Who benefits from broker ID disclosure?

Juliane D. Krug[*], Peter L. Swan[†] and Joakim Westerholm[‡]

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Abstract

Unlike virtually all market microstructure research that is, of necessity, restricted to actual trades, we analyse the underlying orders prior to their disguise in the form of trades to examine trading cost implications for institutional investors and households separately. We investigate three unique policy changes conducted on Finnish NASDAQ OMX Helsinki stock market in March 2006, June 2008 and April 2009. We find for all participants that transaction costs substantially improve with an enhanced level of information disclosure. The reintroduction of *ex post* broker identities improved transaction costs by over 3.7 bps per order. Overall market volume declined by 12% (trade count, 30%) when *ex ante* broker identities were removed in the first event and by a further 8% (trade count, 18%) in the second when *ex post* identities were removed.

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[*] School of Banking & Finance, UNSW Business School, The University of New South Wales, NSW 2052, Australia, Email: j.krug@student.unsw.edu.au, Telephone: +61 415 465 789.

[†] School of Banking & Finance, UNSW Business School, The University of New South Wales, NSW 2052, Australia, Email: peter.swan@unsw.edu.au, Telephone: +61 (2) 9385 5871.

[‡] Discipline of Finance at the University of Sydney Business School, Correspondence Address: H69, University of Sydney Business School, NSW, 2006, Australia, Email: joakim.westerholm@sydney.edu.au, Tel: +61 (2) 9351 6454.

1 Introduction

Transparency may relate to various levels of information availability, which impact the market in different ways. Information disclosure about trades and prices after trade execution is referred as post-trade transparency whereas information related to on upcoming trades is referred as pre-trade transparency.[1] Some markets provide full information even in real-time, mostly for a fee, whereas others release trade information with a certain delay or not at all. The speed of information availability overall is essential. Pre-trade transparency may lead to information about execution risks, by customers adapting their orders to the liquidity supply when observing the quotes. In addition, the visibility of incoming order improves liquidity as dealer's rents are reduced, uniformed investors benefit from this situation. The visibility of quotes can also help to distinguish between informed and uninformed traders, which improves price discovery and decreases spreads. The disclosure of the trade's actual investor and broker pre- or post-trade increases the value of every other given information as the observer is able to relate background information and known strategies of a broker or investor to actual trades. This allows not only the possibility to adapt one's strategy in a much faster way according to new gained information, which relates to improved price discovery, but can also affect implementation shortfall costs due to the market moving against a trader splitting up a sizable order. Hence, broker ID information is likely to be price relevant irrespective of whether it is either pre-trade or post-trade transparency.

The question we address is how does an increasing informational asymmetry, due to declining broker ID information disclosure, affect market liquidity? Specifically, how does the changing market environment influence the transaction costs of individual orders of institutional and household investors and to which extend do these investor types adapt their trading behaviour? Conflicting findings in previous literature do not allow one to provide soundly founded recommendations to exchanges and regulators. We are able to provide comprehensive results from a different angle allowing to make improved inferences about the impact of these central decisions.

We investigate three unique regulation changes appearing on the Finnish stock market, NASDAQ OMX Helsinki, on 13th March 2006, 2nd June 2008 and 14th April 2009. During the first event the market switched from a fully transparent market where all information on broker IDs was disclosed in real-time in the limit order book prior to trade to post-trade broker information disclosure. In 2008 the market became completely opaque. In 2009 these changes

[1] Admati and Pfleiderer (2001) on the other side refer to the announcement of intentions in advance.

were partly reversed and for all securities, with exception of the Top 5 traded stocks, broker information disclosure was reintroduced post-trade. Hence, the third event allows one to construct a natural control group based on the five most highly traded stocks. Thus, we are able present detailed findings for different levels of broker ID disclosure, allowing broader understanding and comparison of the underlying mechanisms.

We present conclusive results that show that for both types of market participants, transaction costs decrease with enhanced broker information disclosure. Liquidity is positively associated with decreased informational asymmetry, however institutional and individual investors react differently, but submit more orders on average.

We find, that the switch from pre-to post-trade broker ID disclosure, widens the daily relative effective spread, as one measure for transaction costs, by 12 bps at market level.[2] Institutional investors submitting sell-orders, experience an increase of 2.7 bps, individual investors even 6 bps per sell-order. Buyer-initiated orders are not significantly impacted. As a consequence of the switch to opacity in 2008, the relative effective spread for orders of individual investors increases further by 3.4 bps, whereas for institutional investors the relative effective spread widens by 0.8 bps. On a market level, we find a that the effective spread widens by 29 bps. The difference-in-difference analysis for the third event confirms the previous findings, as the daily relative effective spread for the treatment group falls over 78 bps more than for the control group. The results on market level are consistent with our findings for orders submitted by individual as well as institutional investors: The effective spread for orders submitted by individuals tightens on average by 4.6 bps for securities within the treatment group in comparison to the control group, while institutional investors experience a reduction of 2 bps for buyer-initiated orders and 4.8 bps for seller-initiated orders respectively.[3] We find that these results are mainly driven by less liquid securities. In fact, individual investors do not experience any change in transaction costs for trading rather liquid securities within the treatment group. Institutional investors experience thorough reduced transaction costs, unrelated to the order direction or the liquidity of the security. These conclusive results stand in contrast to the findings of Pham et al (2016) for the reintroduction of post-trade broker ID disclosure on the Korean Stock Exchange. Frino et al (2010) find that trades have a higher price impact when the relevant broker information are disclosed to the public. In accordance, our analyses show

[2] Henceforth bps.

[3] The magnitude of impact on orders is much lower than on a market level, however still high. Other studies as Putnins and Barbara (2017) refer to our measure 'Effective Spread of an order' as 'Implementation shortfall costs of an order'. The authors use that measure to show that some high-frequency traders appear toxic to institutional investors, while others seem beneficial. Toxic traders increase the transaction costs of one order by an institutional investor by over 10 bps. Hence, the magnitude of change for a single order is found in different studies too.

that price impact increases by 10 bps on a market level, when the exchange implemented post-trade broker ID disclosure in 2006. Seller-initiated orders by individuals experience an increase of 7 bps. Furthermore, the same parameter for institutional investors shows an increase of 4.5 bps. The introduction of opacity in 2008 however, reduces the price as well as market impact of buyer-initiated orders by individual investors, while seller-initiated orders do not seem to be significantly impacted. The partial reintroduction of post-trade transparency in 2009 indicates a fall by 17 bps of the price impact measure on a market level for the treatment group relative to the control group. We observe a drop by 2.3 bps for the price impact for orders by institutional investors. Orders submitted by households are not significantly affected by the reintroduction of broker ID disclosure.

Moreover, we find a consistent and highly significant negative relation between reduced transparency and liquidity at the market level.[4] The regulation change in 2006 leads to a significant drop in daily on-market volume and trade count of 12% and 30% respectively. Furthermore, the second event reduces liquidity further. The daily on-market trading volume falls by 8% and the number of trades by 15%. Both events lead to a significant drop in quoted depth at the best bid and ask. In addition, the average order volume of individual investors falls by 7% on average in 2008, when the market becomes opaque. In 2009, when post-trade transparency was reintroduced for all securities with the exception of the Top 5 most highly traded stocks, we find that individual investors increase their order volume by 20% for buyer-initiated, and 11% for seller-initiated orders. Further analyses show, that these changes in trading only apply to less liquid securities. These findings are important as they indicate that individual household investors are not simply 'noise traders' but respond to altering levels of information provided on the identity of traders and, additionally, are more responsive on the buy side of the market. The number of daily submitted orders increases. In contrast, institutional traders adapt their order submission behaviour differently: With an increasing level of opacity, they split up seller-initiated orders further to better disguise their intentions. Our findings indicate a relatively small 2% increase in the average number of trades per order for the policy change in 2006 and a further 3% increase in 2008. Accordingly, in 2009 when the market becomes more transparent we observe a fall of 3% in the number of trades within an institutional order. Especially for more liquid securities within the treatment group the number of trades within an order falls, confirming the observations due to the first two regulatory changes. Institutional traders submit significantly more orders on a daily base when

[4] This finding is in accordance with results of Pham et al (2016), Eom et al (2007).

the market switched to ex-post broker identities in 2006, however the third (transparency) event in 2009, seems to operate in the same direction. The result could relate to Gallagher et al (2013), where price efficiency, measured by lower spreads, is improving when more institutional investors execute swing trades simultaneously. In our case, the overall trading volume of institutional investors does not increase with a declining level of transparency, however the number of trades within an order fall significantly. The third event shows that institutional investors submit significantly smaller orders for less liquid securities for which broker ID transparency is reintroduced. The higher number of daily order submissions could indicate that institutional investors change trade direction more often when the market becomes more transparent. By doing so, institutional investors are able to hold on their informational advantage for longer.

The findings are supported by Pham et al (2016) results for the Korean event. Liquidity declines with a decreasing level of broker ID disclosure, while transaction costs increase. Publicly displayed broker IDs provides information about the investor's intentions. This leads to an improved price discovery from the order flow.[5] Our study shows that each regulation change towards total opacity led to decline in market liquidity for individual as well as institutional investors. Our findings should be included in ongoing discussions concerning broker information disclosure and the impact of market transparency on market quality, not only within the academic literature but also in debates of regulators and the conceptual construction of exchanges.

We approach our study using two data sets: First, we use Thomson-Reuters-Tick-History data, which was processed by the Market Quality Dashboard by the CMCRC, to provide a comprehensive picture of the consequences for market liquidity, resilience and transaction costs of these three policy changes for the complete market.[6] Second, this paper is the first to examine the effect of different levels of broker information disclosure on liquidity parameters of underlying orders derived from the Euroclear database for the Finnish OMX Helsinki market. The quality of the underlying Euroclear data set allows to rebuild the actual orders of each investor which provides an improved and rare picture of the impacts on market liquidity and transaction costs of the switch from pre-trade broker transparency to post-trade transparency to total opacity and back to post-trade transparency. The data set includes information about the actual investors, the brokers and even about their nature, e.g. households,

[5] NASDAQ OMX Helsinki is an order driven market, hence our conclusion refers to limit order markets rather than dealer markets. It is expected that the impact of transparency on market quality will be the same overall, but as we need to distinguish between different market structures, we expect different mechanisms which lead to changed market quality.

[6] Henceforth, we refer to Thomson-Reuters-Tick-History as TRTH, the Market Quality Dashboard as MQD.

institutional and accordingly about the counterparty side. To our knowledge this paper is the first to elaborate the impact these well-known events on the Finnish Stock exchange on the market's liquidity on basis of orders, distinguishing between trade direction as well as individual and institutional investors, which captures the impacts in an improved and more realistic way than the common approach. By distinguishing between individual and institutional investors, this paper can narrow down the true impact of broker ID transparency for different types of market participants and their reaction.

Bloomfield and O'Hara (1999) show that trade disclosure leads to enhanced informational efficiency in trade prices and widens spreads. Market makers do no longer need to compete for order flow in order to acquire information. Hence, trade disclosure benefits market makers at the expense of informed and liquidity traders, who do not time their trading. We find that broker ID disclosure narrows spreads significantly, which does not stand in contrast to the findings by Bloomfield and O'Hara (1999). Rindi (2008) presents a theoretical analysis of two possible consequences of pre-trade transparency. Transparency leads either to decreased or increased liquidity. The identification of the counterparty by uninformed traders leads overall to enhanced confidence about the market and its risk. Under these circumstances uninformed traders are willing to provide liquidity, which results in increased market liquidity. Important is whether the information about the market participant's identity is free and publicly available or its acquisition is costly. The costlier the information, the higher the proportion of uninformed traders. It can be expected that any change lowering the transparency level of trades will lead to a reduced number of informed traders. As a consequence, trading costs increase due to enhanced adverse selection as well as less competition between traders as only a few have information and hence liquidity decreases.[7] These conclusions are supported by our study which shows a positive relation of increased liquidity and enhanced transparency. In accordance with Rindi (2008) we assume that individual traders feel more comfortable to provide liquidity, when broker ID information are disclosed.

Collin-Dufresne and Fos (2015) argue that standard adverse selection measures are not robust to informed trading by strategic traders with long-lived information who are able to choose when and how to trade. The authors identify informed traders by studying Schedule 13D filers. They find that insiders predominantly use limit orders and improve any adverse selection measures. This results in an asymmetric relation between buy- and sell- initiated orders, with higher measures for price impact for buyer-initiated transactions on days of informed trading,

[7] See also Foucault et al (2007), who present a similar model where the uniformed benefit of a higher level of market transparency, as they can observe the order placement of informed investors.

suggesting that major purchases are made. On the same days, realised spread is on average lower, but more for buyer-initiated trades. This indicates that liquidity provider will have smaller rents on days of informed trading, especially when acting as the counterparty for buyer-initiated trades, since the measure stands for the revenue of liquidity providers, see Hendershott, Jones and Menkfeld (2011). Collin-Dufresne and Fos (2015) conclude that the asymmetry between buy- and sell- initiated measures of adverse selection might be a signal for the presence of strategic traders, using both market and limit orders. We do not find significant different coefficients for the price impact of buyer- and seller-initiated orders.

The level of market transparency is an essential question in an exchange's design and in the face of competition with increasingly fragmented markets. Broker IDs have shown to be informative, such that market participants can infer price information and thus price stocks more accurately.[8] Pham et al (2016) present strong evidence that the disclosure of the broker identity post-trade not only improved their measure of market liquidity, namely the trade volume which increased significantly, while the realised spread declined. They interpret this as a sign of higher competition between market makers. They also present significant results showing that the enhanced post-trade transparency increases the informational content of trades by analysing the efficiency improvement using measures based alterations to volatility ratios. The more traditional measure of liquidity, namely the effective spread, rose due to the much greater rate of information release. Overall, their analysis of the Korean Stock Exchange in 1996 shows that when broker IDs were revealed at the close of the morning and afternoon trading sessions, there were significant market quality improvements. Their findings support the model of Pagano and Roell (1996) where the bid-ask spread is widened as a protection against adverse selection resulting from greater transparency. Hence, an increased level of information concerning the counterpart benefits liquidity since the fear of better informed investors is lowered.[9] In addition, uninformed participants have the opportunity to copycat supposedly informed participants with a market converging to informational efficiency with the beliefs of both parties converging. In contrast to Pham et al (2016), we find that effective spreads narrow significantly, when broker ID disclosure was reintroduced, and increase steadily with transparency. In accordance with the findings for the Korean Stock exchange, we

[8] Linnainmaa and Saar (2012).

[9] These conclusions go along with Biais (1993). The implicit bid-ask spread of noise traders is tighter in an auction than a dealer market as a consequence of higher transparency. Therefore, these traders are able to observe and learn from and about other market participant's trades what leads to less risk for themselves. Thus, they are willing to trade with a lower spread. Yin (2005) extends this analysis by introducing the idea that quote transparency leads to competitive pressure since the costs for information acquisition are lowered. When investors must pay for opacity in an opaque market, he concludes that the spread is smaller in the more transparent market.

observe a positive relation between liquidity and improving transparency. Bessembinder et al (2006) develop a theoretical model and test its implications on institutional trades in bonds. They find that trade execution costs fall by 50% for bonds eligible for a more transparent reporting system and 20% for not eligible bonds. According to the authors, the results reflect a liquidity externality by which better pricing information regarding a subset of bonds improves valuation and execution cost monitoring for related bonds.

Literature presents conflicting arguments how the market reacts on informational efficiency. While Grossman and Stiglitz (1980) state that a competitive equilibrium is not compatible with informational efficient markets and argue that a market would thin, Ou-Yang and Wu (2014) claim an informed trader always has a superior level of information resulting in potentially increased trading volume overall.[10] This conclusion conforms with Chau and Vayanos (2006) who find that an informed trader's profit does not converge to zero, also continuous exposure to other participants and driving a steady-state market towards (informational) efficiency. To conclude, the interest of exchanges in the aspects of broker information transparency does not only result through its obvious impact on transaction costs and overall market quality, in addition, trading volume, a critical element in competitive outcomes, is affected.

Based on previous research, we base our analysis on the following hypotheses:

H1: Liquidity is positively associated with enhanced broker ID information disclosure.

Based on the findings by Pham et al (2016), the decreased information symmetry encourages individual investors to provide liquidity. Presumably uninformed investors become quasi-informed and incorporate information in their orders. As Rindi (2008) points out, there is a possibility that informed investors reduce their liquidity provision, since rents decrease with enhanced information disclosure and uninformed copying their strategies.

H2: A decreased level of broker ID information disclosure leads to increased transaction costs.

We expect that the effective spread measures narrow with increasing transparency and accordingly lower informational asymmetry. This impact will not only be visible on market level, but also for an investor's order itself. In accordance with Foucault (2013), the disclosure of broker ID's balances out asymmetric information and improves price discovery which leads to lower transaction costs.[11] Quasi-informed household investors will increase their trading activities and support a faster price discovery. While the impact on a market level is well

[10] Ou-Yang and Wu (2014) claim that the trading volume of informed traders has a positive limiting value also error term of the variance of the informed's signal is converging to zero with an increased market efficiency.

[11] Frino et al (2010) show that improved transparency leads to a significantly higher price impact.

studied, we expect that the transaction costs for individual orders as an accurate measurement to determine the magnitude of impact for the investor himself, will increase too.

Furthermore:

H3: Not only institutional investors adapt their order submission to a changing market environment, but so do household investors.

Institutional investors, as potentially superior and informed traders, adapt their order submission characteristics to the level of broker ID information disclosure. In an opaque market, uninformed can only infer information from trade size, price and direction and cannot copy strategies easily, which allows higher rents for informed, since price discovery is slowed down. Informed investors carefully split up orders to minimize implementation shortfall costs and to avoid unnecessary information disclosure. Therefore, we expect in a transparent market smaller orders or increased order splitting by institutional investors. Research on the Finnish stock market has shown, that individual investors trade at an inferior level in relation to institutional investors and especially foreign investors, whereas other studies provide evidence, that households can exhibit superior trading performance and cannot per se be categorized as noise traders.[12] However, we expect that both types of investors actively adapt their trading behaviour in accordance with the regulatory changes to minimize the risk of losses or exposure.

This paper is organized as follows. Section 2 discusses previous findings in literature, section 3 presents our methodology. Further, section 4 explains the market and our 3 analysed policy changes. Section 5 shows our univariate analysis followed by section 6 with a comprehensive presentation of our multivariate analysis. A summary concludes the results in section 7.

2 Previous Literature

Findings by Linnainmaa and Saar (2012) suggest that broker IDs are informative for other market participants. Information related to trading motivation can be inferred from the identity of an investor or broker. Market participants can combine order flow and trade size with the investor's or broker's identity and infer underlying information. This leads to changes in their trading behaviour and hence the degree of information efficiency relates to market's quality.[13]

[12] Grinblatt and Keloharju (2000) demonstrate on base of the same data set used in this study, that momentum behaviour is correlated with investor performance and both appear to be associated with the level of sophistication of the investor. They show, that domestic investors, specifically households pursue contrarian strategies, leading to an inferior performance. In contrast to the generalized view that households underperform, but not in conflict with the mentioned determinants of performance, other studies show that certain categories of household investors outperform as a reward for providing liquidity (Kaniel Saar and Titman (2008)) and are better informed (Kelley and Tetlock (2013)).

[13] Please see also Beneviste et al (1992) and Chakravarty (2001) who came to similar conclusions in their analyses.

Frino et al (2010) present similar findings for broker ID transparency at the Australian Stock Exchange. Consecutive buyer-/seller-initiated trade by the same broker have an above average price impact when the broker identity is available. The magnitude of impact is even more significant for securities with higher estimated adverse selection costs as well as in the first half hour of a trading day. Overall, that implies that trades with disclosed broker information have more informational value, and lead to a higher market efficiency.

