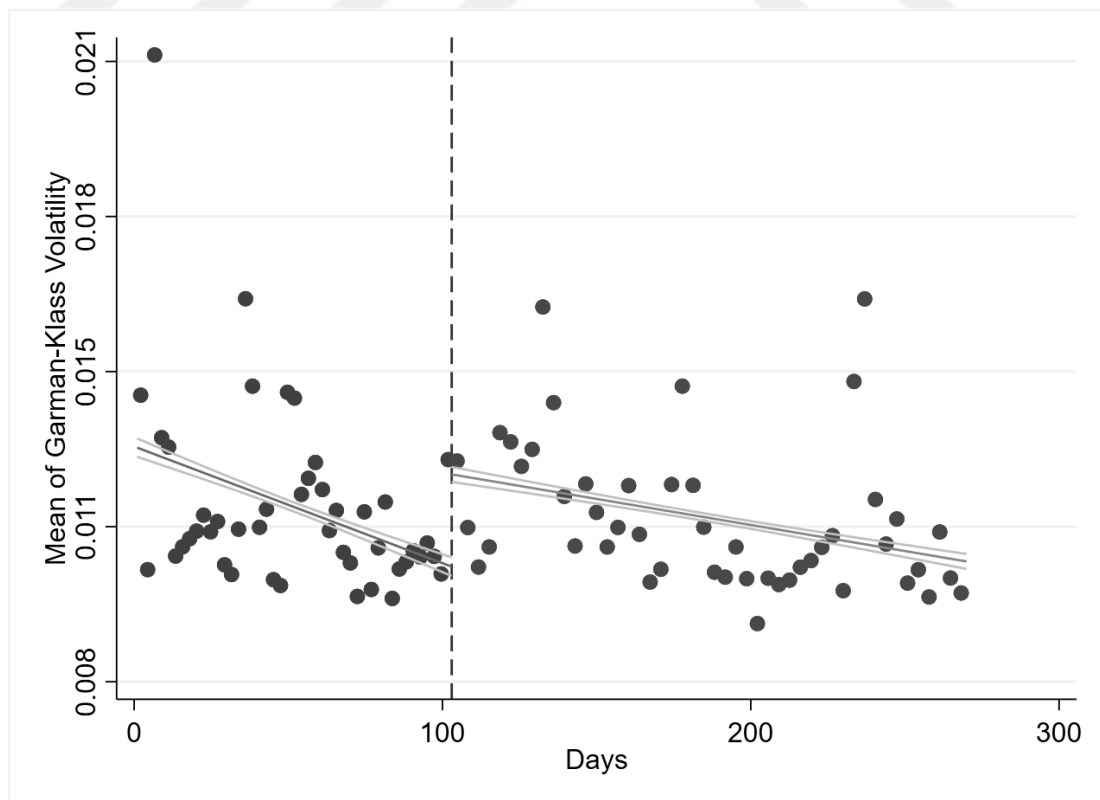


Table 23. Panel Data Regression Analyses on Volatility (Full Period)