The treatment group in the last experiment of our study is exposed to similar changes examined by Pham et al (2016) since broker identities are provided ex post. The authors find strong evidence that the disclosure of broker ID information on the Korea Exchange has a positive effect on trading activity, market efficiency and liquidity. Eom et al (2007) support these findings for the same exchange, concluding that market quality is increasing with the introduction of pre-trade transparency. On the other hand, Comerton-Forde et al (2005) study the impact of broker ID disclosure on 3 different exchanges and finds a negative relation between liquidity and enhanced broker ID disclosure. Our events enable us to examine the effect of three different kinds of transparency changes whereas most papers investigate only one type of change, mainly pre-trade transparency in other than limit order markets.[14]

Karpoff (1997) states that it is possible to distinguish the mechanisms of correlation between trade volume and absolute returns of informed and noise traders.[15] As described in the Glosten-Milgrom (1985) model, liquidity demands results from these two types of traders. Kyle (1985) presents a model focusing on asymmetric information. Orders are combined, so that the market maker is not able to distinguish between the orders of informed or uninformed investors. However, the market maker knows that a uniformed investor submits on an aggregate level a normal distributed order of a zero mean and random variance. In contrast, the better-informed trader submits an order with a mean of μ, and a variance of σ_v^2, as he has information about the true value of the security. The market maker observes an aggregated order, not knowing about the securities true price v, but infers it from the order flow. The relation between the equilibrium price and the order flow is assumed to be linear, where the price is equal to the true value plus the influence of the order flow. This influence, the slope of the order flow, is Kyle's λ, which is a measure of price pressure exerted per unit of the order, in other terms the price impact. Within a deep market order size is not as relevant as it does not drive the price as much as it would in a market which has a lack of market depth. If a market is deep Kyle's λ is small.

[14] As Beneviste et al (1992), Desgranges and Foucault (2005) and Green et al (2007).
[15] See also Wang (1994).

Thus, the market depth can be measure as the inverse of Kyle's λ. The market depth, liquidity, is proportional to the share of liquidity demand by noise traders. Therefore, volume and liquidity are positively correlated.[16] This leads to the conclusion that enhanced transparency in form of the disclosure of broker IDs leads to decreased asymmetric information, which gives uninformed traders the confidence to make more valid conclusions from the order flow. Price discovery improves, which enables higher liquidity demand by uniformed, which triggers more informed trading as a result a higher level of transparency goes along with a higher trading volume and liquidity. In addition, the improved liquidity leads to a faster implementation of information in the security's price. Hence, not only price discovery improves but also transaction costs are lowered. Foucault (2013) shows that bid and ask prices are determined with a top up to protect the price setters against adverse selection costs. With decreased adverse selection through the disclosure of broker information, traders are willing to buy at higher and sell at a lower price if they believe the price is closer to the security's actual value. The disclosure of broker ID's balances out asymmetric information and the improved price discovery leads to lower transaction costs. Flood et al (1999) agree with these arguments but point out the possibility that increased transparency can also widen spreads. Market participants are less willing to provide liquidity at the beginning of trading and to compete for order flow, since no information is yet available. This trend vanishes over time. Further, while in an opaque market both informed and uninformed pay higher half spreads, with increasing transparency these costs of trading shift towards the informed participants.[17]

A broad literature addresses the relation and the mechanisms of post-trade transparency and market efficiency and liquidity, but few base their conclusions on real world events. Boehmer et al (2005) find for the NYSE that the introduction of the real-time order book feed in 2002 leads to significant lower trading costs. In contrast, Madhavan et al (2005) analyse the introduction of pre-trade transparency at the Toronto Stock Exchange. They show that the pre-trade disclosure lead to increased volatility as well as execution costs. The impact was observable for the floor traded stocks, but not for stocks under their Computer Aided Trading System. Simaan et al (2003) analysed the introduction of pre-trade anonymity of quotes and trades placed by liquidity providers. The authors argue that transparency enables traders to quote wider spreads. Participants setting narrower quotes can be identified as potentially

[16] See Johnson (2008), Foster and Viswanathan (1990) and Admati and Pfleiderer (1988). Ou-Yang and Wu (2014) relax Kyle's (1985) assumption that an informed receives information only in the beginning of a trading day. The insider receives information continuously and therefore also noise traders are able to copycat through the day if information efficiency is improved. Aspects of market efficiency and liquidity will be impacted in a more intense and different way.

[17] Fong et al (2011) find for the Australian ASX that the disclosure of broker IDs to the brokers but not to non-broker traders let to increased splitting of orders across brokers to increase their information content.

informed. Hence, spreads will be narrower in an anonymous environment. Consistent with their analysis they provide empirical evidence based on NASDAQ data.

Pagano and Roell (1996) find a positive and significant impact of trade information reports on market efficiency. Baruch (2004) supports these results as his theoretical model considers a situation where smart limit order traders and specialists supply liquidity and shows that an open limit order book has a positive effect on liquidity. Gemmill (1996) does not find any significant changes in liquidity nor the speed of price discovery, when the London Stock Exchange implemented post-trade transparency for large block trades. Hendershott and Jones (2005) find the switch to an undisclosed order book for very liquid ETF in Island led to a decrease in share in trading activity and price discovery worsens. Trading costs rise in Island but decline on other trading venues. Madhavan et al (2005) on the other hand infer from their model that greater order book transparency has a negative impact on liquidity. Furthermore, the changes also affect the order placement behaviour of investors who split large orders into several trades to prevent a fast revelation of trading intentions. Implantation shortfall costs, the cumulative price impact of a large, split up orders, are supposed to increase with an improved transparency.[18]

3 Market, Market Design Decisions and Data

NASDAQ OMX Helsinki is a significant part of the global portfolio, being home to important companies of the technology sector like Nokia. The Helsinki Security Exchange within OMX AB was acquired by NASDAQ in 2008. NASDAQ OMX is a conglomerate of Nordic exchanges that includes exchanges from Sweden, Iceland, Denmark, Copenhagen, the Baltic countries and Finland. NASDAQ OMX comprises 2,400 companies with a market value over US $ 8.5 trillion. The OMX Helsinki trades from 10:00a.m. through 6:30 p.m. via a centralized pure limit order book market with Relatively simple trading rules and a transparent market design.

Our analysis about the impact of different stages of broker ID disclosure is based on three events, where new regulations regarding the transparency of broker information were implemented. Prior the investigated event on the 13th March 2006, OMX Helsinki reported broker information pre-trade and can hence be considered as fully transparent. With the implementation of the new regulation, broker information were available post trade. On 2nd June 2008, the market became completely opaque. This decision was partly reversed on 14th April 2009, when for all securities with exception of the Top 5 traded stocks, post-trade broker

[18] Van Kervel and Menkveld (2015).

ID disclosure was reintroduced. For the Top 5 the securities, Nokia, Fortum, Stora Enso, UPM and Sampo, the market remained opaque.[19] We refer to this policy change as the third event.

We base our study on two data sets. First, we use end-of-day security-level metrics, computed from TRTH data to analyse the impact of the regulatory changes overall on market quality and liquidity. The metrics were computed with the Market quality dashboard developed and managed by Capital Markets CRC.[20] Thomson-Reuters provides un-manipulated trade and quote records data for all major markets since 1996. For NASDAQ OMX Helsinki, we find complete intraday times-and-sales data, with time stamps at millisecond level, allowing a comprehensive analysis. All securities classified as equity by Thomson-Reuters, which were traded at least on 90% of the days pre- and post the event within the event horizons were included in the analysis. The metrics for each security were extracted from the Market quality dashboard and included in our event study. For the first event study, analysing the switch from pre- to post-trade transparency, 97 securities fulfil our criteria. For the second analysed regulation implementation,126 securities remain in our data set. 111 securities are included in the last difference-in-difference analysis studying the partial reintroduction of post-trade transparency.

Our second data set is provided by Euroclear Finland Ltd. The book entry system of OMXH holds the official record of the shareholdings and all trades and consists of information on investor identity, date, stock, transaction type, price and volume. The dataset is a copy of the book entry system records and is reliable given that it is the only official certificate of share ownership. Each investor account has been assigned an anonymous number for privacy reasons. Therefore, with negligible exceptions, it is possible to construct the precise composition and value of a particular investor's portfolio at a given date. A valuable characteristic of this data set is that it allows the classification of all holdings and transactions by the investor type. The book entry system records the compulsory registration for every investor on the OMXH and allocates a unique investor type identification code for each investor. Based on this unique identification code, trades can be sorted by investor type and trade packages can be constructed. The unique data set allows observing not only comprehensive trade information, but also both counterparties to each trade, investor (type),

[19] The majority of the turnover at OMXH is concentrated within the Top 10. The companies, acting as a natural control group, are of public interest and a major stakeholder might have an interest and advantage to trade within an opaque market. Please note, that the Euroclear data set does not provide full trades data for Sampo for the third event horizon and is therefore missing. The security is included in the data set provided by the Market Quality dashboard.

[20] The Capital Markets Cooperative Research Centre (CMCRC) provides through the MQD a high-level description of enhanced data analytics for exchanges, regulators and academics. A unique ETL (Extract, transform and load) Workflow engine allows data management automation and the computation of various market quality metrics on the basis of any kind of market data.

broker (type) and even the related account number the investor. Investors are categorized into six investor categories: individuals (resident in Finland), financial institutions (registered in Finland), foreign investors, government, not-for-profit organizations and non-financial institutions. NASDAQ OMX Helsinki trades roughly 150 securities throughout our analysis period. Our final data set contains 171 securities over the complete horizon from 1st July 2004 until 30th December 2009. After applying certain criteria as to liquidity to the data, we remain with the same securities for each event study as for the first data set.[21]

4 Methodology

The TRTH data processed with the MQD of the CMCRC is used to analyse the overall impact of the regulatory changes. The second data set from Euroclear provides account information allowing to study the consequences for institutional investors and households. For both we compute similar metrics, however the methodologies differ.

For both data sets, we ignore securities which are not traded in the relevant period either before or after an event. For each event, we exclude five trading days prior and post the event. Our benchmark and analysis horizon are each 125 trading days for each event to analyse effects in the long run.[22] The event horizon for the first event on 13th March 2006, when the market switched from pre- to post-trade transparency, starts on 7th September 2005, the last day after the event in our sample period is 18th September 2006. Accordingly, the sample period for the second event on 2nd June 2008, when the market became opaque, starts on 20th November 2007 and lasts until 2nd December 2008. The last analysis of the third policy change, where broker ID disclosure post-trade was partially reintroduced, on 14th April 2009 is based on a sample horizon from 2nd October 2008 until 16th October 2009.

Thomson-Reuters-Tick-History/Market Quality Dashboard data

All included metrics for all securities of Nasdaq OMXH were directly extracted from the MQD. The MQD provides through its workflow engine the complete data management, extraction from Thomson-Reuters, transforming and visualization, as well as the metric computation. The metrics included in this study are computed as follows:

We analyse the impact on market liquidity through liquidity measures, measures for transaction costs, as well as resilience. As liquidity measures we include the trade volume, trade count and value of security. These are defined as the sum of the relevant parameter across all on-market trades. A trade is classified as on-market, if it occurs within the trading hours and is flagged as

[21] We require that a security is traded at least on 90% of the days within the pre- and post event horizon.

[22] In addition, we tested our results for an event horizon of 21 and 63 trading days. The magnitude of the coefficients varies slightly, however the significance and impact direction are always the same.

on-market. We include the relative effective, realised spread, price impact, implementation shortfall costs and quoted depth as measures of transaction costs. The relative or percentage effective spread represents the actual, round-trip trading costs for a liquidity demander. It is computed as the difference between the trade price and the prevailing mid-point price, defined as the average of the best bid and ask price, scaled by the mid-point price, multiplied by the trade direction. The dummy variable for the trade direction equals -1 if the trade is seller-initiated and 1 otherwise. We express all spread measures in bps, therefore multiplied by 100. We compute the relative realised spread as the trade price minus the mid-point price 10 minutes later, times 2 and the trade direction, which is inferred from the Lee-Ready algorithm. The value is scaled by the initial prevailing mid-point price, and expressed in bps. The measure can be interpreted as the revenue earned for the liquidity provider. The relative price impact is computed as the difference between the relative effective and realised spread, measuring the subsequent price change following a transaction, an indicator regarding the amount of private information within a trade. Our quoted depth measure, is computed as the sum of the daily time-weighted depth of the best ask and bid. Implementation shortfall costs are defined as the opportunity plus the execution costs of a trade. The explicit costs incur with the usual order-processing, settlement costs in form of fees or commissions. However, implicit costs depend on the order book, on the spread between the best bid and ask price. The implementation shortfall costs are based on the liquidity premium as the difference between the mid-point and the bid (ask) price for sell (buy)orders and the adverse price movement. Further they include the adverse price movement which is especially relevant for larger orders. The trading costs then increase as the difference between the best bid or ask price and the average order execution price. The market impact costs are redistributed to liquidity suppliers. The measure is the sum of the market impact in bps for a given euro transaction volume, describing the performance loss due to liquidity costs. We include intraday volatility and the variance ratio as resilience measures. We compute this measure as the standard deviation of the 5 minutes log returns of the mid-point throughout the trading day. The variance ratio measures the linearity of the variance of the mid-point price returns in a certain data interval, in our case 1 and 5 minute(s). An efficient market has an expected variance of close to 1, as the variance of mid-point price returns in t (5) minutes is expected to be close to k times the variance of the mid-point price return over x (1) minutes. Hence, our measure follows Lo and Mac Kinlay (1988) and implies a test for the random walk hypothesis.

We include these measures as dependent variables in following fixed effect model for the first and the second event:

$$Q_{id} = \beta_1 Event_d + \beta_2 Trend_{id} + \sum_{k=1}^{K=5} \theta_k Weekday_k + \sum_{i=2}^{I=n} \gamma_i D_i + \varepsilon_{id} \quad (1)$$

where Q_{id} of security i on day d acts as the dependent market quality variable. $Event_d$ is a dummy variable equal to 1 post the analysed event and 0 before. We include a time variable, $Trend_{id}$, to correct for trends as our event horizons are extensive. $\theta_k Weekday_k$ is a weekday specific dummy variable allowing for weekday and stock fixed effects, accordingly $\gamma_i D_i$ allows us to include stock fixed effects. Standard errors are clustered by security.[23]

The nature of the third event allows one to include a difference-in-difference measure as the top 5 traded stock are not affected by the new regulation and act as a control group. Therefore, we implement a dummy variable, $Treatment_i$, equal to 1 if the security is affected by the regulations, or 0 otherwise. The difference-in-difference (DID) measure is a dummy variable computed as the product of $Treatment_i$ and $Event_d$ for each security on a daily basis. Again, standard errors are clustered by security. We estimate the following model for the third event:

$$Q_{id} = \beta_1 Event_d + \beta_2 Treatment_i + DID_{id} + \sum_{k=1}^{K=5} \theta_k \, weekday_k + \varepsilon_{id} \quad (2)$$

Euroclear data set

Most available trade data sets do not provide information about the actual brokers and investors on both sides of the market. The Euroclear data set provides account information such as the investor ID and allows one to recreate the underlying orders. The dataset provides a fully transparent overview about trades, including the actual account numbers taking part, as well as the broker. This allows us to consolidate the data in way which actually reflects the underlying, splitted up orders of an investor. This leads improved understanding of the investor's trading behaviour as well as a better visualization of the impact of their trades. All analyses are computed separately for orders overall as well as for seller- and buyer-initiated orders. Further we distinguish the type of investor, e.g. individual investors, or households, and institutional investors.

We construct the underlying order in two steps. First, we consolidate trade sequences of the same investor, in the same direction, of the same security if the time difference between two trades is less than five trading days. In a second step, we analyse whether investors perform minor trades in the opposite direction between larger trades. If a trade's/order's volume between two orders in the opposite direction is less than 5 % of the combined volume of the previous and the following trade, we consider this trade as minor and not relevant. We then

[23] Chang and Fong (2000) document that the trade size itself has relevant informational content. We ran additional regressions and found, also the coefficients for volume are indeed significant, this does not change the magnitude or significance for the coefficient of the event dummy variable.

rerun the first to combine trades if minor trades in between were removed. With this method, we are able to construct the underlying orders and evaluate the impact of broker information policy changes directly on the actual order, even if the trader tries to disguise his intention by making small reversals. To our knowledge this paper is the first to investigate this issues from this point of view. Putnins and Barbara (2017) use a similar approach as ours to analyse how the transaction costs for orders of institutional traders are affected by different types of high frequency and algorithmic traders. The study shows that toxic traders trade with the institutional order flow rather than against it. This behaviour can reduce liquidity provision by institutional traders, but also enhance price discovery. The advantage of their and our approach is, that it allows to measure trading costs for an investor himself very accurately. The discrepancy in the magnitude of impact between results on a market and an order level can be observed in our findings.

We use similar market liquidity measures as used in the baseline dataset, liquidity measures as well as transaction cost measures. However, all these measures are computed on basis of the actual orders, not on a conventional daily trade base.

We evaluate the impact of the different regulations on trading activity and market liquidity. We estimate the impact with a fixed effects regression model, as in the following, for the first two events:

$$Q_{itd} = \beta_1 Event_d + \beta_2 Trend_{itd} + \sum_{k=1}^{K=5} \theta_k \, weekday_k + \sum_{i=2}^{I=n} \eta_{itd} \, Investor_{itd} + \sum_{i=2}^{I=n} \gamma_i D_i + \varepsilon_{itd} \qquad (3)$$

where we include a market quality determinant Q_{itd} , as for instance the logarithmized total order volume of order $t,$ security i on date $d,$ as the dependent variable. A dummy variable $Event_d$, equals 0 prior and 1 post the event. We control for the first weekday of the order and the investor of the order, further we include stock fixed effects. Standard errors are clustered by security.[24] We do not control for the investor type, when analysing individual and institutional investors separately. In addition, we estimate the same kind of model for the logarithmized number of trades within an order as well as its duration. The order volume, value, the number of trades within an order are the sum of the relevant parameters after the orders are constructed. Further, we compute the number of daily issued order per security (and direction) as the sum of all orders issued on the relevant day. The order duration, is the number of hours (within trading hours) it takes to execute an order fully.

Furthermore, we investigate the impact of the policy changes on transaction costs. We compute the relative effective spread of an order as the difference of the volume weighted order price

[24] By clustering the standard errors by firm, we account for both heteroscedasticity and correlation within stocks.

and the first mid-point price of the order scaled by the first mid-point price, times the order direction.[25] In addition, we evaluate the impact on the relative realised spread by the difference between the last mid-point price and the volume weighted order price scaled by the volume weighted order price, multiplied by the order direction. We further compute the relative market impact as the difference between the last and first mid-point price scaled by the first mid-point price. The relative price impact is measured by the difference between the last and first order price, scaled by the first order price. Van Kervel and Menkfeld (2016) use this measure as a proxy for institutional implementation shortfall.[26] The values are multiplied by 10,000, and are therefore expressed in bps. We estimate the relative price impact of an order using the following fixed effect model for events one and two, when evaluating the overall effect regardless the type of investor:

$$Q_{itd} = \beta_1 Event_d + \beta_2 Trend_{itd} + \sum_{k=1}^{K=5} \theta_k weekday_k + \sum_{i=2}^{I=n} \eta_{itd} Investor_{itd} + \sum_{i=2}^{I=n} \gamma_i D_i + \varepsilon_{itd} \quad (4)$$

Here, Q_{itd} acts as the dependent variable, further we control for the first weekday of the order, the security, as well as for the investor type. We skip the latter control when analysing the impact by investor type separately. Again, standard errors are clustered by security. For the third event, we follow the same approach as in the TRTH data set and estimate a model including a difference-in-difference analysis:

$$Q_{itd} = \beta_1 Event_d + \beta_2 Treatment_i + DID_{id} + \sum_{k=1}^{K=5} \theta_k weekday_k + \sum_{i=2}^{I=n} \eta_{itd} Investor_{itd} + \varepsilon_{itd} \quad (5)$$

where Q_{itd} acts again as the dependent variable and we control for the first weekday of the order issue, as well as for the investor type if we do not distinguish our analysis by the type. We cluster standard errors by security.

Combining these two approaches, we receive a comprehensive picture and an improved understanding of the impact of the three policy changes on market quality and trading activity.

5 Univariate Analyses

Tables 1, 2, and 3 each present an overview of relevant determinant's mean and standard deviation before and after the event within each of the three sample horizons. The Wilcoxon rank-sum test tests whether the two samples derive from the same distribution.[27] Each table refers in Panel A to the market liquidity parameters derived from the TRTH data/MQD data

[25] Putnins and Barbara (2017) refer to the exact same measure as implementation shortfall costs for an order. The authors use that measure to show that some high-frequency traders appear toxic to institutional investors, while others seem beneficial.

[26] By contrast, Bikker et al (2004) compute the implementation shortfall for pension funds as $IS_{it}^{B} = \log(P_{it}^{exe}/P_{it}^{pt}) - \log(M_{it}^{exe}/M_{it}^{pt})$ with P_{it}^{exe} and P_{it}^{pt} as the execution and pre-trade stock price of stock i at day t, M_{it}^{exe} and M_{it}^{pt} are determined accordingly.

[27] Also known as Mann –Whitney two-sample statistic.

set, presenting daily parameters. Panel B presents the market liquidity parameter per order for individual investors only derived from the Euroclear data set, while Panel C refers for the same parameters for institutional investors.

[Insert Table 1 here]

The switch from pre-trade to post-trade broker information disclosure on 13th March 2006 leads to significantly higher transaction costs overall as shown in Table 1, Panel A. All t-tests for transaction cost metrics show that the mean transaction costs after the event are higher than before, the mean relative effective spread widens about 15 bps. The variance ratio test indicates a significant decrease in market liquidity. Liquidity metrics, as the on-market trade count as well as value, the event leads to an increase in the mean. However, the daily trade volume does not show any significant change in the mean. This could indicate that orders are being splitted up further after the event. Panel B and C refer to our analysis for individual and institutional investors using the underlying order. The mean number of trades within an order submitted by an individual investor increases by 0.1, whereas institutional investors seem to reduce the number of trades. The mean order volume of individual investors does not change at a significant level. In contrast, the average order volume of institutional investors decreases significantly by over 3,100. The mean order value for falls accordingly. The mean value for orders submitted by individual investors is significantly higher after the switch to post-trade broker ID disclosure than before the event. The results show that the mean order execution time increases slightly for individual investors, while it decreases for institutional investors. For orders submitted by institutional investors, this is consistent with the reduced order volume, value and the falling number of trades within an order. For both investor types the t-test shows that the daily number of issued orders increases significantly. For institutional investors, this trend indicates that orders are further split. Overall, the transaction costs for both investor types increase significantly with the switch to post-trade broker ID disclosure. Individual investor's transaction costs seem more impacted by the event than those of institutional investors. The liquidity parameters present a contrary impact for both investor types, where institutional investors loose significantly.

[Insert Table 2 here]

The second investigated policy change occurred on 2nd June 2008. Nasdaq OMX Helsinki decided to become opaque and to discontinue the broker ID disclosure post-trade. As shown in Table 2, Panel A, this decision led to a significant increase in the mean daily on-market trade volume and count, while the average daily on-market value decreases. This could indicate that investors tend to split up their orders due to the introduced opacity. The univariate analysis of

the transaction costs presents a consistent and strong increase in the mean. The mean relative effective spread increases by over 74 bps at a 1% significance level. Furthermore, the implementation shortfall costs rise about 37 bps. The t-test for the variance ratio shows that the market becomes less efficient. The mean daily quoted depth at the best bid and ask decreases significantly. Panel B presents a quite contrary picture for individual investors. The mean daily number of order issues increases steeply, while the t-test for the mean number of trades within an order and the average order value presents a highly significant decrease, indicating smaller orders. We observe a homogenous picture across both investor types regarding the impact on the mean effective spread. In both cases the mean spread widens at a highly significant level, however the increase for individual investors is 3 times larger than the one for institutional investors. For institutional investors however, the mean relative realised spread per order tightens, whereas the it widens for individual investors. For both investor types the average relative price and market impact per order increases significantly by the policy change. In contrast to the impact on individual investors, with the switch to opacity institutional investors submit less orders, also we can observe an increase in the number of trades within an order as well as the order volume. However, the mean order value itself decreases significantly.

[Insert Table 3 here]

The third event allows us to build a control group and analyse the impact of the policy change as a natural experiment. For the Top 5 securities, Nokia, Fortum, Stora Enso, UPM and Sampo, the market remained opaque, hence these were unaffected by the reversed policy. For securities within the treatment group, broker information disclosure was reintroduced on the 14th April 2009. The results for the univariate analysis are presented in Table 3. A detailed comparison between the development of the treatment and control group using a difference-in-difference approach, is presented in Tables 10 to 12. The mean daily transaction costs fall overall over our study period, however, over sixty times more for securities within the treatment group. For the average daily on-market trading volume we observe a decrease post the event for both groups. The fall for the daily trade volume is more significant for securities within the treatment group than the control group, whereas the mean number of daily trades decreases less. The median presents a contrary picture to the mean, where an increase in liquidity for securities of the treatment group can be anticipated. The t-test for market efficiency, measured by the mean daily variance ratio before and after the implementation of the policy, shows an overall significant improvement. Before and after the event market is more efficient for smaller securities, e.g. the treatment group. Transaction cost coefficients present a decrease in general. The mean daily relative effective spread tightens by 94 bps for securities within the treatment

group, whereas securities of the control group experience a decrease of 2 bps on average. As shown in Panels B and C, the same parameter decreases by 2 bps for individual investors submitting orders with securities of the treatment group and accordingly 5 bps for institutional investors. When submitting orders including securities of the control group, individual investors experience an increase in the relative effective spread by 6 bps costs on average. The mean price impact of orders submitted by individual investors decreases overall, however 3 times less for the treatment group. The price impact for order submitted by institutional investors increases by 0.8 bps, whereas we observe a slight decrease for orders including securities of the control group. The new regulation leads overall to highly significant increase in liquidity for institutional investors. For households, we observe a negative trend, however the decrease is significantly less severe for the treatment group.

An appropriate and detailed multivariate analysis of the impact on market liquidity by the three events is given in the following chapter.

6 Multivariate Analyses

Our study provides a unique approach to address the controversial findings in previous literature. For each event, we first analyse the impact by using a fixed effect regression model based on TRTH data. We use daily liquidity, transaction costs and resilience metrics derived from the MQD. Second, we present our findings based on the Euroclear data set. We reconstructed the underlying orders of each investor and computed all determinants based on these orders. Further, the data set allows us to distinguish between individual and institutional investors. In addition, we show the impact on buy and seller-initiated orders separately.

6.1 Switch from pre- to post-trade broker ID disclosure on 13th March 2006

Tables 4 to 6 present the regression coefficients for the first investigated event. Table 4 shows the relevant daily parameters regarding market liquidity derived from TRTH/MQD. Our highly significant results show an increase in the daily transaction costs. The relative effective spread widens by over 12 bps at a 1% significance level. We observe an increase in relative price impact by 10 bps. Furthermore, the coefficient for implementation shortfall costs shows an increase by around 6 bps, whereas the relevant coefficient for relative realised spread does not indicate any significant change. The daily intraday volatility as a measure of resilience presents a minimal but positive change. All coefficients for market liquidity indicate a drop with the switch to post trade broker ID disclosure. On-market volume and trade count drop by over 12%. The quoted depth at the best bid as well as ask are decreasing. Market efficiency, measured by variance ratio, does not seem to be impacted by the new regulations.

Our findings suggest, that the informational content of trades increases due to switch broker ID transparency. This finding can be expected, since the market participants are no longer able to observe eventual information upfront, the infer more information from the order flow itself. The increased information asymmetry between institutional investors and households might lead to a certain hesitation of households to trade and provide liquidity. On the other side institutional traders might benefit, since their intentions are less obvious.

[Insert Table 4 here]

Our study deepens the understanding of different levels of broker ID information disclosure, by analysing the impact separately for individual and institutional investors. While the first should benefit from broker ID disclosure in general, the latter might benefit from a reduced availability of information. To clarify, how exactly these investors adapt to the new regulations, we use the Euroclear data set and base our study on the actual orders the individual investor submits. We distinguish between buyer- and seller-initiated orders, allowing a comprehensive picture.

Panel A in Table 5 presents the impact on liquidity measures, regardless the investor type. We can observe a significant decrease in liquidity in Table 4, however we do not find any significant impact on order volume itself. The coefficients for the logarithmized number of trades within for buyer-initiated orders decreases by 2%, whereas we observe an incline for the same coefficient for seller-initiated orders by 2%. These different developments lead to an insignificant coefficient, when the order direction is not considered. Panel C shows, that these developments are driven by the changes in the trading of institutional investors. The order submission of individual investors does not seem to be affected at any significant level. The coefficient for the overall number of daily submitted orders presents a steep increase a 10% significance level. Again, this overall finding in Panel A is driven by the changes in trading of institutional investors as shown in Panel C. Both, the number of buyer- as well as seller-initiated orders, increases equally at a 5% and 10% significance level respectively.

The order execution time falls overall, indicating that order execution becomes faster with the switch to post trade transparency. This finding is in accordance with a smaller number of trades within orders. We observe, that the order execution time for seller-initiated orders increase, whereas the order execution time for buyer-initiated orders becomes smaller. Panel C shows that order execution time for buyer- as well as seller-initiated orders of institutional investors decreases, while only seller-initiated orders of individual investors experience a shorter execution time.

To conclude, our results present no significant change in the individual's order submission by the policy implementation. Institutional investors submit significantly more orders on a daily base. While seller-initiated orders are splitted up further, the number of trades within buyer-initiated orders is reduced.

[Insert Table 5 here]

Secondly, we investigate the impact on order transaction costs as shown in Table 6. The relative effective spread of an order increases overall by 2.3 bps at a 1% significance, see Panel A. This incline is solely driven by the impact on seller-initiated orders, for which we observe an increase by 6 bps for individual investors and 2.7 bps for institutional investors respectively. Overall, the relative effective spread widens by 4 bps for individual investors and 1.4 bps for institutional investors. We observe a similar impact for the coefficients regarding the relative realised spread. The coefficients for seller-initiated orders present an increase by 2 bps, whereas the relative realised spread drops for buyer-initiated orders by 1.2 bps at a 5% significance level. Overall, there is no impact. Individual investors experience a significant decrease by 2 bps for buyer-initiated orders. In contrast, only seller-initiated orders of institutional investors are impacted, the relative realised spread widens by 1.7 bps with the switch to post-trade broker ID disclosure. In Panels B and C we observe, that the policy led to an increase of the relative market impact of seller-initiated orders by 7.4 bps for both individual and 4.5 bps for institutional investors at a 1% significance level. Since buyer-initiated orders do not seem to be impacted, the overall coefficient is increasing at a highly significant level. The same impact can be observed for the relative price impact of orders. Our results show a highly significant increase of about 2.5 bps overall, driven by the coefficients for buyer-initiated orders.

The first event leads to consistently higher transaction costs with the switch from pre- to post-trade broker ID disclosure. Our findings for each investor type show a heterogeneous picture, and clear differences in the impact on buyer- and seller-initiated orders. The changes in transaction costs seem mainly driven by seller-initiated orders. Individual investors experience a more significant incline in transaction costs than institutional investors do, however that does not result in a significant change in the order submission. While the daily measures in Table 4 present a highly significant decrease, the liquidity measures for orders submitted by individual investors are insignificant. Order submission by institutional investors shoots up.

[Insert Table 6 here]

Literature usually assigns more informational value to buyer-initiated orders and trades than seller-initiated. However, we find that consistently across both investor types, that the

informational content of seller-initiated orders increases, whereas the price impact of buyer-initiated orders falls. The switch from pre- to post-trade transparency still allows market participants to still infer information from other sources that the order flow. It seems, that the regulation impacts seller-initiated orders more, increasing the transaction costs as a result of more information asymmetry.

6.2 Switch from post-trade broker ID disclosure to opacity on 2nd June 2008

The regression coefficients in Tables 7 to 9 present our findings regarding the change from post-trade broker ID disclosure to total opacity in June 2008. Table 7 shows our findings regarding the impact on daily measures of market liquidity. We observe a consistent and highly significant increase in transaction costs. The daily relative effective spread widens by about 29.6 bps, same as the relative realised spread. Further, the implementation shortfall costs jump by nearly 16 bps. In contrast, our liquidity measures show a significant drop. The daily on-market volume falls about 8% at a 1% significance level, on-market trade count about 18%. Our results show a decrease of 14% for the depth at the best ask and 10% for the market depth at the best bid. We cannot observe any significant impact on variance ratio.

[Insert Table 7 here]

Despite the findings in Table 7, we cannot observe a significant impact regarding the logarithmized order volume overall. However, we find that seller as well as buyer-initiated orders by individual investors are negatively impacted by the switch to opacity. The order volume falls about 8% for buyer-initiated orders and 6% for seller-initiated orders at a 10% significance level, as shown in Panel B. We do not find a significant impact for orders submitted by institutional investors. Furthermore, individual investors submit significantly more buyer-initiated orders on a daily base, whereas institutional investors do not change their order submission. Panel A shows, that the number of daily submitted orders is not significantly impacted, when the investor type is ignored. Moreover, we find a highly significant positive increase of 3% for the number of trades within seller-initiated orders by institutional investors, which remains dominant in Panel A, when the investor type is disregarded. Individual investors do not change the number of trades their order is splitted up to on a significant base. Only the order execution time of buyer-initiated orders is negatively impacted by the policy change. The results indicate a reduced liquidity provision by individual traders, whereas institutional investors tend to implement seller-initiated orders more carefully.

[Insert Table 8 here]

[Insert Table 9 here]

In Table 9 we observe a highly significant increase for the coefficient for the relative effective spread. Neither the coefficients for buyer- nor seller-initiated orders are significant. The relative effective spread widens about 3.4 bps for orders submitted by individual investors and 0.8 bps for orders by institutional investors respectively. These findings are consistent with the results observed in Table 7. Buyer-initiated orders submitted by individual investors experience a declining relative realised spread of 3.3 bps. Seller-initiated orders are not affected, however seller-initiated orders of institutional investors experience a slight by significant incline. We cannot observe any significant impact when the investor type is not considered. The relative market as well as price impact of buyer-initiated orders of individual investors declines by over 2.5 bps. Seller-initiated orders submitted by institutional investors experience an increase in market- and price impact by over 1.5 bps, whereas the relevant value for buyer-initiated orders is insignificant. The coefficients are significant at a 10% and 5% significance level. As Panel A shows, only the coefficient for relative price impact of buyer-initiated orders presents a significant negative change when the investor type is disregarded.

6.3 Partial switch from opacity to post-trade broker ID disclosure on 14th April 2009

The final event allows us to perform a difference-in-difference analysis, as the top traded stocks are not impacted from the reversed regulations, originally introduced in 2008. These top stocks, Nokia, Fortum, Stora Enso, UPM and Sampo, act as a control group. Hence, we can clearly observe how the reintroduction of the disclosure of broker information post-trade affects the securities in contrast to securities for which broker information are not revealed. Our focus lays on the difference-in-difference (DID) dummy variable, which is the product of binary dummy variables for the event horizon and the group the security belongs to.

We investigate the impact on market liquidity measures on a daily basis as presented in Table 10. We find overall highly significant coefficients for the DID variable. The relative effective spread tightens about 78 bps more for the treatment group in contrast to the control group, when post-trade broker ID disclosure was reintroduced. In comparison, the DID coefficient for the implementation shortfall costs decreases by 39 bps more over the event for the treatment group.

The relative realised spread declines by 57 bps for treated securities in contrast to the control group. Moreover, the relative price impact falls about 17 bps.

[Insert Table 10 here]

The DID coefficient for all liquidity measures signals that the reintroduction of post-trade broker ID disclosure had a positive effect: Also, the daily on-market volume and trade count decrease overall. However, for securities within the treatment group in contrast to the securities

of the control group these coefficients fall by 2.2% and 5.7% less. The coefficients for quoted depth at the best bid or ask do not change significantly different for the treatment group in comparison to the control group. The variance ratio as a measure of efficiency is increasing more for treatment group than for the control group, at a 10% significance level. In combination with our findings about the mean variance ratio for both, the control as well as the treatment, groups in Table 3, we can infer that pre-event, the market seemed to be less efficient for the top traded stocks also their variance around the mean was smaller. Post-event, both groups show a significant improvement in market efficiency, e.g. the mean decreases, same for the standard deviation. Hence, the slight increase in Table 10, is due to the much larger variance in the variance ratio for smaller securities. A distinct statement that this event improves the market efficiency cannot be made.

We perform the same difference-in-difference approach for the Euroclear data set, investigating the impact for orders themselves, as well as two types of investors and regarding buyer- and seller-initiated orders.

Table 11 presents the regression coefficients for the analysis of the impact on liquidity measures. As Panels B and C show, the results are quiet contrary for individual and institutional investors. While the order volume for orders including securities of the treatment group submitted by individual investors increases by on average 17% at a 10% significance level, for both buyer- as well as seller-initiated orders, the same coefficient decreases about 24% at a 1% significance level for institutional investors. The overall impact as presented in Panel A, presents only a significant coefficient for seller-initiated orders, which falls about 13% at a 5% significance level. The decline is a result of the significant stronger and negative impact of the event on orders including less liquid securities which are submitted by institutional investors. We observe a similar finding for the coefficient for the number of trades within an order. For orders submitted by individual investors, the DID coefficient inclines by around 7% at a 5% significance-level. Both, the coefficients for buyer- and seller-initiated orders increase at a significant level. Institutional investors reduce the numbers of trades within seller-initiated orders for securities of the treatment group in contrast to the control group by about 7%. Buyer-initiated orders are not significantly impacted. When the investor type is not considered, only the DID-coefficient for seller-initiated orders presents a highly significant decrease of 4.8%. The most dominant and consistent change across investor types by the partial reintroduction of broker ID disclosure can be observed in the daily number of submitted orders: The DID-coefficient shows a dramatic increase of over 820% at a 1% significance level overall and for both investor types. This is driven equally by both buyer-initiated as well as seller-initiated

orders. Seller-initiated orders present a higher coefficient than buyer-initiated orders. This does not mean that the number of submitted orders increases per se, rather that overall the determinant is steeply falling, but much less for securities within the treatment group. This effect is twice as large for individual investors than for institutional investors. Panel B shows that the order implementation time is significantly reduced for individual investors trading securities within the treatment group in contrast to securities within the control group. This effect cannot be observed for institutional investors. Here, buyer-initiated order execution time for securities within the treatment increase at a 1% significance level. This goes along with the overall increasing order execution time. Panel A presents an overall increase of order execution time, whereas order execution time is significantly shorter for the treatment group.

[Insert Table 11 here]

[Insert Table 12 here]

Last, our study investigates the differences between the control and treatment group regarding transaction costs for orders when post-trade broker ID disclosure was reintroduced for less liquid securities.

While the effective spread overall seems to decrease, it decreases by 3.7 bps more for securities within the treatment group. This overall impact is mainly driven by seller-initiated orders. The relative effective spread for orders submitted by individual investors decreases about 4.7 bps more for securities within the treatment group. The relevant coefficient for institutional investors is 3.3 bps.

In contrast, the coefficients for the relative realised spread present no significant impact overall. Only for orders submitted by institutional investors, the DID coefficient shows a highly significant increase of 1.1 bps overall and 1.5 bps for seller-initiated orders, while the remaining DID coefficients are insignificant.

Orders of individual investors do not experience any significant impact by the partial reintroduction of broker ID regarding their relative market or price impact. We find, that seller-initiated orders of securities within the treatment group by institutional investors, have a 4 basis point lower market and price impact after the event than of securities within the control group. Seller-initiated orders are not impacted. This leads to a decrease of 2 bps overall for institutional investors and a 3.1 bps smaller market and price impact when order direction and investor type are not considered. In contrast, seller-initiated orders of securities within the treatment group seem to have a smaller relative market and price impact, than those in the control group.

7 Summary

This paper investigates three unique policy changes conducted at the Nasdaq OMX Helsinki. On 13th March 2006 Nasdaq OMX Helsinki switched from pre-trade broker ID disclosure to post-trade broker ID disclosure. On 2nd June 2008, the exchange decided not to disclose broker information anymore, hence the market became opaque. This decision was partly reversed on 14th April 2009. For all securities with exception of the top 5 traded stocks, broker ID disclosure was reintroduced post-trade. The last event allows us therefore to conduct a difference-in-difference analysis, where the top traded stocks, Nokia, Fortum, Stora Enso, UPM and Sampo, act as the control group. These multiple events allow us to analyse the relevance of broker ID disclosure for market liquidity as well as to determine the impact for different investor types submitting an order in terms of their personal transaction costs as well as their reaction to the new market environment.