	GKVolatility Full Sample	GKVolatility Full Sample	GKVolatility Small Stockcs	GKVolatility Small Stockcs	GKVolatility Big Stockcs	GKVolatility Big Stockcs
	(1)	(2)	(3)	(4)	(5)	(6)
(Intercept)	-0.0153*** [-7.9390]	-0.0141*** [-7.3900]	-0.0204*** [-2.8665]	-0.0203*** [-2.8585]	0.0119* [1.7256]	0.0168** [2.4559]
Lagged Return	0.0028*** [5.7419]		0.0074*** [5.9007]		-0.0039*** [-4.3142]	
Winners		0.0010*** [18.7627]		0.0016*** [10.9403]		0.0002*** [2.5770]
Losers		0.0001** [2.3024]		0.0002 [1.3340]		-0.0001 [-1.4517]
Policy Change	-0.0006*** [-12.3765]	-0.0006*** [-12.7479]	-0.0003** [-2.0064]	-0.0003** [-2.1288]	-0.0009*** [-7.5512]	-0.0008*** [-7.3816]
Lagged Turnover	0.0004*** [13.8470]	0.0004*** [12.6351]	0.0007*** [9.7484]	0.0006*** [9.1104]	0.0002* [1.8783]	0.0001 [1.1221]
Lagged Spread	0.1372*** [77.8186]	0.1311*** [72.9516]	0.1072*** [25.9477]	0.0997*** [23.8615]	0.1309*** [32.1727]	0.1286*** [30.9923]
ROA (%)	0.0000*** [2.8686]	0.0000*** [2.9750]	0.0000*** [2.6991]	0.0000*** [2.8646]	-0.0000*** [-3.2471]	-0.0000*** [-3.0157]
M/B Ratio	0.0002*** [3.9000]	0.0001*** [3.7441]	0.0001* [1.6771]	0.0001 [1.5715]	0.0005*** [5.4042]	0.0005*** [5.2907]
Log(MarketCap)	0.0029*** [11.5379]	0.0028*** [10.9847]	0.0056*** [8.1899]	0.0055*** [8.1464]	-0.0005 [-0.7273]	-0.0012* [-1.8177]
Lagged Short Ratio	-0.0000** [-1.9971]	-0.0000** [-2.2420]	-0.0001 [-0.8625]	-0.0001 [-0.7024]	-0.0000** [-2.2818]	-0.0000** [-2.3990]
BIST100 Return	-0.0005*** [-34.5044]	-0.0005*** [-34.7999]	-0.0004*** [-10.0068]	-0.0004*** [-10.3595]	-0.0005*** [-18.4673]	-0.0005*** [-18.3565]
High Short Demand Quintile	-0.0002 [-1.5835]	-0.0002 [-1.4782]	0.0005 [0.7131]	0.0004 [0.5808]	-0.0004** [-2.2654]	-0.0004** [-2.0324]
Policy Change x High Short Demand	0.0006*** [5.9205]	0.0006*** [5.9985]	-0.0003 [-0.4109]	-0.0002 [-0.3148]	0.0010*** [6.5769]	0.0010*** [6.3308]
Adj. R-sq	0.2463	0.2490	0.2094	0.2138	0.1786	0.1784
Number of Observations	102151	102151	19154	19154	21224	21224

*:10%, **:5%, ***: 1% Significance Level

Table 24. Panel Data Regression Analyses on Volatility (-20, +20 days)

	GK Volatility Full Sample	GK Volatility Full Sample	GK Volatility Small Stocks	GK Volatility Small Stocks	GK Volatility Big Stocks	GK Volatility Big Stocks
	(1)	(2)	(3)	(4)	(5)	(6)
(Intercept)	-0.0196** [-2.0818]	0.0016 [0.1703]	-0.0893*** [-3.6374]	-0.0740*** [-3.0378]	0.0103*** [4.1278]	0.0099*** [3.9319]
Lagged Return	-0.0072*** [-5.9319]		-0.0043 [-1.3005]		-0.0156*** [-6.7489]	
Winners		0.0009*** [6.6644]		0.0013*** [3.2408]		0.0003 [1.0136]
Losers		0.0002 [1.5811]		0.0004 [1.1239]		0.0001 [0.2064]
Policy Change	0.0003** [2.0130]	0.0002* [1.8480]	0.0006 [1.6383]	0.0005 [1.3049]	0.0001 [0.3954]	0.0003 [1.0239]
Lagged Turnover	0.0006*** [5.5528]	0.0004*** [4.0835]	0.0009*** [3.4629]	0.0007*** [2.6274]	0.0000 [0.0824]	-0.0001 [-0.6865]
Lagged Spread	0.0809*** [14.7169]	0.0775*** [13.9848]	0.0382*** [3.1581]	0.0372*** [3.0758]	0.1940*** [20.6685]	0.1879*** [19.4704]
ROA (%)	0.0001** [2.2819]	0.0001** [2.3526]	0.0001** [2.4173]	0.0001** [2.3763]	-0.0000** [-1.9646]	-0.0000** [-2.1462]
M/B Ratio	-0.0006 [-1.6208]	-0.0009** [-2.5156]	0.0053** [2.2250]	0.0047** [1.9868]	0.0002*** [3.2356]	0.0001** [2.5685]
Log(MarketCap)	0.0045*** [3.6376]	0.0019 [1.5871]	0.0131*** [3.9406]	0.0113*** [3.4202]	-0.0007*** [-2.6554]	-0.0006** [-2.4220]
Lagged Short Ratio	0.0001 [1.2655]	0.0000 [1.2114]	-0.0005* [-1.7522]	-0.0005* [-1.6900]	0.0000 [1.2042]	0.0001 [1.4503]
BIST100 Return	-0.0004*** [-13.0695]	-0.0004*** [-12.4920]	-0.0003*** [-3.5231]	-0.0003*** [-3.5032]	-0.0005*** [-8.7314]	-0.0005*** [-7.9452]
High Short Demand Quintile	-0.0006* [-1.8786]	-0.0006* [-1.9393]	0.0032* [1.7241]	0.0030 [1.6236]	0.0000 [0.0951]	0.0001 [0.2528]
Policy Change x High Short Demand	0.0008*** [3.0966]	0.0008*** [3.0945]	0.0013 [0.6077]	0.0015 [0.7127]	-0.0002 [-0.4448]	-0.0002 [-0.5868]
Adj. R-sq	0.2921	0.2925	0.2163	0.2186	0.1641	0.1520
Number of Observations	15240	15240	2898	2898	3148	3148