We base our analysis on two different data sets and introduce a different methodology than the previous literature: First, we analyse all policy changes on base of daily measure regarding transaction costs, market resilience and liquidity, using TRTH data, which was processed by the MQD, which is developed and managed by the CMCRC. Second, we study the impact on these parameters using the Euroclear data set, which provides us with additional information regarding both trade sides, as the account numbers and the investor type. Trades are consolidated in a way to simulate the underlying order of an investor, e.g. sequences following securities of trades in the same direction of the same investor are combined, if the time difference between trades is less than 5 days. Minor trades in the opposite direction than the previous and following trade of the same investor were deleted. We are able to analyse the impact not only on overall market liquidity, but specifically on issued orders. We run basic fixed effect regressions for both data sets.

To our knowledge this paper is the impact of different stages of broker ID disclosure on base of orders and in such an extensive way: On base of the underlying order we not only show the impact of these policy changes on various determinants of market liquidity separately for buyer- and seller-initiated orders, furthermore, we distinguish between the type of investor, individual as well as institutional investors. Our results show that the usually used daily measures, often do not match the impact on single orders and differ across investor types. Further we can show how the market participants adapt their trading behaviour.

Our paper presents consistent results across different levels of broker ID information disclosure on NASDAQ OMX Helsinki. We can show, that any decrease in the level of transparency leads to overall higher transaction costs and reduced liquidity. Individual as well as institutional

investors experience wider spreads, hence transactions costs, with a decreasing level of transparency, however the impact is more severe for individual investors. Households alter their order submission, submitting smaller and less orders when the exchange reduces their level information disclosure. Institutional investors split up their sell-initiated orders further with a decreasing transparency level, and seem to change trade direction more often, when broker ID information is disclosed to all market participants. In detail, the daily relative effective spread as one measure for transaction costs widens by 12 bps when the exchange switched from pre-to post-trade broker ID disclosure. While buyer-initiated orders are not significantly impacted, the relative effective spread increases by 2.7 bps for seller-initiated orders submitted by institutional trades and even 6 bps for seller-initiated orders of individual traders. In 2008, when the market switched to opacity, the relative effective spread for orders of individual investors increases further by 3.4 bps. The market level daily effect is significantly larger, as we find a that the effective spread widens by 29 bps in the second event study. The difference-in-difference analysis for the third event confirms the previous findings, as the daily relative effective spread for the treatment group falls over 78 bps more than for the control group on a market level. These results are consistent with our findings for orders submitted by individual as well as institutional investors: The effective spread for seller-initiated orders submitted by individuals tightens by 9.5 bps for securities within the treatment group in comparison to the control group, while institutional investors experience a reduction of 2 bps for buyer-initiated orders and 4.8 bps for seller-initiated orders respectively. Our results for the third event show, that price impact increases by 10 bps on a market level. Studying the price impact of individual orders, we observe an increase of 7 bps for seller-initiated orders by individual investors and 4.5 bps for institutional investors.

On a market level, we observe a consistent and highly significant negative relation between reduced transparency and liquidity. The regulation change in 2006 leads to a drop in daily on-market volume and trade count of 12% and 30% respectively. We show that the second event reduces liquidity further, where the daily on-market trading volume falls by 8% and the number of trades by 18%. Both events lead to a significant fall in quoted depth at the best bid and ask. Individual investors seem to adapt their orders accordingly. We find that individual investors reduce their order volume of 7% when the market becomes opaque. In 2009, the switch back to post-trade transparency leads to a highly significant increase by 20% for buyer-initiated, and 11% for seller-initiated orders of individual investors. In contrast, institutional traders adapt their order submission behaviour differently: With a decreasing level of transparency, they split up seller-initiated orders further. Our results show a 2% increase for the policy change in 2006

and a 3% rise for the event in 2008. Accordingly, in 2009 we observe a fall of 7% for the number of trades within institutional seller-initiated orders. Institutional traders submit significantly more orders during the first event, same as when post-trade broker ID information disclosure was reintroduced. Institutional traders might need to change order direction more often to keep their informational advantage, when the market becomes more transparent. As a result, the number of daily order submissions increases. This must not necessarily result in an increased turnover, as the order volume itself decreases significantly. As the difference-in-difference analysis for the third event allows the most reliable interpretation, we conclude that for both, type of investors, transaction costs and liquidity improve with an improved information disclosure.

Our results show a consistently negative effect of declining broker ID disclosure on liquidity as well as transaction costs. We show that the intensity of the impact differs significantly between institutional and individual investors and depends on the order direction.

The overall positive effect of broker ID disclosure for all market participants stand in contrast to previous literature and common assumptions, where only household investors benefit from transparency. Institutional traders submit smaller orders, however submit more frequently when the market becomes more transparent. Since their informational advantage is significantly reduced, they cannot implement orders as cheaply into the market as in an opaque market. To ensure that a certain level of informational advantage can still be exploited, these might need to trade more aggressive. Transaction costs decrease significantly.

On the other hand, households do no longer rely solely on the order flow for information. The decreased informational asymmetry encourages individual traders to trade more frequently and contribute to the overall liquidity increase. The transaction costs decrease as the informational content or the order flow decreases overall.

This paper shows, that the decision to reverse the implementation of total opacity was correct and allows NASDAQ OMX Helsinki a superior position in a competitive market environment.

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Table 1 Switch from pre- to post-trade broker ID disclosure – Univariate Analysis

The table below presents the mean and median of the main parameters used in this study for the first analysed event on 13th March 2006. Before that date, NASDAQ OMX Helsinki disclosed broker information prior trade execution. The exchange implemented a new regulation, switching to post-trade disclosure. Our analysis excludes 5 trading days pre- and post the event date and covers a horizon prior and post of 125 trading days, which results in study horizon from 7th September 2005 till 18th September 2006. Our study for this event includes 126 securities.

We distinguish between measures for transaction costs, resilience and liquidity. These were computed on base of two data sets. First, the mean and median daily transaction costs, resilience and liquidity parameters prior and post the event, presented in Panel A, were derived by using TRTH data, which were processed by the MQD, which is developed and managed by the CMCRC. The relative effective spread is computed as the difference between the trade price and the prevailing mid-point price, divided by the mid-point price, times two. The relative realised spread is defined as the difference between the trade price and the mid-point price 10 minutes after the trade, divided by the initial mid-point price, multiplied by two. Accordingly, price impact is computed as the difference between effective and realised spread. These measures are expressed in bps. Implementation shortfall costs capture the execution as well as the opportunity costs. The intraday volatility is computed using 5 min intervals, measuring the intraday mid-point price return volatility. The (on-market) trade volume is defined as the sum of the volume traded within trading hours and on the main market.[31] Accordingly, the on-market trade count is computed. We define the variance ratio in accordance with the methodology of Lo and MacKinlay (1988), testing whether the security prices follow a random walk as a measure for informational efficiency. Panel B as well as C show the mean and median for market liquidity parameters computed with the Euroclear data set, which provides additional information as the actual account numbers of the trading participants. Trades are consolidated in a way to simulate the underlying order of an investor, e.g. sequences of trades in the same direction of the same investor are combined, if the time difference between trades is less than 5 days. Minor trades in the opposite direction than the previous and following trade of the same investor were deleted. Hence, we are able to analyse the impact specifically for orders, distinguishing between buyer- and seller-initiated orders. Further, Panel B presents the findings exclusively for individual investors, while Panel C shows the findings for institutional investors only. Following, we present the summary statistics for the number of trades within an order, as well as the order volume and value. We computed the execution time of an order before and after the new regulation came into force. In addition, the number of daily submitted orders is included. We compute various transaction cost measures on base of the underlying order. The relative effective spread is computed as the difference of the volume weighted order price and the first mid-point price of the order, scaled by the first mid-point price, times the order direction and 10,000, e.g. $\left(\frac{\text{VWAP}_{\text{it}}-\text{Mid-quote}_{\text{it,first}}}{\text{Mid-quote}_{\text{it,first}}}\right) * direction * 10{,}000$.

The relative realised spread is computed by the difference of the last mid-point price and the volume-weighted order price scaled by the volume weighted order price. Again, we multiply by order direction and convert the value in bps. Further, we compute the relative market impact as the difference between the last and first mid-point price scaled by the first mid-point price. The relative price impact is measured by the difference between the last and first order price, scaled by the first order price. Van Kervel and Menkfeld (2016) use this measure as a proxy for institutional implementation shortfall. Both of measures are multiplied by order direction and 10,000. Please refer to the methodology chapter for further information. In addition, we capture the number of daily issued orders pre- and post the event. Finally, we test the differences of the summary statistics prior and post the event for significance. The Wilcoxon-Ranksum test refers to the hypothesis that the two samples of each event derive from the same distribution. ***, **, * denotes statistical significance at 1 %, 5 % and 10 %.

[31] When performing the t-test on the logarithmized daily on-market trading volume, we find a decrease in the mean of 0.1% at a 10% significance level. The original coefficient shows no significant difference in the mean.

Table 1 continued Switch from pre- to post-trade broker ID disclosure – Univariate Analysis

	Prior-Event			Post-Event			Analyses of differences	
	Nobs	Mean	Median	Nobs	Mean	Median	T-Test	Wilcoxon-Ranksum Test
Panel A: Liquidity and efficiency determinants on a daily base derived from TRTH data								
Trade volume	9,776	378,249	17,38	9,437	400,927	400,927	22,678.06	2.949***
Trade count	9,776	188.1	23	9,437	228.8	228.8	40.728***	1.909*
On-market value	9,776	5,482,256	111,899	9,437	6,474,675	6,474,675	992,419.2*	3.278***
Quoted depth	9,776	73,657	22,540	9,437	64,593	64,593	-9,064.36***	8.616***
Rel. realised spread	9,776	49.20	27.52	9,437	58.53	58.53	9.336***	-4.995***
Rel. effective spread	9,776	67.67	45.10	9,437	83.60	83.60	15.928***	-12.540***
Rel. price impact	9,776	18.47	7.583	9,437	25.07	25.07	6.592***	-7.633***
Intraday volatility	9,776	0.002	0.00126	9,437	0.002	0.002	0***	-27.251***
Implementation shortfall	9,776	34.97	23.83	9,437	43.18	43.18	8.219***	-12.362***
Variance ratio (1-5 min)	9,722	1.173	0.2	9,393	1.189	58.53	0.017***	-6.866***
Panel B: Liquidity determinants per order derived from Euroclear data for individual investors only								
No of trades	420,566	1.524	1	367,386	1.637	1	0.113***	-36.268***
Order volume	420,566	1,788	400	367,386	1,814	400	25.244	-11.165***
Order value	420,566	19,749	4,215	367,386	22,925	4,788	3,176.323***	-50.263***
Execution time (hrs)	420,566	3.058	0	367,386	3.350	0	0.291***	-24.241***
Rel. eff. spread	420,566	30.33	8.678	367,386	32.26	9.606	1.928***	7.697***
Rel. real. spread	423,679	-12.60	-6.821	367,386	-10.96	-6.855	1.645***	-0.315
Rel. market impact	423,679	17.26	0	367,386	20.71	0	3.315***	4.627***
Rel. price impact	420,566	16.76	0	367,386	20.08	0	-1.445***	7.661***
Daily no of issues p sec	420,566	403.5	157	367,386	415.3	196	11.805***	-32.512***
Panel C: Liquidity determinants per order derived from Euroclear data for institutional investors only								
No of trades	432,707	4.522	9.939	602,846	4.358	8.897	-0.164***	2.520**
Order volume	432,707	11,170	66,677	602,846	8,816	47,690	-2,354.378***	37.154***
Order value	432,707	166,877	985,089	602,846	143,646	757,376	-23,231.41***	17.347***
Execution time (hrs)	432,707	1.899	12.07	602,846	1.386	10.53	-0.512***	31.442***
Rel. eff. spread	432,707	11.37	36.35	602,846	11.81	43.48	0.444***	27.740***
Rel. real. spread	432,707	-0.990	34.51	602,846	-1.489	37.99	-0.5***	-16.434***
Rel. market impact	432,707	10.39	54.68	602,846	10.29	54.62	-0.098	5.659***
Rel. price impact	432,707	10.20	52.90	602,846	9.974	52.63	-0.228**	9.418***
Daily no of issues p sec	432,707	689.9	941.9	602,846	743.4	923.7	53.516***	-71.504***

Table 2 Switch from post-trade broker ID disclosure to opacity – Univariate Analysis

Table 2 presents univariate analysis for the second event on 2nd June 2008. Until this date, the relevant broker information for any sides of a trade were disclosed post-trade to the public. NASDAQ OMX Helsinki decided to stop displaying any broker information, leading to total opacity.
Around the event, 5 trading days were excluded. The sample period before and after includes 125 trading days from 20th November 2007 and lasts till 2nd December 2008. We require securities to be traded at least 90% of the trading days prior and post the event. We remain with 102 securities.
We distinguish between measures for transaction costs, resilience and liquidity. These were computed on base of two data sets. First, the mean and median daily transaction costs, resilience and liquidity parameters prior and post the event, presented in Panel A, were derived by using TRTH data, which were processed by the MQD, which is developed and managed by the CMCRC. The relative effective spread is computed as the difference between the trade price and the prevailing mid-point price, divided by the mid-point price, times two. The relative realised spread is defined as the difference between the trade price and the mid-point price 10 minutes after the trade, divided by the initial mid-point price, multiplied by two. Accordingly, price impact is computed as the difference between effective and realised spread. These measures are expressed in bps. Implementation shortfall costs capture the execution as well as the opportunity costs. The intraday volatility is computed using 5 min intervals, measuring the intraday mid-point price return volatility. The (on-market) trade volume is defined as the sum of the volume traded within trading hours and on the main market. Accordingly, the on-market trade count is computed. We define the variance ratio in accordance with the methodology of Lo and MacKinlay (1988), testing whether the security prices follow a random walk as a measure for informational efficiency. Panel B as well as C show the mean and median for market liquidity parameters computed with the Euroclear data set, which provides additional information as the actual account numbers of the trading participants. Trades are consolidated in a way to simulate the underlying order of an investor, e.g. sequences of trades in the same direction of the same investor are combined, if the time difference between trades is less than 5 days. Minor trades in the opposite direction than the previous and following trade of the same investor were deleted. Hence, we are able to analyse the impact specifically for orders, distinguishing between buyer- and seller-initiated orders. Further, Panel B presents the findings exclusively for individual investors, while Panel C shows the findings for institutional investors only. Following, we present the summary statistics for the number of trades within an order, as well as the order volume and value. We computed the execution time of an order before and after the new regulation came into force. In addition, the number of daily submitted orders is included. We compute various transaction cost measures on base of the underlying order. The relative effective spread is computed as the difference of the volume weighted order price and the first mid-point price of the order, scaled by the first mid-point price, times the order direction and 10,000, e.g. $\left(\frac{\text{VWAP}_{\text{it}}-\text{Mid-quote}_{\text{it,first}}}{\text{Mid-quote}_{\text{it,first}}}\right) * direction * 10{,}000$.
The relative realised spread is computed by the difference of the last mid-point price and the volume-weighted order price scaled by the volume weighted order price. Again, we multiply by order direction and convert the value in bps. Further, we compute the relative market impact as the difference between the last and first mid-point price scaled by the first mid-point price. The relative price impact is measured by the difference between the last and first order price, scaled by the first order price. Van Kervel and Menkfeld (2016) use this measure as a proxy for institutional implementation shortfall. Both of measures are multiplied by order direction and 10,000. Please refer to the methodology chapter for further information. In addition, we capture the number of daily issued orders pre- and post the event. Finally, we test the differences of the summary statistics prior and post the event for significance. The Wilcoxon-Ranksum test refers to the hypothesis that the two samples of each event derive from the same distribution. ***, **, * denotes statistical significance at 1 %, 5 % and 10 %.

Table 2 continued Switch from post-trade broker ID disclosure to opacity – Univariate Analysis

	Prior-Event			Post-Event			Analyses of differences	
	Nobs	Mean	Median	Nobs	Mean	Median	T-Test	Wilcoxon-Ranksum Test
Panel A: Market liquidity and efficiency determinants on a daily base derived from TRTH data								
Trade volume	9,776	378,249	17,38	9,437	400,927	16,100	71,377.91**	2.491**
Trade count	9,776	188.1	23	9,437	228.8	22	32.406*	2.778***
On-market value	9,776	5,482,256	111,899	9,437	6,474,675	99,072	-2,292,313***	9.967***
Quoted depth	9,776	73,657	22,540	9,437	64,593	19,446	-18,791.37***	18.870***
Rel. realised spread	9,776	49.20	27.52	9,437	58.53	31.84	56.797***	-14.107***
Rel. effective spread	9,776	67.67	45.10	9,437	83.60	55.23	74.621 ***	-22.129***
Rel. price impact	9,776	18.47	7.583	9,437	25.07	9.608	17.825***	-7.382***
Intraday volatility	9,776	0.002	0.00126	9,437	0.002	0.00165	0.001***	-28.433***
Implementation shortfall	9,776	34.97	23.83	9,437	43.18	29.05	37.585***	-21.982***
Variance ratio (1-5 min)	9,722	1.173	1.102	9,393	1.189	1.119	0.011***	-2.071**
Panel B: Liquidity determinants derived from Euroclear data for individual investors only								
No of trades	386,045	2.424	1	364,998	2.334	1	-0.09***	23.506***
Order volume	386,045	2,134	450	364,998	2,197	400	-62.54	22.197***
Order value	386,045	36,242	6,276	364,998	25,602	4,080	-10,640.05***	95.977***
Execution time (hrs)	386,045	3.519	0	364,998	3.921	0	0.401***	10.835***
Rel. eff. spread	386,045	33.44	7.452	364,998	45.49	9.425	12.06**	-61.715***
Rel. real. spread	386,045	-4.863	-4.690	364,998	0.323	-5.886	5.19***	66.456***
Rel. market impact	386,045	27.95	0	364,998	45.09	0	17.142***	5.326***
Rel. price impact	386,045	27.38	0	364,998	44.59	0	17.209***	1.710*
Daily no of issues p sec	386,045	850.1	449	364,998	967.5	549	117.386***	-70.517***
Panel C: Liquidity determinants derived from Euroclear data for institutional investors only								
No of trades	961,153	4.468	2	819,932	4.640	2	0.172***	-18.577***
Order volume	961,153	4,495	1,261	819,932	4,972	1,549	476.066***	-58.717***
Order value	961,153	90,707	25,956	819,932	67,165	22,043	-23,542.03***	87.963***
Execution time (hrs)	961,153	0.729	0.000278	819,932	0.730	0.000278	0.001	0.626
Rel. eff. spread	961,153	10.61	4.027	819,932	14.90	5.068	4.291***	-129.847***
Rel. real. spread	961,153	-1.658	-2.575	819,932	-2.063	-3.626	-0.405***	123.364***
Rel. market impact	961,153	8.881	0	819,932	12.68	0	3.802***	-10.858***
Rel. price impact	961,153	8.485	0	819,932	11.87	0	3.385***	-10.487***
Daily no of issues p sec	961,153	1,163	611	819,932	1,130	671	-33.024***	-24.561***

Table 3 Switch from opacity to post-trade broker ID disclosure – Univariate Analysis

The following table shows the summary statistics of the main parameters used in this study for the third analysed event on 14th April 2009. For all securities but the Top5 traded stocks, the regulations introduced on 2nd June 2008 were reversed. Hence, the market remained opaque for the top traded securities, while post-trade broker ID disclosure was reintroduced for the remaining securities.
Our analysis excludes 5 trading days prior and post the event date and covers a horizon prior and post of 125 trading days, hence from 2nd October 2008 till 16th October 2009. Our data set includes 102 securities which are traded on at least 90% of the trading days before and after the event. The control group includes the following securities: Nokia, Fortum, Stora Enso, UPM and Sampo. Please note, that due to data availability, Sampo is not included in the analyses in Panels B and C e.g. the Euroclear data set.
We distinguish between measures for transaction costs, resilience and liquidity. These were computed on base of two data sets. First, the mean and median daily transaction costs, resilience and liquidity parameters prior and post the event, presented in Panel A, were derived by using TRTH data, which were processed by the MQD, which is developed and managed by the CMCRC. The relative effective spread is computed as the difference between the trade price and the prevailing mid-point price, divided by the mid-point price, times two. The relative realised spread is defined as the difference between the trade price and the mid-point price 10 minutes after the trade, divided by the initial mid-point price, multiplied by two. Accordingly, price impact is computed as the difference between effective and realised spread. These measures are expressed in bps. Implementation shortfall costs capture the execution as well as the opportunity costs. The intraday volatility is computed using 5 min intervals, measuring the intraday mid-point price return volatility. The (on-market) trade volume is defined as the sum of the volume traded within trading hours and on the main market. Accordingly, the on-market trade count is computed. We define the variance ratio in accordance with the methodology of Lo and MacKinlay (1988), testing whether the security prices follow a random walk as a measure for informational efficiency. Panel B as well as C show the mean and median for market liquidity parameters computed with the Euroclear data set, which provides additional information as the actual account numbers of the trading participants. Trades are consolidated in a way to simulate the underlying order of an investor, e.g. sequences of trades in the same direction of the same investor are combined, if the time difference between trades is less than 5 days. Minor trades in the opposite direction than the previous and following trade of the same investor were deleted. Hence, we are able to analyse the impact specifically for orders, distinguishing between buyer- and seller-initiated orders. Further, Panel B presents the findings exclusively for individual investors, while Panel C shows the findings for institutional investors only. Following, we present the summary statistics for the number of trades within an order, as well as the order volume and value. We computed the execution time of an order before and after the new regulation came into force. In addition, the number of daily submitted orders is included. We compute various transaction cost measures on base of the underlying order. The relative effective spread is computed as the difference of the volume weighted order price and the first mid-point price of the order, scaled by the first mid-point price, times the order direction and 10,000, e.g. $\left(\frac{\mathrm{VWAP_{it}-Mid-quote_{it,first}}}{\mathrm{Mid-quote_{it,first}}}\right) * direction * 10{,}000$.
The relative realised spread is computed by the difference of the last mid-point price and the volume-weighted order price scaled by the volume weighted order price. Again, we multiply by order direction and convert the value in bps. Further, we compute the relative market impact as the difference between the last and first mid-point price scaled by the first mid-point price. The relative price impact is measured by the difference between the last and first order price, scaled by the first order price. Van Kervel and Menkfeld (2016) use this measure as a proxy for institutional implementation shortfall. Both of measures are multiplied by order direction and 10,000. Please refer to the methodology chapter for further information. In addition, we capture the number of daily issued orders pre- and post the event. Finally, we test the differences of the summary statistics prior and post the event for significance. The Wilcoxon-Ranksum test refers to the hypothesis that the two samples of each event derive from the same distribution. ***, **, * denotes statistical significance at 1 %, 5 % and 10 %.
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Table 3 continued Switch from opacity to post-trade broker ID disclosure – Univariate Analysis

		Prior-Event			Post-Event			Analyses of differences	
	Group	Nobs	Mean	Median	Nobs	Mean	Median	T-Test	Wilcoxon-Ranksum Test
Panel A: Liquidity and efficiency determinants on a daily base derived from TRTH data									
On-market trade volume	Control	432	9,575,000	3,517,000	432	7,268,000	2,752,000	-2,306,709***	4.830***
	Treatment	11,304	234,587	14,467	11,377	182,187	16,450	-52,406.6***	-1.154
On-market trade count	Control	432	5,517	3,578	432	4,182	2,654	-1,334.912***	6.779***
	Treatment	11,304	353.8	23	11,377	308.1	26	-45.702***	-3.332***
On-market value	Control	432	97,260,000	34,640,000	432	71,760,000	26,760,000	41,820.02 ***	18.870***
	Treatment	11,304	1,921,000	42,745	11,377	1,732,000	52,556	-189,736.8***	-5.678***
Quoted depth	Control	432	129,833	78,507	432	171,653	108,263	74.621 ***	-22.129***
	Treatment	11,304	23,194	10,354	11,377	27,613	12,117	4,417.101***	-6.620***
Rel. realised spread	Control	432	4.061	3.316	432	3.330	2.917	-0.731**	1.045
	Treatment	11,304	191.0	71.13	11,377	126.3	51.14	-64.692 ***	11.673***
Rel. effective spread	Control	432	14.15	12.36	432	11.37	8.447	-2.838***	10.607**
	Treatment	11,304	238.0	121.2	11,377	153.2	80.11	-94.659***	23.502**
Rel. price impact	Control	432	10.09	9.563	432	8.036	6.760	-2.107***	5.251***
	Treatment	11,304	47.01	16.07	11,377	26.85	10.85	-29.967***	9.967***
Intraday volatility	Control	432	0.00357	0.00324	432	0.00208	0.00189	-0.001***	18.896***
	Treatment	11,304	0.00398	0.00314	11,377	0.00255	0.00203	-0.001***	45.389***
Implementation shortfall	Control	432	8.343	7.301	432	6.883	5.325	-1.461***	10.403***
	Treatment	11,304	130.7	66.14	11,377	83.52	44.00	-47.231***	23.627***
Variance ratio (1-5 min)	Control	432	1.320	1.290	432	1.285	1.253	-0.035***	2.392**
	Treatment	11,003	1.213	1.133	11,074	1.203	1.130	-0.01***	2.381**
Panel B: Liquidity determinants derived from Euroclear data for individual investors only									
No of trades/order	Control	145,383	2.592	1	136,270	2.283	1	-0.309***	25.335***
	Treatment	246,763	1.918	1	298,539	1.912	1	-0.006	1.185
Order volume	Control	145,383	3,279	800	136,270	2,726	600	-552.309***	20.494***
	Treatment	246,763	1,420	310	298,539	1,262	350	-158.21*	-11.450***
Order value	Control	145,383	32,148	7,029	136,270	25,609	5,920	-6,539.153***	14.656***
	Treatment	246,763	8,108	2,320	298,539	8,812	2,846	704.060***	-45.047***
Order execution time in hrs	Control	145,383	3.830	0	136,270	3.798	0	-0.032***	24.128***
	Treatment	246,763	3.758	0	298,539	3.160	0	-0.598***	19.128***
Rel. effective spread/order	Control	145,383	30.23	6.254	136,270	24.10	5.450	6.131***	23.875***
	Treatment	246,763	0.00505	0.00126	298,539	0.00368	0.00102	-2.007***	44.405***
Rel. realised Spread/order	Control	145,383	14.29	-4.883	136,270	7.599	-4.869	6.688***	-26.083***
	Treatment	246,763	-0.00109	-0.000943	298,539	-0.00133	-0.000792	10.39***	-55.035***
Rel. market impact/order	Control	145,383	43.26	0	136,270	30.25	0	-13.01***	-0.650
	Treatment	246,763	0.00395	0	298,539	0.00236	0	-4.58***	-9.033***
Rel. price impact/order	Control	145,383	43.26	0	136,270	30.25	0	-12.91***	-0.091
	Treatment	246,763	0.00391	0	298,539	0.00234	0	-4.2***	-6.229***
Daily no of issues p sec	Control	145,383	1,773	1,617	136,270	1,537	964	-235.823***	124.795***
	Treatment	246,763	367.4	303	298,539	264.2	225	-41.48***	95.375***
Panel C: Liquidity determinants derived from Euroclear data for institutional investors only									
No of trades/order	Control	315,129	4.911	7.778	227,918	5.388	3	0.477***	-9.404***
	Treatment	300,144	4.758	2	292,820	4.927	3	0.17***	-7.958***
Order volume	Control	315,129	8,007	18,882	227,918	9,251	3,400	1,242.96***	-8.185***
	Treatment	300,144	2,649	1,000	292,820	2,639	819	-10.2	51.628***
Order value	Control	315,129	74,955	157,593	227,918	87,342	32,814	12,387.23**	-8.364***
	Treatment	300,144	23,321	9,972	292,820	25,769	10,136	2,447.8***	-6.012***
Order execution time in hrs	Control	315,129	0.270	3.055	227,918	0.396	0.000278	0.126***	-9.762***
	Treatment	300,144	1.408	0.000278	292,820	1.636	0.000556	0.228***	-14.312*
Rel. effective spread/order	Control	315,129	10.71	83.81	227,918	10.32	5.084	-0.38**	-11.533***
	Treatment	300,144	21.58	8.244	292,820	16.27	6.028	-5.31***	74.624***
Rel. realised Spread/order	Control	315,129	-1.693	52.92	227,918	-2.211	-4.643	-0.7***	-25.823***
	Treatment	300,144	21.58	8.244	292,820	16.27	6.028	3.829***	-94.852***
Rel. market impact/order	Control	315,129	8.856	80.45	227,918	7.721	0	-1.135***	-10.207***
	Treatment	300,144	19.95	0	292,820	15.37	0	0.878**	-14.612***
Rel. price impact/order	Control	315,129	8.466	41.31	227,918	6.962	0	-1.5***	-6.915***
	Treatment	300,144	19.19	0	292,820	14.99	0	0.821***	-15.801***
Daily no of issues p sec	Control	315,129	1,627	1,231	227,918	1,450	965	-176.948***	140.775***
	Treatment	300,144	392.8	335	292,820	310.6	277	-82.228***	113.267***

Table 4 Switch from pre- to post-trade broker ID disclosure – Impact on Market Liquidity

The table below presents the regression coefficient estimates for the first analysed event on 13th March 2006. Prior this date Nasdaq OMX Helsinki disclosed broker ID information prior trade execution. The newly implemented policy allowed information disclosure only post-trade. Our analysis excludes 5 trading days pre- and post the event date and covers a horizon prior and post of 125 trading days, which results in study horizon from 7th September 2005 till 18th September 2006. Our study for this event includes 126 securities. We distinguish between measures for transaction costs, resilience and liquidity. These were derived by using TRTH data, which was processed by the MQD, which is developed and managed by the CMCRC. The relative effective spread is computed as the difference between the trade price and the prevailing mid-point price, divided by the mid-point price, times two. The relative realised spread is defined as the difference between the trade price and the mid-point price 10 minutes after the trade, divided by the initial mid-point price, multiplied by two. Accordingly, price impact is computed as the difference between effective and realised spread. These measures are expressed in bps. Implementation shortfall costs capture the execution as well as the opportunity costs. The intraday volatility is computed using 5 min intervals, measuring the intraday mid-point price return volatility. The (on-market) trade volume is defined as the sum of the volume traded within trading hours and on the main market. Accordingly, the on-market trade count is computed. We define the variance ratio in accordance with the methodology of Lo and MacKinlay (1988), testing whether the security prices follow a random walk as a measure for informational efficiency. We use a 1 to 5 minute/s return ratio. We run the following fixed effect regression model for the analysis of the impact of the event on the market quality determinant effective spread

$$2(trade\ price - midquote)/midquote)_{id} * 10{,}000 = \beta_1 Event_d + \beta_2 Trend_{id} + \sum_{k=1}^{K=5} \theta_k Weekday_k + \sum_{i=2}^{I=n} \gamma_i D_i + \varepsilon_i$$

where the relative effective spread is computed per security i and day d, $Event_d$ equals 0 prior the event and 1 post the event and $Trend_d$ refers to time trend as 1, 2, 3, …, 250. We cluster the standard errors by security and included stock as well as weekday fixed effects. The t-statistics are presented in parentheses. ***, **, * denotes statistical significance at 1 %, 5 % and 10 %.

	Relative Effective Spread	Relative Realised Spread	Price impact	Implementation shortfall	Intraday volatility	Log On-market Volume	Log On-market Trade Count	Log Ask Depth	Log Bid Depth	Variance Ratio 1-5 min
Event	12.372***	2.139	10.169***	6.265***	0.001***	-0.121***	-0.304***	-0.093***	-0.112***	0.009
	(6.201)	(1.019)	(5.480)	(6.414)	(12.282)	(-5.974)	(-6.017)	(-2.831)	(-3.735)	(1.236)
Trend	0.042**	0.078***	-0.035**	0.022**	-0.000**	0.001***	0.003***	-0.000	-0.000*	0.000
	(2.033)	(3.900)	(-2.377)	(2.112)	(-2.445)	(4.947)	(5.048)	(-1.329)	(-1.824)	(0.831)
Observations	19,213	19,213	19,213	19,213	19,213	19,213	19,213	19,213	19,213	19,115
Adj. R^2	0.506	0.334	0.093	0.533	0.146	0.024	0.032	0.756	0.784	0.080
Clustered SE	Stock	Stock	Stock	Stock	Stock	Stock	Stock	Stock	Stock	Stock
Stock FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Weekday FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-Test	43.56	19.63	22.94	47.57	99.87	25.83	28.82	14.64	16.87	8.214

Table 5 Switch from pre- to post-trade broker ID disclosure – Impact on Liquidity measures households and institutional investors

Prior this date Nasdaq OMX Helsinki disclosed broker ID information prior trade execution. The newly implemented policy allowed information disclosure only post-trade. Our analysis excludes 5 trading days pre- and post the event date and covers a horizon prior and post of 125 trading days, which results in study horizon from 7th September 2005 till 18th September 2006. Our study for this event includes 126 securities. Trades are consolidated in a way to simulate the underlying order of an investor, e.g. sequences of trades in the same direction of the same investor are combined, if the time difference between trades is less than 5 days. Minor trades in the opposite direction than the previous and following trade of the same investor were deleted. We are able to analyse the impact not only on overall market quality, but specifically on issued orders. We run basic fixed effect regression with various determinants as the number of trades within an order, the order volume as well as the order value as dependent variable. Further we analyse the order execution time and the number of daily submitted orders per security. We run basic fixed effect models as the following one

$$Q_{itd} = \beta_1 Event_d + \beta_2 Treatment_{it} + \beta_3 DID_{itd} + \sum_{k=1}^{K=5} \theta_k \, weekday_k + \sum_{i=2}^{I=n} \eta_{itd} \, Investor_{itd} + \sum_{i=2}^{I=n} \gamma_i D_i + \varepsilon_{itd}$$

where the Q_{itd} is computed per order t and security i on day d, $Event_d$ equals 0 prior the event and 1 post the event and $Treatment_i$ refers to a dummy variable, equal to 0 for the Top5 traded securities acting as a control group, and 1 for the remaining securities, which were affected by the policy change. DID_{itd} is the product of $Event_d$ and $Treatment_{it}$. It measures the difference in the impact of the new regulations between the control and treatment group. The standard errors are clustered by security. Further, we control for the security, the week day of the first trade's execution as well as the investor in Panel A. In Panels B and C, the latter is not applicable. Panel A presents the regression coefficients when the type of investor is disregarded and only distinguishes between seller- and buyer-initiated orders. Panel B shows the findings for individual investors only, again presenting the overall effect as well as the impact on buyer- and seller- initiated orders. Accordingly, Panel C presents the results for institutional investors. The t-statistics are presented in parentheses. ***, **, * denotes statistical significance at 1 %, 5 % and 10 %.

Table 5 continued Switch from pre- to post-trade broker ID disclosure – Impact on Liquidity measures households and institutional investors

	Log Order volume	Log Order volume	Log Order volume	Log No of trades per order	Log No of trades per order	Log No of trades per order	Log Daily No of issued orders	Log Daily No of issued orders	Log Daily No of issued orders	Order execution time (hrs)	Order execution time (hrs)	Order execution time (hrs)
Order type	Any	Buy	Sell	Any	Buy	Sell	Any	Buy	Sell	Any	Buy	Sell
Panel A: Impact on Liquidity measures												
Event	-0.002	-0.040	0.033	0.000	-0.027**	0.026***	128.422*	57.562	69.713*	-0.114**	-0.615***	0.375**
	(-0.074)	(-1.248)	(1.042)	(0.146)	(-2.556)	(2.859)	(1.795)	(1.557)	(1.927)	(-2.567)	(-5.066)	(2.207)
Trend	-0.000	-0.000	-0.000	0.000**	0.000	0.000	-0.000*	-0.000	-0.000**	0.000	0.000*	-0.000
	(-0.691)	(-0.638)	(-0.536)	(2.500)	(1.295)	(0.502)	(-1.741)	(-1.048)	(-2.100)	(0.066)	(1.709)	(-0.939)
Observations	1,870,155	931,794	938,357	1,870,155	931,794	938,357	1,870,155	931,794	938,357	1,870,155	931,794	938,357
Adj. R^2	0.350	0.367	0.339	0.186	0.180	0.195	0.646	0.540	0.667	0.012	0.012	0.016
F-Test	0.549	5.102	0.563	7.332	7.213	16.57	2.026	1.370	2.262	6.400	23.44	6.257
Panel B: Impact on Liquidity measures for orders of individual investors only												
Event	-0.019	-0.031	-0.005	0.008	-0.006	0.021	80.246	21.325	56.419	-0.120	-0.877***	0.567
	(-0.580)	(-0.772)	(-0.159)	(1.576)	(-0.538)	(1.628)	(1.380)	(0.678)	(1.477)	(-1.177)	(-3.857)	(1.621)
Trend	0.000***	0.000	0.000**	0.000***	0.000**	0.000	-0.000	-0.000	-0.000	0.000***	0.000**	0.000
	(2.647)	(1.369)	(2.387)	(4.744)	(2.176)	(1.423)	(-1.153)	(-0.748)	(-1.472)	(3.407)	(2.328)	(0.224)
Observations	800,818	388,607	412,209	800,818	388,607	412,209	800,818	388,607	412,209	800,818	388,607	412,209
Adj. R^2	0.165	0.190	0.158	0.009	0.014	0.014	0.616	0.468	0.665	0.003	0.005	0.007
F-Test	6.901	1.135	5.314	42.34	5.677	20.06	1.077	0.304	1.103	11.07	8.795	12.40
Panel C: Impact on Liquidity measures for orders of institutional investors only												
Event	-0.001	-0.050	0.049	-0.010	-0.047**	0.028***	170.352**	86.985*	82.620**	-0.205***	-0.505***	0.113*
	(-0.034)	(-1.338)	(1.566)	(-1.468)	(-2.604)	(3.060)	(2.181)	(1.968)	(2.481)	(-3.043)	(-3.702)	(1.965)
Trend	-0.000***	-0.000***	-0.000***	-0.000	0.000	-0.000	-0.000**	-0.000*	-0.000***	-0.000***	-0.000	-0.000***
	(-3.549)	(-2.681)	(-3.067)	(-0.048)	(0.570)	(-0.631)	(-2.577)	(-1.975)	(-2.986)	(-3.303)	(-1.200)	(-3.642)
Observations	1,040,844	531,957	508,884	1,040,844	531,957	508,884	1,040,844	531,957	508,884	1,040,844	531,957	508,884
Adj. R^2	0.228	0.242	0.215	0.002	0.002	0.003	0.652	0.579	0.649	0.073	0.072	0.076
F-Test	9.187	16.32	4.706	1.503	9.359	6.118	3.360	2.540	4.827	6.751	7.066	6.722

Table 6 Switch from pre- to post-trade broker ID disclosure – Impact on transaction costs for individual and institutional investors

Following Table presents the coefficient estimates of the fixed effect regression concerning the transaction costs on base of the underlying order for the first event on 13th March 2006, when NASDAQ OMXH changed the regulations from full pre-trade transparency to post-trade broker information disclosure. To analyse the impact of the event specifically for individual and institutional investors, we compute the underlying order of each investor using the Euroclear data set, which is providing account information. Around the event, 5 trading days were excluded, the sample period before and after are 125 trading days from 7th September 2005 till 18th September 2006. After removing securities not traded at least 90% of the trading days in both event horizons, we remain with 126 securities for our analysis. Trades are consolidated in a way to simulate the underlying order of an investor, e.g. sequences of trades in the same direction of the same investor are combined, if the time difference between trades is less than 5 days. Minor trades in the opposite direction than the previous and following trade of the same investor were deleted.
As one measure for transaction costs we use the relative effective spread computed on base of the underlying order as the difference of the volume weighted order price and the first mid-point price of the order scaled by the first mid-point price, times the order direction and 10,000. We run the following model in Panel A:

$$\left(\frac{\mathrm{VWAP_{itd}} - \mathrm{Mid} - \mathrm{quote_{itd,first}}}{\mathrm{Mid} - \mathrm{quote_{itd,first}}}\right)_{it} * direction * 10{,}000 = \beta_1 Event_d + \beta_2 Trend_{itd} + \sum_{k=1}^{K=5} \theta_k \, weekday_k + \sum_{i=2}^{I=n} \eta_{itd} \, Investor_{itd} + \sum_{i=2}^{I=n} \gamma_i D_i + \varepsilon_{itd}$$

where the relative effective spread of the order t of security i acts as the dependent variable. $\mathrm{Event_d}$ equals 0 prior the event and 1 post the event and $\mathrm{Trend_d}$ refers to a trend as 1,2,3…D to adjust for trend related changes in the dependent variable. We cluster the standard errors by security and control for the security, the week day of the first trade's execution as well as the investor in Panel A. In Panels B and C, the latter is not applicable. Accordingly, the other models for any market quality determinant Q_{itd} are designed. The relative realised spread is computed by the difference of the last mid-point price and the volume weighted order price scaled by the volume weighted order price. Again, we multiply by order direction and convert the value in bps. We further compute the relative market impact as the difference between the last and first mid-point price scaled by the first mid-point price. The relative Price impact is measured by the difference between the last and first order price, scaled by the first order price. Van Kervel and Menkfeld (2016) use this measure as a proxy for institutional implementation shortfall. Both of these measures are multiplied by order direction and 10,000.
Panel A presents the regression coefficients when disregarding the type of investor and only distinguishing between seller- and buyer-initiated orders. Panel B shows the findings for individual investors only, again presenting the overall effect as well as the impact on buyer- and seller- initiated orders. Accordingly, Panel C presents the results for institutional investors. The t-statistics are presented in parentheses. ***, **, * denotes statistical significance at 1 %, 5 % and 10 %.