*:10%, **:5%, ***: 1% Significance Level

CHAPTER 6

CONCLUSION

In this study, I investigate the impact of short sale disclosure frequency, utilizing the policy change that happened on 30th of October 2015 in Borsa Istanbul. Before that date, Borsa Istanbul published the short sale volumes on every stock listed in Borsa Istanbul two times a day, after every session. After 30th of October 2015, they quit reporting the short sale information after the first session and starts to publish only once at the end of the day.

I conduct analyses in two time periods, short term period consists of 20 days before and 20 days after the policy change. The reduction in the short sale disclosure frequency has an impact on the short period length in Borsa Istanbul parallel to existing short sale disclosure literature and my hypotheses, except the effect on returns is the opposite of what I expected. In contrast, the results for full time period are mixed and not as meaningful as the results for the shorter period. However, Borsa Istanbul is directly affected by the Turkish economy and interpreting these results requires extra caution.

The results show that the decreasing frequency of short sale disclosure has a significantly negative effect on shorting demand of more liquid stocks, while the negative effect on the shorting demand for the whole market is significant for the entire period. On the contrary, the shorting demand of already highly shorted stocks increased after the change. A critical interpretation of my results is that the distribution of short sales shifted to more informed short sales, the proportion of trend chasing short sales of uninformed traders decreased.

An exciting result I get is that the effect of the policy change is significantly negative on returns in both short and long period lengths, which I believe may be explained by the changing source of negative signals after the information amount of bad news decreased with the policy change, parallel to Diamond and Verrecchia's (1987) theory. However, the reasons for decreased returns need further research.

The negative effect of the policy change is significant on the volumes in the short period, while it is unclear in the long period. However, the volumes of the highly shorted stocks are affected significantly positively, except for the small stocks in the short period. The uninformed traders may increase their activity on the stocks which are already highly shorted.

The volatilities of the prices significantly increased after the policy change in short and long periods for the highly shorted stocks, parallel to the increasing activity of uninformed traders on these stocks.

The effect of the policy change on the bid ask spreads is insignificant and significantly negative on turnover ratios in the short period, which I interpret that the liquidity in the market got hurt by the decreasing frequency of short sale disclosure in the short term. However, the effect is unclear in the long period length.

Policymakers should evaluate the results of this study carefully. While reducing the short sale disclosure frequency may decrease the proportion of uninformed traders among short sellers, it fails to support stock prices and the short term results show that the market quality decreased by decreasing market transparency on short sales.