Table 6 continued Switch from pre- to post-trade broker ID disclosure – Impact on transaction costs for households and institutional investors

	Relative Effective Spread	Relative Effective Spread	Relative Effective Spread	Relative Realised Spread	Relative Realised Spread	Relative Realised Spread	Relative Market Impact	Relative Market Impact	Relative Market Impact	Relative Price impact	Relative Price impact	Relative Price impact
Order type	Any	Buy	Sell	Any	Buy	Sell	Any	Buy	Sell	Any	Buy	Sell
Panel A: Impact on transaction costs												
Event	2.378***	0.482	4.369***	0.299	-1.286**	1.969***	2.511***	-0.868	5.957***	2.453***	-0.867	5.849***
	(4.831)	(0.965)	(3.788)	(1.077)	(-2.107)	(2.660)	(4.994)	(-0.916)	(3.559)	(4.988)	(-0.907)	(3.531)
Trend	-0.000	0.000	-0.000	-0.000**	-0.000	-0.000*	-0.000*	0.000	-0.000	-0.000*	0.000	-0.000
	(-0.285)	(1.029)	(-0.806)	(-2.455)	(-0.249)	(-1.800)	(-1.754)	(0.436)	(-1.369)	(-1.810)	(0.398)	(-1.396)
Observations	1,870,155	931,794	938,357	1,870,155	931,794	938,357	1,870,155	931,794	938,357	1,870,155	931,794	938,357
Adj. R^2	0.316	0.302	0.336	0.232	0.213	0.251	0.011	0.010	0.017	0.011	0.010	0.016
F-Test	13.15	3.522	13.57	3.405	4.236	4.020	15.21	0.637	16.46	14.86	0.667	16.12
Panel B: Impact on transaction costs for orders of individual investors only												
Event	3.933***	0.514	6.089***	0.294	-2.438**	2.222	3.863***	-2.155	7.369***	3.822***	-2.035	7.203***
	(6.680)	(0.522)	(3.545)	(0.455)	(-2.511)	(1.551)	(4.283)	(-1.223)	(2.681)	(4.244)	(-1.146)	(2.622)
Trend	0.000	0.000**	0.000	-0.000*	0.000	-0.000	0.000	0.000	-0.000	0.000	0.000	-0.000
	(1.192)	(2.073)	(0.145)	(-1.795)	(0.279)	(-1.044)	(0.044)	(1.289)	(-0.359)	(0.024)	(1.262)	(-0.369)
Observations	800,818	388,607	412,209	800,818	388,607	412,209	800,818	388,607	412,209	800,818	388,607	412,209
Adj. R^2	0.320	0.329	0.346	0.264	0.278	0.300	0.010	0.009	0.019	0.010	0.009	0.020
F-Test	39.07	8.300	32.54	1.622	9.553	1.382	14.59	0.837	19.91	14.21	0.797	18.92
Panel C: Impact on transaction costs for orders of institutional investors only												
Event	1.381***	0.195	2.660***	0.553***	-0.518	1.764***	2.028***	-0.274	4.509***	1.948***	-0.361	4.448***
	(3.199)	(0.804)	(3.388)	(4.001)	(-1.643)	(4.584)	(4.118)	(-0.698)	(3.918)	(4.152)	(-0.885)	(3.931)
Trend	-0.000**	-0.000	-0.000***	-0.000***	-0.000*	-0.000***	-0.000***	-0.000*	-0.000***	-0.000***	-0.000*	-0.000***
	(-2.593)	(-1.498)	(-2.685)	(-3.109)	(-1.847)	(-3.194)	(-2.964)	(-1.764)	(-3.047)	(-3.001)	(-1.780)	(-3.082)
Observations	1,040,844	531,957	508,884	1,040,844	531,957	508,884	1,040,844	531,957	508,884	1,040,844	531,957	508,884
Adj. R^2	0.172	0.162	0.188	0.034	0.026	0.046	0.044	0.047	0.044	0.042	0.047	0.040
F-Test	2.171	2.586	4.096	10.56	2.735	12.71	8.977	2.421	9.220	8.988	2.562	9.183

Table 7 Switch from post-trade broker ID disclosure to opacity – Impact on Market Liquidity

Table 7 presents the univariate analysis for the second event on 2nd June 2008. Until this date, the relevant broker information for any sides of a trade were disclosed post-trade to the public. NASDAQ OMX Helsinki decided to stop displaying any broker information, leading to total opacity. Around the event, 5 trading days were excluded. The sample period before and after includes 125 trading days from 20th November 2007 and lasts till 2nd December 2008. We require securities to be traded at least 90% of the trading days prior and post the event. We remain with 102 securities.

We distinguish between measures of transaction costs, resilience as well as liquidity using TRTH data, which was processed by the MQD, which is developed and managed by the CMCRC. The relative effective spread is computed as the difference between the trade price and the prevailing mid-point price, divided by the mid-point price, times two. The relative realised spread is defined as the difference between the trade price and the mid-point price 10 minutes after the trade, divided by the initial mid-point price, multiplied by two. Accordingly, price impact is computed as the difference between effective and realised spread. These measures are expressed in bps. Implementation shortfall costs capture the execution as well as the opportunity costs. The intraday volatility is computed using 5 min intervals, measuring the intraday mid-point price return volatility. The (on-market) trade volume is defined as the sum of the volume traded within trading hours and on the main market. Accordingly, the on-market trade count is computed. We define the variance ratio in accordance with the methodology of Lo and MacKinlay (1988), testing whether the security prices follow a random walk as a measure for informational efficiency. We use a 1 to 5 minute/s return ratio. We run the following fixed effect regression model for the analysis of the impact on the market quality determinant Q_{itd}

$$Q_{itd} = \beta_1 Event_d + \beta_2 Trend_{id} + \sum_{k=1}^{K=5} \theta_k Weekday_k + \sum_{i=2}^{I=n} \gamma_i D_i + \varepsilon_i$$

where Q_{itd} is computed per security i and day d, $Event_d$ equals 0 prior the event and 1 post the event and $Trend_d$ refers to time trend as 1, 2, 3, …, 250. We cluster the standard errors by security and included stock as well as weekday fixed effects. The t-statistics are presented in parentheses. ***, **, * denotes statistical significance at 1 %, 5 % and 10 %.

	Relative Effective Spread	Relative Realised Spread	Price impact	Implementation shortfall	Intraday volatility	Log On-market Volume	Log On-market Trade Count	Log Ask Depth	Log Bid Depth	Variance Ratio 1-5 min
Event	29.671***	29.226***	1.349	15.984***	0.000**	-0.081***	-0.185***	-0.148***	-0.099**	-0.007
	(3.076)	(2.911)	(0.489)	(3.162)	(2.198)	(-3.861)	(-5.021)	(-3.845)	(-2.513)	(-0.930)
Trend	0.270***	0.174**	0.088***	0.125***	0.000***	0.001***	0.002***	-0.001***	-0.002***	0.000**
	(3.734)	(2.332)	(3.901)	(3.385)	(7.765)	(3.697)	(4.937)	(-3.066)	(-5.813)	(2.432)
Observations	22,697	22,697	22,697	22,697	22,697	22,697	22,697	22,697	22,697	22,218
Adj. R^2	0.673	0.596	0.063	0.703	0.151	0.113	0.147	0.683	0.717	0.067
Clustered SE	Stock	Stock	Stock	Stock	Stock	Stock	Stock	Stock	Stock	Stock
Stock FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Weekday FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-Test	40.44	28.34	20.98	39.72	105.7	7.453	12.73	76.99	82.03	6.972

Table 8 Switch from post-trade broker ID disclosure to opacity – Impact on Liquidity measures individual and institutional investors

Following Table presents the coefficient estimates of the fixed effect regression concerning the market liquidty measures on base of the underlying order for the second event on 2nd June 2008. Until this date, the relevant broker information for any sides of a trade were disclosed post-trade to the public. NASDAQ OMX Helsinki decided to stop displaying any broker information, leading to total opacity. Around the event, 5 trading days were excluded. The sample period before and after includes 125 trading days from 20th November 2007 and lasts till 2nd December 2008. We require securities to be traded at least 90% of the trading days prior and post the event. We remain with 102 securities. To analyse the impact of the event specifically for institutional and individual investors, we compute the underlying order of each investor using the Euroclear data set, which is providing account information. Trades are consolidated in a way to simulate the underlying order of an investor, e.g. sequences of trades in the same direction of the same investor are combined, if the time difference between trades is less than 5 days. Minor trades in the opposite direction than the previous and following trade of the same investor were deleted. We are able to analyse the impact not only on overall market quality, but specifically on issued orders. We run basic fixed effect regression with various determinants as the number of trades within an order, the order volume as well as the order value as dependent variable. Further we analyse the order execution time and the number of daily submitted orders per security. We run fixed effect models as the following one

$$Q_{itd} = \beta_1 Event_d + \beta_2 Treatment_{it} + \beta_3 DID_{itd} + \sum_{k=1}^{K=5} \theta_k \, weekday_k + \sum_{i=2}^{I=n} \eta_{itd} \, Investor_{itd} + \sum_{i=2}^{I=n} \gamma_i D_i + \varepsilon_{itd}$$

where Q_{itd}, as for instance the logarithmized order volume, is computed per order t and security i on day d and acts as the dependent variable. $Event_d$ equals 0 prior the event and 1 post the event and $Treatment_i$ refers to a dummy variable, equal to 0 for the Top5 traded securities acting as a control group, and 1 for the remaining securities, which were affected by the policy change. DID_{itd} is the product of $Event_d$ and $Treatment_{it}$. It measures the difference in the impact of the new regulations between the control and treatment group. The standard errors are clustered by security. Further, we control for the security, the week day of the first trade's execution as well as the investor in Panel A. In Panels B and C, the latter is not applicable. Panel A presents the regression coefficients when the type of investor is disregarded and only distinguishes between seller- and buyer-initiated orders. Panel B shows the findings for individual only, again presenting the overall effect as well as the impact on buyer- and seller- initiated orders. Accordingly, Panel C presents the results for institutional investors. The t-statistics are presented in parentheses. ***, **, * denotes statistical significance at 1 %, 5 % and 10 %.

Table 8 continued Switch from post-trade broker ID disclosure to opacity – Impact on Liquidity measures households and institutional investors

	Log Order volume	Log Order volume	Log Order volume	Log No of trades per order	Log No of trades per order	Log No of trades per order	Log Daily No of issued orders	Log Daily No of issued orders	Log Daily No of issued orders	Order execution time (hrs)	Order execution time (hrs)	Order execution time (hrs)
Order type	Any	Buy	Sell	Any	Buy	Sell	Any	Buy	Sell	Any	Buy	Sell
Panel A: Impact on Liquidity measures												
Event	-0.015	-0.026	-0.010	0.022***	0.008	0.033***	-137.487	-91.088	-54.196	0.001	-0.135**	0.149
	(-0.678)	(-0.881)	(-0.302)	(4.076)	(0.515)	(3.430)	(-1.389)	(-1.580)	(-1.196)	(0.054)	(-2.266)	(1.137)
Trend	0.000***	0.000	0.000***	-0.000*	-0.000***	0.000	0.000	0.000**	0.000	0.000***	-0.000	0.000***
	(4.270)	(0.844)	(5.416)	(-1.961)	(-4.370)	(1.087)	(1.613)	(2.068)	(0.747)	(2.870)	(-0.427)	(4.113)
Observations	2,555,998	1,350,710	1,205,288	2,555,998	1,350,710	1,205,288	2,555,998	1,350,710	1,205,288	2,555,998	1,350,710	1,205,288
Adj. R^2	0.256	0.273	0.240	0.092	0.097	0.088	0.741	0.704	0.760	0.031	0.022	0.044
F-Test	10.00	0.435	27.37	11.70	9.592	56.12	2.080	5.701	3.276	8.384	5.240	14.96
Panel B: Impact on Market liquidity measures for orders of individual investors only												
Event	-0.070**	-0.082*	-0.063*	0.012	-0.003	0.026	-144.942	-87.348*	-44.697	0.053	-0.377**	0.686
	(-2.211)	(-1.692)	(-1.684)	(0.834)	(-0.134)	(0.835)	(-1.505)	(-1.854)	(-1.311)	(0.513)	(-2.271)	(1.473)
Trend	-0.000	-0.000**	0.000***	-0.000***	-0.000***	0.000	0.000	0.000**	0.000	0.000	-0.000	0.000***
	(-1.003)	(-2.380)	(3.055)	(-3.375)	(-5.303)	(0.047)	(1.653)	(2.304)	(0.582)	(1.500)	(-1.145)	(2.742)
Observations	751,043	421,030	330,013	751,043	421,030	330,013	751,043	421,030	330,013	751,043	421,030	330,013
Adj. R^2	0.135	0.141	0.138	0.036	0.048	0.033	0.731	0.718	0.778	0.002	0.004	0.008
F-Test	13.08	36.87	7.132	12.41	32.72	5.927	1.619	3.603	6.754	6.469	12.40	25.34
Panel C: Impact on Market liquidity measures for orders of institutional investors only												
Event	-0.005	-0.017	0.006	0.025***	0.013	0.037***	-142.697	-89.852	-58.387	0.020	-0.037	0.094**
	(-0.194)	(-0.577)	(0.170)	(3.844)	(0.865)	(4.931)	(-1.332)	(-1.445)	(-1.188)	(0.958)	(-1.403)	(2.082)
Trend	0.000***	0.000***	0.000***	0.000	-0.000*	0.000*	0.000	0.000*	0.000	0.000	0.000	0.000
	(4.385)	(3.249)	(4.887)	(0.054)	(-1.900)	(1.817)	(1.523)	(1.880)	(0.752)	(1.112)	(0.982)	(0.747)
Observations	1,781,084	918,541	862,537	1,781,084	918,541	862,537	1,781,084	918,541	862,537	1,781,084	918,541	862,537
Adj. R^2	0.215	0.223	0.209	0.001	0.002	0.002	0.732	0.698	0.752	0.073	0.061	0.088
F-Test	12.75	6.549	21.06	9.192	2.156	37.58	1.758	5.248	3.178	2.022	0.997	3.635

Table 9 Switch from post-trade broker ID disclosure to opacity – Impact on transaction costs for individual and institutional investors

Following Table presents the coefficient estimates of the fixed effect regression concerning the transaction costs on base of the underlying order for the second event on 2nd June 2008. Until this date, the relevant broker information for any sides of a trade were disclosed post-trade to the public. NASDAQ OMX Helsinki decided to stop displaying any broker information, leading to total opacity. Around the event, 5 trading days were excluded. The sample period before and after includes 125 trading days from 20th November 2007 and lasts till 2nd December 2008. We require securities to be traded at least 90% of the trading days prior and post the event. We remain with 102 securities. To analyse the impact of the event specifically for institutional and individual investors, we compute the underlying order of each investor using the Euroclear data set, which is providing account information. Trades are consolidated in a way to simulate the underlying order of an investor, e.g. sequences of trades in the same direction of the same investor are combined, if the time difference between trades is less than 5 days. Minor trades in the opposite direction than the previous and following trade of the same investor were deleted. The relative effective spread of an order is computed on base of the underlying order as the difference of the volume weighted order price and the first mid-point price of the order scaled by the first mid-point price, times the order direction and 10,000. We run the following model in Panel A:

$$\left(\frac{\mathrm{VWAP_{itd}} - \mathrm{Mid} - \mathrm{quote_{itd,first}}}{\mathrm{Mid} - \mathrm{quote_{itd,first}}}\right)_{it} * direction * 10{,}000 = \beta_1 Event_d + \beta_2 Trend_{itd} + \sum_{k=1}^{K=5} \theta_k \, weekday_k + \sum_{i=2}^{I=n} \eta_{itd} \, Investor_{itd} + \sum_{i=2}^{I=n} \gamma_i D_i + \varepsilon_{itd}$$

where the relative effective spread of the order t of security i acts as the dependent variable. $\mathrm{Event_d}$ equals 0 prior the event and 1 post the event and $\mathrm{Trend_d}$ refers to a trend as 1,2,3…D to adjust for trend related changes in the dependent variable. We cluster the standard errors by security and control for the security, the week day of the first trade's execution as well as the investor in Panel A. In Panels B and C, the latter is not applicable. Accordingly, the other models are designed, where the other market quality determinants act as the dependent variable Q_{itd}. The relative realised spread is computed by the difference of the last mid-point price and the volume weighted order price scaled by the volume weighted order price. Again, we multiply by order direction and convert the value in bps. We further compute the relative market impact as the difference between the last and first mid-point price scaled by the first mid-point price. The relative Price impact is measured by the difference between the last and first order price, scaled by the first order price. Van Kervel and Menkfeld (2016) use this measure as a proxy for institutional implementation shortfall. Both of these measures are multiplied by order direction and 10,000.

Panel A presents the regression coefficients when disregarding the type of investor and only distinguishing between seller- and buyer-initiated orders. Panel B shows the findings for individual investors only, again presenting the overall effect as well as the impact on buyer- and seller- initiated orders. Accordingly, Panel C presents the results for institutional investors. The t-statistics are presented in parentheses. ***, **, * denotes statistical significance at 1 %, 5 % and 10 %.

Table 9 continued Switch from post-trade broker ID disclosure to opacity – Impact on transaction costs for individual and institutional investors

	Relative Effective Spread	Relative Effective Spread	Relative Effective Spread	Relative Realised Spread	Relative Realised Spread	Relative Realised Spread	Relative Market Impact	Relative Market Impact	Relative Market Impact	Relative Price impact	Relative Price impact	Relative Price impact
Order type	Any	Buy	Sell	Any	Buy	Sell	Any	Buy	Sell	Any	Buy	Sell
Panel A: Impact on transaction costs												
Event	1.179***	0.525	1.447	-0.431	-1.166***	0.547	0.652	-0.707	2.076	0.263	-1.102**	1.793
	(2.806)	(0.581)	(1.071)	(-0.894)	(-2.854)	(0.629)	(0.982)	(-1.079)	(1.004)	(0.327)	(-2.126)	(0.847)
Trend	0.000***	0.000***	0.000***	-0.000	-0.000**	0.000	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	(10.302)	(5.158)	(10.836)	(-1.190)	(-2.135)	(0.855)	(6.493)	(4.324)	(6.947)	(6.407)	(4.307)	(6.820)
Observations	2,555,998	1,350,710	1,205,288	2,555,998	1,350,710	1,205,288	2,555,998	1,350,710	1,205,288	2,555,998	1,350,710	1,205,288
Adj. R^2	0.223	0.223	0.235	0.137	0.174	0.116	0.024	0.013	0.043	0.025	0.015	0.042
F-Test	61.15	58.54	60.24	5.671	16.80	2.239	167.1	9.372	54.44	149.4	9.337	50.85
Panel B: Impact on transaction costs for orders of individual investors only												
Event	3.393***	0.892	5.635	-1.870	-3.305***	1.758	1.620	-2.592*	7.113	1.111	-2.935**	6.884
	(2.978)	(0.530)	(1.418)	(-1.005)	(-4.372)	(0.549)	(0.566)	(-1.691)	(1.046)	(0.376)	(-2.072)	(1.013)
Trend	0.000***	0.000***	0.000***	0.000	-0.000***	0.000	0.000***	-0.000	0.000***	0.000***	0.000	0.000***
	(9.922)	(3.099)	(6.220)	(0.041)	(-2.930)	(1.138)	(3.338)	(-0.157)	(3.085)	(3.458)	(0.108)	(3.065)
Observations	751,043	421,030	330,013	751,043	421,030	330,013	751,043	421,030	330,013	751,043	421,030	330,013
Adj. R^2	0.209	0.246	0.192	0.172	0.260	0.166	0.010	0.010	0.023	0.010	0.010	0.024
F-Test	82.40	18.01	91.19	1.325	27.19	3.487	41.03	2.034	38.51	41.61	2.617	37.04
Panel C: Impact on transaction costs for orders of institutional investors only												
Event	0.786*	0.531	0.918	0.111	-0.362	0.714***	0.860**	0.118	1.736**	0.494	-0.305	1.433*
	(1.912)	(0.803)	(1.423)	(0.436)	(-1.125)	(2.826)	(2.263)	(0.270)	(2.294)	(1.118)	(-0.968)	(1.806)
Trend	0.000***	0.000***	0.000***	-0.000**	-0.000	-0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	(8.875)	(7.464)	(9.658)	(-2.518)	(-1.045)	(-3.376)	(9.856)	(9.150)	(8.135)	(10.282)	(10.104)	(7.892)
Observations	1,781,084	918,541	862,537	1,781,084	918,541	862,537	0.860**	0.118	1.736**	1,781,084	918,541	862,537
Adj. R^2	0.146	0.114	0.190	0.028	0.036	0.023	(2.263)	(0.270)	(2.294)	0.034	0.027	0.041
F-Test	77.15	145.4	46.65	10.69	8.160	5.763	89.05	147.4	46.10	65.81	122.3	39.01

Table 10 Switch from opacity to post-trade broker ID disclosure – Impact on Market Liquidity

The following table presents the regression coefficient estimates for the third analysed event on 14th April 2009. For all securities but the Top5 traded stocks, NASDAQ OMX Helsinki reversed the regulations introduced on 2nd June 2008. Hence, the market remained opaque for the top traded securities, while post-trade broker ID disclosure was reintroduced for the remaining securities.
Our analysis excludes 5 trading days prior and post the event date and covers a horizon of 125 trading days before and after the event, hence from 2nd October 2008 till 16th October 2009. Our data set includes 102 securities which are traded on at least 90% of the trading days before and after the event. The control group includes the following securities: Nokia, Fortum, Stora Enso, UPM and Sampo. We distinguish between measures of resilience, transaction costs as well as liquidity derived by using TRTH data, which was processed by the MQD, which is developed and managed by the CMCRC. The relative effective spread is computed as the difference between the trade price and the prevailing mid-point price, divided by the mid-point price, times two. The relative realised spread is defined as the difference between the trade price and the mid-point price 10 minutes after the trade, divided by the initial mid-point price, multiplied by two. Accordingly, price impact is computed as the difference between effective and realised spread. These measures are expressed in bps. Implementation shortfall costs capture the execution as well as the opportunity costs. The intraday volatility is computed using 5 min intervals, measuring the intraday mid-point price return volatility. The (on-market) trade volume is defined as the sum of the volume traded within trading hours and on the main market. Accordingly, the on-market trade count is computed. We define the variance ratio in accordance with the methodology of Lo and MacKinlay (1988), testing whether the security prices follow a random walk as a measure for informational efficiency. We use a 1 to 5 minute/s return ratio. We run the following fixed effect regression model for the analysis of the impact of the event on any market quality determinant:

$$Q_{itd} = \beta_1 Event_d + \beta_2 Treatment_i + \beta_3 DID_{id} + \sum_{k=1}^{K=5} \theta_k Weekday_k + \sum_{i=2}^{I=n} \gamma_i D_i + \varepsilon_i$$

where Q_{itd} is computed per security i and day d, $Event_d$ equals 0 prior the event and 1 post the event and $Trend_d$ refers to time trend as 1, 2, 3, …, 250. We cluster the standard errors by security and included stock as well as weekday fixed effects. The t-statistics are presented in parentheses. ***, **, * denotes statistical significance at 1 %, 5 % and 10 %.

	Relative Effective Spread	Relative Realised Spread	Price impact	Implementation shortfall	Intraday volatility	Log On-market Volume	Log On-market Trade Count	Log Ask Depth	Log Bid Depth	Variance Ratio 1-5 min
Event	-2.640***	-0.731	-2.107*	-1.334***	-0.001***	-0.014**	-0.028***	0.265***	0.256***	-0.035**
	(-3.321)	(-1.391)	(-1.905)	(-3.211)	(-33.047)	(-2.580)	(-3.468)	(3.642)	(4.141)	(-2.368)
Treatment	225.968***	177.484***	42.947***	114.824***	0.000	-0.473***	-0.947***	-2.132***	-2.464***	-0.108***
	(7.961)	(7.320)	(12.084)	(7.946)	(0.947)	(-15.796)	(-16.654)	(-6.930)	(-7.885)	(-7.403)
DID	-78.823***	-57.494***	-17.460***	-39.460***	0.000*	0.022***	0.057***	-0.125	0.004	0.026*
	(-7.263)	(-5.931)	(-7.084)	(-7.301)	(1.882)	(2.909)	(3.906)	(-1.591)	(0.054)	(1.689)
Observations	23,543	23,543	23,543	23,543	23,543	23,543	23,543	23,543	23,543	22,939
Adj. R^2	0.029	0.020	0.012	0.028	0.070	0.087	0.074	0.124	0.138	0.007
Clustered SE	Stock	Stock	Stock	Stock	Stock	Stock	Stock	Stock	Stock	Stock
Stock FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Weekday FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-Test	26.72	19.20	48.93	26.95	683.3	164.4	129.7	23.61	38.97	26.57

Table 11 Switch from opacity to post-trade broker ID disclosure – Impact on Liquidity measures for individual and institutional investors and liquid and illiquid securities

The following table presents the regression coefficient estimates for the third analysed event on 14th April 2009. For all securities but the Top5 traded stocks, NASDAQ OMX Helsinki reversed the regulations introduced on 2nd June 2008. Hence, the market remained opaque for the top traded securities, while post-trade broker ID disclosure was reintroduced for the remaining securities. Our analysis excludes 5 trading days prior and post the event date and covers a horizon of 125 trading days before and after the event, hence from 2nd October 2008 till 16th October 2009. Our data set includes 102 securities which are traded on at least 90% of the trading days before and after the event. The control group includes the following securities: Nokia, Fortum, Stora Enso, UPM and Sampo. However, our data set did not provide sufficient trades for Sampo, hence the security is not included. Trades are consolidated to simulate the underlying order of an investor, e.g. sequences following securities of trades in the same direction of the same investor are combined, if the time difference between trades is less than 5 days. Minor trades in the opposite direction than the previous and following trade of the same investor were deleted. We are able to analyse the impact not only on overall market liquidity, but specifically on issued orders. We run basic fixed effect regression with various determinants as the number of trades within an order, the order volume as well as the order value as dependent variable. Further we analyse the order implementation time and the number of daily issued orders per security. We run fixed effect regression models as the following one

$$Q_{itd} = \beta_1 Event_d + \beta_2 Treatment_{it} + \beta_3 DID_{itd} + \sum_{k=1}^{K=5} \theta_k \, weekday_k + \sum_{i=2}^{I=n} \eta_{itd} \, Investor_{itd} + \varepsilon_{itd}$$

where Q_{itd} is computed per order t and security i on day d, $Event_d$ equals 0 prior the event and 1 post the event and $Treatment_i$ refers to a dummy variable, equal to 0 for the Top5 traded securities acting as a control group, and 1 for the remaining securities, which were affected by the policy change. DID_{itd} is the product of $Event_d$ and $Treatment_{it}$. It measures the difference in the impact of the new regulations between the control and treatment group. We included investor fixed effects for models run in Panel A, not in Panel B and C. Further, we control for the week day the order is submitted, and cluster standard errors by security.

In addition to the Difference-in-Difference analysis between the control and treatment group, we distinguish within the treatment group by liquid vs illiquid securities to gain insight which securities are driving the results. We determine the 5 most liquid securities within the treatment group in the same way the top 5 traded securities were determined, by the highest total trading volume in the previous year. We refer to those as the Liquid group. All remaining securities are considered illiquid.

Panel A presents the regression coefficients when disregarding the type of investor and only distinguishing between seller- and buyer-initiated orders. Panel B shows the findings for individual investors only, again presenting the overall effect as well as the impact on buyer- and seller- initiated orders. Accordingly, Panel C presents the results for institutional investors. The t-statistics are presented in parentheses. Across all Panels we present the Difference-in-Difference coefficients only for brevity. Comprehensive results to these analyses can be found in the Tables E, F and G. ***, **, * denotes statistical significance at 1 %, 5 % and 10 %.

Table 11 continued Switch from opacity to post-trade broker ID disclosure – Impact on Liquidity measures for individual and institutional investors and liquid and illiquid securities

	Liquid group?	Log Order volume	Log Order volume	Log Order volume	Log No of trades per order	Log No of trades per order	Log No of trades per order	Log Daily No of issued orders	Log Daily No of issued orders	Log Daily No of issued orders	Order execution time (hrs)	Order execution time (hrs)	Order execution time (hrs)
Order type		Both	Buy	Sell	Both	Buy	Sell	Both	Buy	Sell	Both	Buy	Sell
Panel A: Impact on Liquidity measures													
DID	N/A	-0.037	0.024	-0.133**	-0.004	0.027	-0.048***	82.598***	58.828**	101.094***	-0.270***	0.089	-0.838***
		(-0.544)	(0.306)	(-2.299)	(-0.435)	(1.325)	(-3.160)	(3.566)	(2.619)	(3.436)	(-5.175)	(0.663)	(-2.808)
Adj. R^2		0.198	0.200	0.195	0.150	0.155	0.139	0.306	0.276	0.316	0.017	0.012	0.028
F-Test		7.376	5.085	14.97	92.35	47.31	36.85	37.73	30.11	40.53	14.91	26.12	14.30
DID	Yes	-0.073	0.003	-0.225	0.017	0.058*	-0.058**	65.809**	40.308	115.047***	-0.277***	0.137	-1.196**
		(-0.567)	(0.023)	(-1.618)	(1.563)	(2.421)	(-3.976)	(2.755)	(1.047)	(5.126)	(-8.361)	(0.665)	(-3.115)
Adj. R^2		0.193	0.217	0.156	0.126	0.139	0.104	0.093	0.090	0.105	0.033	0.021	0.052
F-Test		4.593	3.629	6.824	268.7	234.7	370.5	35.51	23.54	51.46	92.68	10.90	101.6
DID	No	-0.027	0.025	-0.104*	-0.007	0.020	-0.044***	67.842***	61.977**	82.306***	-0.256***	0.066	-0.746**
		(-0.393)	(0.309)	(-1.863)	(-0.799)	(1.009)	(-2.774)	(3.263)	(2.560)	(3.273)	(-4.358)	(0.486)	(-2.520)
Adj. R^2		0.203	0.204	0.203	0.149	0.154	0.138	0.281	0.275	0.303	0.017	0.013	0.027
F-Test		7.237	5.397	13.76	102.2	38.69	58.63	34.65	27.79	41.31	13.81	26.44	12.60
Panel B: Impact on Market liquidity measures for orders of individual investors only													
DID	N/A	0.177*	0.209*	0.117*	0.069**	0.079*	0.053***	81.541***	63.001*	141.350***	-0.487***	-0.006	-1.219
		(1.811)	(1.765)	(1.825)	(2.584)	(1.757)	(2.764)	(3.390)	(1.688)	(5.872)	(-2.689)	(-0.020)	(-1.222)
Adj. R^2		0.041	0.027	0.074	0.007	0.005	0.015	0.303	0.297	0.355	0.001	0.000	0.006
F-Test		5.819	10.27	41.90	12.11	15.69	65.99	93.21	30.64	280.4	41.05	6.947	75.26
DID	Yes	0.150	0.171	0.002	0.096*	0.105	0.044*	68.061	44.651	141.247***	-0.641**	0.132	-2.322*
		(1.436)	(1.314)	(0.024)	(2.321)	(1.544)	(2.080)	(1.944)	(0.788)	(9.398)	(-3.299)	(0.304)	(-2.166)
Adj. R^2		0.038	0.029	0.059	0.004	0.003	0.007	0.107	0.104	0.132	0.000	0.001	0.004
F-Test		3.731	10.14	40.47	53.51	57.63	259.9	67.48	19.68	465.3	350.7	10.48	99.61
DID	No	0.181*	0.208*	0.146**	0.066**	0.074*	0.056***	92.357***	69.111*	124.872***	-0.432**	-0.044	-0.940
		(1.810)	(1.719)	(2.293)	(2.446)	(1.662)	(2.891)	(3.487)	(1.673)	(5.530)	(-2.396)	(-0.153)	(-0.956)
Adj. R^2		0.043	0.028	0.082	0.009	0.006	0.019	0.315	0.303	0.349	0.001	0.000	0.005
F-Test		5.788	7.427	39.58	14.36	10.09	58.57	92.64	30.60	464.9	33.78	4.679	81.88
Panel C: Impact on Market liquidity measures for orders of institutional investors only													
DID	N/A	-0.242***	-0.200***	-0.284***	-0.037***	-0.004	-0.071***	81.926**	69.535**	87.431***	0.085	0.198***	-0.072
		(-4.103)	(-3.026)	(-5.163)	(-4.776)	(-0.356)	(-4.094)	(2.621)	(2.397)	(2.732)	(1.426)	(3.047)	(-0.963)
Adj. R^2		0.138	0.140	0.137	0.003	0.003	0.002	0.284	0.259	0.290	0.008	0.009	0.008
F-Test		13.42	10.45	17.21	219.0	85.14	81.90	15.71	16.41	12.48	29.80	32.25	22.43
DID	Yes	-0.246	-0.155	-0.343*	-0.024	0.035	-0.089***	64.766*	41.637	98.876**	-0.011	0.076	-0.124
		(-1.371)	(-0.797)	(-2.072)	(-1.220)	(1.159)	(-5.103)	(2.071)	(0.950)	(3.733)	(-0.126)	(1.013)	(-1.025)
Adj. R^2		0.058	0.060	0.056	0.001	0.002	0.002	0.083	0.079	0.094	0.002	0.003	0.002
F-Test		5.015	4.190	6.911	282.7	92.36	1327	12.08	12.00	11.35	3151	131.2	49.96
DID	No	-0.236***	-0.206***	-0.263***	-0.039***	-0.013	-0.065***	66.519**	71.093**	69.632**	0.089	0.209***	-0.074
		(-4.017)	(-3.139)	(-4.899)	(-4.685)	(-1.339)	(-3.532)	(2.597)	(2.549)	(2.584)	(1.266)	(2.941)	(-0.788)
Adj. R^2		0.150	0.152	0.148	0.003	0.004	0.002	0.257	0.253	0.272	0.010	0.011	0.011
F-Test		13.50	11.46	16.22	247.2	75.05	127.2	13.44	13.80	11.57	33.07	29.96	27.13

Table 12 Switch from opacity to post-trade broker ID disclosure – Impact on transaction costs for individual and institutional investors and liquid and illiquid securities

The following table presents the regression coefficient estimates for the third analysed event on 14th April 2009. For all securities but the Top5 traded stocks, NASDAQ OMX Helsinki reversed the regulations introduced on 2nd June 2008. Hence, the market remained opaque for the top traded securities, while post-trade broker ID disclosure was reintroduced for the remaining securities.
Our analysis excludes 5 trading days prior and post the event date and covers a horizon of 125 trading days before and after the event, hence from 2nd October 2008 till 16th October 2009. Our data set includes 102 securities which are traded on at least 90% of the trading days before and after the event. The control group includes the following securities: Nokia, Fortum, Stora Enso, UPM and Sampo. To analyse the impact of the event specifically for institutional and individual investors, we compute the underlying order of each investor using the Euroclear data set, which is providing account information. Our data set did not provide sufficient trades for Sampo, hence the security is not included. Trades are consolidated to simulate the underlying order of an investor, e.g. sequences following securities of trades in the same direction of the same investor are combined, if the time difference between trades is less than 5 days. Minor trades in the opposite direction than the previous and following trade of the same investor were deleted. As one measure for transaction costs we use the relative effective spread computed on base of the underlying order as the difference of the volume weighted order price and the first mid-point price of the order scaled by the first mid-point price, times the order direction and 10,000. We run the following model in Panel A:

$$\left(\frac{\mathrm{VWAP_{itd}} - \mathrm{Mid} - \mathrm{quote_{itd,first}}}{\mathrm{Mid} - \mathrm{quote_{itd,first}}}\right)_{it} * direction * 10{,}000 = \beta_1 Event_d + \beta_2 Trend_{itd} + \sum_{k=1}^{K=5} \theta_k \, weekday_k + \sum_{i=2}^{I=n} \eta_{itd} \, Investor_{itd} + \sum_{i=2}^{I=n} \gamma_i D_i + \varepsilon_{itd}$$

where the relative effective spread of the order t of security i acts as the dependent variable. $\mathrm{Event_d}$ equals 0 prior the event and 1 post the event and $\mathrm{Trend_d}$ refers to a trend as 1,2,3…D to adjust for trend related changes in the dependent variable. We cluster the standard errors by security and control for the security, the week day of the first trade's execution as well as the investor in Panel A. In Panels B and C, the latter is not applicable. Accordingly, we design the model for any other market quality determinant Q_{itd}. The relative realised spread is computed by the difference of the last mid-point price and the volume weighted order price scaled by the volume weighted order price. Again, we multiply by order direction and convert the value in bps. We further compute the relative market impact as the difference between the last and first mid-point price scaled by the first mid-point price. The relative Price impact is measured by the difference between the last and first order price, scaled by the first order price. Van Kervel and Menkfeld (2016) use this measure as a proxy for institutional implementation shortfall. Both of these measures are multiplied by order direction and 10,000.
In addition to the Difference-in-Difference analysis between the control and treatment group, we distinguish within the treatment group by liquid vs illiquid securities to gain insight which securities are driving the results. We determine the 5 most liquid securities within the treatment group in the same way the top 5 traded securities were determined, by the highest total trading volume in the previous year. We refer to those as the Liquid group. All remaining securities are considered illiquid.
Panel A presents the regression coefficients when disregarding the type of investor and only distinguishing between seller- and buyer-initiated orders. Panel B shows the findings for individual investors only, again presenting the overall effect as well as the impact on buyer- and seller- initiated orders. Accordingly, Panel C presents the results for institutional investors. The t-statistics are presented in parentheses. Across all Panels we present the Difference-in-Difference coefficients only for brevity. Comprehensive results to these analyses can be found in the Tables H, I and J.
***, **, * denotes statistical significance at 1 %, 5 % and 10 %.