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APPENDIX

i : individual stock, t : trade day, m : month, q : quarter

$H_{i,t}$: Highest price at day t for stock i

$L_{i,t}$: Lowest price at day t for stock i

$O_{i,t}$: Opening price at day t for stock i

$C_{i,t}$: Closing price at day t for stock i

$$\text{Short Demand}_{i,t} = \frac{\text{Quantity of Shorted Stocks}_{i,t}}{\text{Quantity of Traded Stocks}_{i,t}}$$

$$\text{Return}_{i,t} = \frac{C_{i,t}}{C_{i,t-1}}$$

$$\text{Price Spread}_{i,t} = \frac{H_{i,t} - L_{i,t}}{H_{i,t}}$$

$$\text{Turnover Ratio}_{i,t} = \frac{\text{Quantity of Traded Stocks}_{i,t}}{\text{Outstanding Shares}_{i,t}}$$

$$\text{Garman Klass Volatility}_{i,t} = \sqrt{\frac{1}{2} \left(\log \left(\frac{H_{i,t}}{L_{i,t}} \right) \right)^2 - (2 \log(2) - 1) \left(\log \left(\frac{C_{i,t}}{O_{i,t}} \right) \right)^2}$$

$$\text{Lagged Return}_{i,t} = \frac{C_{i,t-1}}{C_{i,t-6}}$$

$$\text{Lagged Spread}_{i,t} = \frac{\sum_{n=1}^5 \text{Price Spread}_{i,t-n}}{5}$$

$$\text{Lagged Turnover}_{i,t} = \frac{\sum_{n=1}^5 \text{Turnover Ratio}_{i,t-n}}{5}$$

$$\text{Bist100 Return}_t = \frac{\text{Bist100 Index Price}_t}{\text{Bist100 Index Price}_{t-1}}$$

$$\text{M/B Ratio}_m = \frac{\text{Market Capitalization}_m}{\text{Book Value}_m}$$

$$\text{Log}(\text{MarketCap})_{i,m} = \log_{10}(\text{Market Capitalization}_{i,m})$$

$$\text{Net Profit}_q = \sum_{k=1}^4 (\text{Quarterly Net Profit})_{q-k}$$

$$\text{ROA}_m = \frac{\text{Net Profit}_q}{\text{Book Value}_m}$$

$$\text{Policy Change}_t = \begin{cases} 1 & \text{if } t \geq 30 \text{ October 2015} \\ 0 & \text{otherwise} \end{cases}$$

$$\text{Small}_{i,m} = \begin{cases} 1 & \text{if } \text{Log}(\text{MarketCap})_{i,m} < 1^{\text{st}} \text{ quintile of } \text{Log}(\text{MarketCap}) \text{ at } m \\ 0 & \text{otherwise} \end{cases}$$

$$\text{Winners}_{i,t} = \begin{cases} 1 & \text{if } \text{Lagged Return}_{i,t} > 70^{\text{th}} \text{ percentile of Lagged Return at day } t \\ 0 & \text{otherwise} \end{cases}$$

$$\text{Losers}_{i,t} = \begin{cases} 1 & \text{if } \text{Lagged Return}_{i,t} < 30^{\text{th}} \text{ percentile of Lagged Return at day } t \\ 0 & \text{otherwise} \end{cases}$$

$$\text{High Short Demand}_{i,t} = \begin{cases} 1 & \text{if } \text{Short Demand}_{i,t} > 4^{\text{th}} \text{ quintile of S. Demand at } t \\ 0 & \text{otherwise} \end{cases}$$

$$\text{High Short Demand}(\text{prechange})_{i,t} =$$

$$\begin{cases} 1 & \text{if } \frac{\sum_{t=1.6.2015}^{27.10.2015} \text{Short Demand}_{i,t}}{\text{Number of days stock } i \text{ traded till } t_p} > 4^{\text{th}} \text{ quintile of } \frac{\sum_{t=1.6.2015}^{27.10.2015} \text{Short Demand}_{i,t}}{\text{Number of days stock } i \text{ traded till } t_p} \text{ at } t \\ 0 & \text{otherwise} \end{cases}$$