Table 12 continued Switch from opacity to post-trade broker ID disclosure – Impact on transaction costs for individual and institutional investors and liquid and illiquid securities

	Liquid group?	Relative Effective Spread	Relative Effective Spread	Relative Effective Spread	Relative Realized Spread	Relative Realized Spread	Relative Realized Spread	Relative Market Impact	Relative Market Impact	Relative Market Impact	Relative Price Impact	Relative Price Impact	Relative Price Impact
Order type		Both	Buy	Sell	Both	Buy	Sell	Both	Buy	Sell	Both	Buy	Sell
Panel A: Impact on Liquidity measures													
DID	N/A	-3.748***	-1.124	-7.810***	0.221	1.461	-1.734	-3.352***	0.434	-9.250***	-3.157***	0.690	-9.023***
		(-3.296)	(-1.045)	(-3.455)	(0.305)	(1.218)	(-1.121)	(-4.304)	(0.282)	(-2.826)	(-4.329)	(0.438)	(-2.825)
Adj. R^2		0.050	0.043	0.065	0.009	0.012	0.012	0.011	0.005	0.025	0.011	0.006	0.024
F-Test		22.95	8.681	29.12	6.924	3.822	21.41	93.57	5.522	60.77	96.11	6.028	59.37
DID	Yes	-2.837**	-0.651	-7.198**	0.260	2.280	-3.784*	-2.512**	1.841	-11.092**	-2.425**	1.939	-10.944**
		(-3.656)	(-1.250)	(-3.289)	(0.553)	(1.585)	(-2.192)	(-3.640)	(0.966)	(-2.817)	(-3.774)	(1.016)	(-2.816)
Adj. R^2		0.027	0.016	0.049	0.017	0.005	0.040	0.024	0.011	0.049	0.024	0.011	0.049
F-Test		89.26	608.2	33.60	55.32	42.75	170.6	2711	0.955	88.76	1925	1.138	79.25
DID	No	-4.388***	-2.008	-7.882***	0.678	1.906	-1.180	-3.464***	0.070	-8.756***	-3.247***	0.327	-8.506***
		(-2.946)	(-1.501)	(-3.075)	(0.630)	(1.299)	(-0.696)	(-4.188)	(0.044)	(-2.662)	(-4.188)	(0.203)	(-2.653)
Adj. R^2		0.059	0.054	0.072	0.013	0.017	0.016	0.011	0.005	0.024	0.011	0.006	0.023
F-Test		16.69	9.601	17.05	6.038	4.070	15.15	74.01	7.579	51.36	77.09	8.459	50.69
Panel B: Impact on Market liquidity measures for orders of individual investors only													
DID	N/A	-4.657**	-0.484	-9.599*	2.512	2.822	1.702	-1.502	2.847	-6.888	-1.389	2.998	-6.608
		(-2.265)	(-0.220)	(-1.785)	(1.076)	(1.221)	(0.293)	(-0.588)	(0.853)	(-0.664)	(-0.551)	(0.889)	(-0.641)
Adj. R^2		0.014	0.019	0.022	0.020	0.021	0.035	0.003	0.000	0.015	0.003	0.000	0.015
F-Test		22.42	6.906	34.23	36.12	5.894	62.51	90.83	0.347	109.3	90.54	0.346	110.8
DID	Yes	-2.479	0.614	-9.391	0.189	3.770	-6.313	-2.210	4.631	-15.994	-2.210	4.620	-15.827
		(-1.424)	(0.468)	(-1.816)	(0.157)	(1.398)	(-1.070)	(-0.758)	(1.149)	(-1.417)	(-0.763)	(1.145)	(-1.412)
Adj. R^2		0.003	0.001	0.012	0.002	0.001	0.008	0.002	0.000	0.010	0.002	0.000	0.010
F-Test		135.3	12.21	71.24	748.3	30.80	133.1	313.2	1.854	103.4	304.0	1.656	98.37
DID	No	-5.891**	-2.298	-9.385*	4.129	3.870	3.397	-1.208	2.418	-4.729	-1.076	2.531	-4.382
		(-2.323)	(-0.895)	(-1.667)	(1.360)	(1.381)	(0.566)	(-0.445)	(0.708)	(-0.461)	(-0.401)	(0.734)	(-0.428)
Adj. R^2		0.020	0.030	0.025	0.028	0.032	0.046	0.004	0.000	0.015	0.004	0.000	0.016
F-Test		18.14	8.892	19.05	33.72	7.432	45.96	70.55	0.459	104.9	70.69	0.396	105.2
Panel C: Impact on Market liquidity measures for orders of institutional investors only													
DID	N/A	-3.316***	-1.996***	-4.792***	1.066***	1.514***	0.456	-2.410***	-0.613	-4.543***	-2.135***	-0.327	-4.274***
		(-5.067)	(-3.815)	(-5.344)	(2.865)	(2.943)	(1.476)	(-4.499)	(-0.964)	(-5.507)	(-4.081)	(-0.492)	(-5.551)
Adj. R^2		0.021	0.017	0.027	0.000	0.001	0.000	0.009	0.008	0.010	0.008	0.008	0.009
F-Test		27.07	17.45	29.99	5.368	11.41	2.331	47.19	12.26	64.02	39.22	12.18	84.00
DID	Yes	-2.609**	-1.680**	-3.654**	0.976*	1.170*	0.510	-1.804**	-0.567	-3.212***	-1.616**	-0.371	-3.048***
		(-3.539)	(-3.127)	(-3.716)	(2.279)	(2.385)	(1.113)	(-3.354)	(-0.925)	(-5.353)	(-2.671)	(-0.549)	(-4.746)
Adj. R^2		0.005	0.003	0.007	0.001	0.001	0.001	0.003	0.002	0.003	0.003	0.003	0.003
F-Test		16.94	13.08	20.62	3.641	27.61	2.777	45.58	7.738	65.38	39.56	6.221	85.71
DID	No	-3.642***	-2.219***	-5.217***	1.130***	1.629***	0.509	-2.636***	-0.723	-4.926***	-2.345***	-0.418	-4.649***
		(-4.369)	(-3.480)	(-4.520)	(2.781)	(2.892)	(1.497)	(-3.869)	(-1.023)	(-4.551)	(-3.613)	(-0.578)	(-4.569)
Adj. R^2		0.027	0.022	0.033	0.000	0.001	0.000	0.011	0.010	0.012	0.010	0.010	0.011
F-Test		20.05	14.27	22.23	4.061	8.166	2.354	40.21	11.48	59.64	32.52	11.56	79.96

8 Appendix

Switch from opacity to post-trade broker ID disclosure – Scatter plot: Impact on Effective spread and On-market volume

The following scatter plots presents the daily effective spread/on-market volume parameters for the third analysed event on 14th April 2009. For all securities but the Top5 traded stocks, the regulations introduced on 2nd June 2008 were reversed. Hence, the market remained opaque for the top traded securities, while post-trade broker ID disclosure was reintroduced for the remaining securities. Our analysis excludes 5 trading days prior and post the event date and covers a horizon of 125 trading days before and after the event, hence from 2nd October 2008 till 16th October 2009. Our data set includes 102 securities which are traded on at least 90% of the trading days before and after the event. The control group includes the following securities: Nokia, Fortum, Stora Enso, UPM and Sampo. A. Exchanges aim for a market with a higher depth and lower transaction costs, hence values in the lower right corner resemble a more efficient market. The first scatter plot presents the daily aggregated values for securities within the control group, the second shows values for securities affected by the reintroduction of post-trade transparency.
The yellow points present any daily values after the event, the orange values stand for the pre-event period.

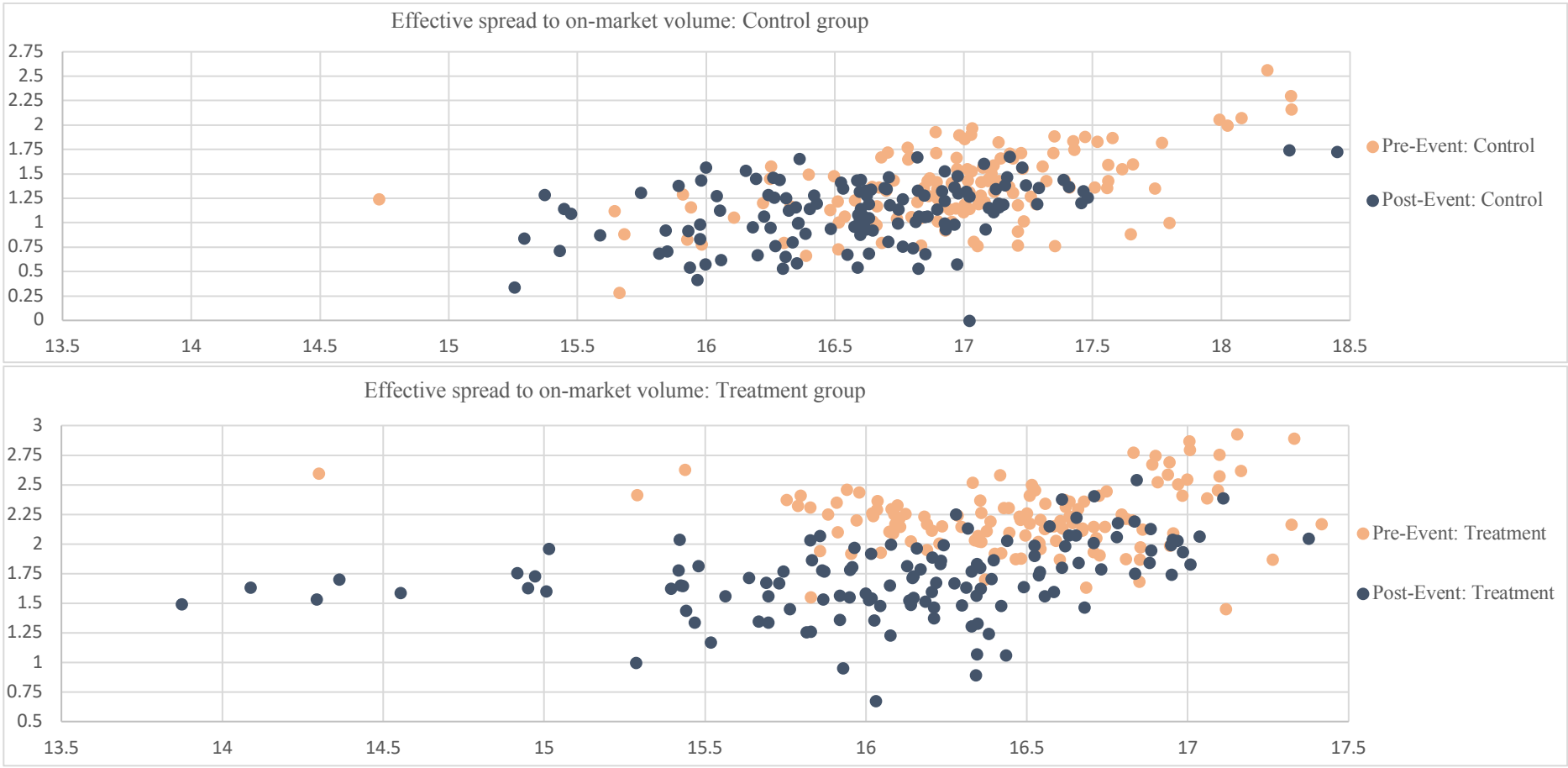

Table A Switch from pre- to post-trade broker ID disclosure – Extended Univariate Analysis

Table A shows an extended overview about the determinants used to analyse event on 13th March 2008, when NASDAQ OMX Helsinki switched from pre- to post trade broker ID disclosure. Determinants in Panel A were derived by using TRTH data, which was processed by the MQD, which is developed and managed by the CMCRC. Panel B and C present the univariate analysis for parameters computed with the Euroclear data set, which provides additional information. Trades are consolidated in a way to simulate the underlying order of an investor. We are able to distinguish between buyer- and seller-initiated orders. Further, Panel B presents the findings exclusively for individual investors, while Panel C shows the findings for institutional investors only.

	Prior-Event						Post-Event					
	Nobs	Mean	Median	St. dev	Min	Max	Nobs	Mean	Median	St. dev	Min	Max
Panel A: Liquidity and efficiency determinants on a daily base derived from TRTH data												
Trade volume	9,776	378,249	17,38	2,602,000	30	131,800,000	9,437	400,927	16,100	2,665,000	20	108,100,000.00
Trade count	9,776	188.1	23	557.3	1	19,035	9,437	228.8	22	645.5	1	16,746
On-market value	9,776	5,482,256	111,899	38,100,000	49.5	1,960,000,000	9,437	6,474,675	99,072	43,900,000	34	1,764,000,000
Quoted depth	9,776	73,657	22,540	206,649	1,394	2,702,000	9,437	64,593	19,446	158,716	1,004	2,433,000
Ask depth	9,776	37,751	11,502	106,035	167.6	1,623,000	9,437	32,924	10,136	80,753	413.6	1,495,000
Bid depth	9,776	35,906	10,226	103,215	210.3	1,589,000	9,437	31,669	8,666	80,490	75.92	1,144,000
Rel. realised spread	9,776	49.20	27.52	76.66	-599	1,335	9,437	58.53	31.84	94.27	-1,113	1,311
Rel. effective spread	9,776	67.67	45.10	78.72	0.54	1,157	9,437	83.60	55.23	96.81	3.862	1,915
Rel. price impact	9,776	18.47	7.583	58.09	-970.2	1,406	9,437	25.07	9.608	74.71	-442	2,038
Intraday volatility	9,776	0.002	0.00126	0.001	0	0.0241	9,437	0.002	0.00165	0.002	0	0.0261
Implementation shortfall	9,776	34.97	23.83	39.4	1.808	579.6	9,437	43.18	29.05	49.02	1.93	957.7
Variance ratio (1-5 min)	9,722	1.173	1.102	0.2	1	2.687	9,393	1.189	1.119	0.209	1	2.695
Panel B: Liquidity determinants per order derived from Euroclear data for individual investors only												
No of trades	423,679	1.524	1	2.132	1	484	377,140	1.637	1	2.907	1	756
Order volume	423,679	1,788	400	16,706	1	4,635,000	377,140	1,814	400	37,611	1	20,680,000
Order value	423,679	19,749	4,215	217,146	0.300	68,070,000	377,140	22,925	4,788	206,967	0.240	69,360,000
Execution time (hrs)	423,679	3.058	0	14.95	0	1,373	377,140	3.350	0	15.51	0	1,829
Rel. eff. Spread	423,679	30.33	8.678	134.6	0	10,552	377,140	32.26	9.606	133.2	0	10,293
Rel. real. Spread	423,679	-12.60	-6.821	97.17	-5,145	5,733	377,140	-10.96	-6.855	95.74	-5,072	5,241
Rel. market impact	423,679	17.26	0	118.3	-4,545	10,345	377,140	20.71	0	110.4	-1,169	9,739
Rel. price impact	423,679	16.76	0	108.4	-2,000	10,000	377,140	20.08	0	102.2	-1,551	3,103
Daily no of issues	423,679	403.5	157	758.4	1	6,667	377,140	415.3	196	741.0	1	5,815
Daily trade volume	423,679	13,190,000	11,940,000	6,691,000	78,660	46,880,000	377,140	1,134,000	124,007	3,584,000	1	33,080,000
Daily trade value	423,679	181,200,000	163,900,000	94,110,000	574,952	680,700,000	377,140	18,910,000	2,035,000	60,290,000	3.080	513,200,000
Panel C: Liquidity determinants per order derived from Euroclear data for institutional investors only												
No of trades	433,066	4.522	9.939	2	1	4,199	607,780	4.358	8.897	2	1	3,491
Order volume	433,066	11,170	66,677	2,460	1	36,930,000	607,780	8,816	47,690	2,100	1	18,190,000
Order value	433,066	166,877	985,089	40,687	0.520	552,100,000	607,780	143,646	757,376	37,697	1.950	276,200,000
Execution time (hrs)	433,066	1.899	12.07	0.00111	0	1,056	607,780	1.386	10.53	0.000556	0	1,253
Rel. eff. Spread	433,066	11.37	36.35	3.744	0	8,340	607,780	11.81	43.48	3.885	0	10,237
Rel. real. Spread	433,066	-0.990	34.51	-3.309	-4,126	5,001	607,780	-1.489	37.99	-3.081	-5,000	5,161
Rel. market impact	433,066	10.39	54.68	0	-1,191	9,192	607,780	10.29	54.62	0	-1,422	10,412
Rel. price impact	433,066	10.20	52.90	0	-4,105	3,437	607,780	9.974	52.63	0	-1,373	2,364
Daily no of issues	433,066	689.9	941.9	312	1	6,667	607,780	743.4	923.7	356	1	5,815
Daily trade volume	433,066	13,640,000	7,134,000	12,020,000	78,660	46,880,000	607,780	13,860,000	6,361,000	12,720,000	4,305,000	38,780,000
Daily trade value	433,066	188,400,000	100,500,000	168,600,000	574,952	680,700,000	607,780	211,000,000	99,150,000	189,300,000	58,380,000	608,700,000

Table B Switch from post-trade broker ID disclosure to opacity– Extended Univariate Analysis

We present an extended univariate analysis for the event on 2nd June 2008, when NASDAQ OMX Helsinki stopped displaying broker ID information post-trade. Determinants in Panel A were derived by using TRTH data, which was processed by the MQD, which is developed and managed by the CMCRC. Panel B as well as C show the summary statistics for market efficiency parameters computed with the Euroclear data set, which provides additional information. Trades are consolidated in a way to simulate the underlying order of an investor. We are able to distinguish between buyer- and seller-initiated orders. Further, Panel B presents the findings exclusively for individual investors, while Panel C shows the findings for institutional investors only.

	Prior-Event						Post-Event					
	Nobs	Mean	Median	St. dev	Min	Max	Nobs	Mean	Median	St. dev	Min	Max
Panel A: Liquidity and efficiency determinants on a daily base derived from TRTH data												
Trade volume	9,776	378,249	17,38	2,602,000	30	131,800,000	9,437	400,927	16,100	2,665,000	20	108,100,000.00
Trade count	9,776	188.1	23	557.3	1	19,035	9,437	228.8	22	645.5	1	16,746
On-market value	9,776	5,482,256	111,899	38,100,000	49.5	1,960,000,000	9,437	6,474,675	99,072	43,900,000	34	1,764,000,000
Quoted depth	9,776	73,657	22,540	206,649	1,394	2,702,000	9,437	64,593	19,446	158,716	1,004	2,433,000
Ask depth	9,776	37,751	11,502	106,035	167.6	1,623,000	9,437	32,924	10,136	80,753	413.6	1,495,000
Bid depth	9,776	35,906	10,226	103,215	210.3	1,589,000	9,437	31,669	8,666	80,490	75.92	1,144,000
Rel. realised spread	9,776	49.20	27.52	76.66	-599	1,335	9,437	58.53	31.84	94.27	-1,113	1,311
Rel. effective spread	9,776	67.67	45.10	78.72	0.54	1,157	9,437	83.60	55.23	96.81	3.862	1,915
Rel. price impact	9,776	18.47	7.583	58.09	-970.2	1,406	9,437	25.07	9.608	74.71	-442	2,038
Intraday volatility	9,776	0.002	0.00126	0.001	0	0.0241	9,437	0.002	0.00165	0.002	0	0.0261
Implementation shortfall	9,776	34.97	23.83	39.4	1.808	579.6	9,437	43.18	29.05	49.02	1.93	957.7
Variance ratio (1-5 min)	9,722	1.173	1.102	0.2	1	2.687	9,393	1.189	1.119	0.209	1	2.695
Panel B: Liquidity determinants per order derived from Euroclear data for individual investors only												
No of trades	386,045	2.424	1	5.412	1	594	364,998	2.334	1	6.322	1	1,518
Order volume	386,045	2,134	450	49,655	1	30,000,000	364,998	2,197	400	37,419	1	20,300,000
Order value	386,045	36,242	6,276	237,279	0.0700	76,080,000	364,998	25,602	4,080	136,738	0.0200	39,180,000
Execution time (hrs)	386,045	3.519	0	15.84	0	1,752	364,998	3.921	0	17.95	0	1,250
Rel. eff. Spread	386,045	33.44	7.452	137.2	0	10,000	364,998	45.49	9.425	141.9	0	11,103
Rel. real. Spread	386,045	-4.863	-4.690	104.2	-5,217	5,255	364,998	0.323	-5.886	139.4	-5,261	4,975
Rel. market impact	386,045	27.95	0	125.1	-5,217	10,000	364,998	45.09	0	194.9	-5,001	9,989
Rel. price impact	386,045	27.38	0	118.1	-2,229	4,175	364,998	44.59	0	192.2	-2,500	5,957
Daily no of issues	386,045	850.1	449	1,299	1	9,398	364,998	967.5	549	1,221	1	6,812
Daily trade volume	386,045	10,900,000	10,130,000	4,457,000	71,765	36,700,000	364,998	9,725,000	8,527,000	4,061,000	53,593	29,800,000
Daily trade value	386,045	201,900,000	185,500,000	81,380,000	565,879	561,300,000	364,998	115,500,000	108,100,000	43,350,000	862,111	340,400,000
Panel C: Liquidity determinants per order derived from Euroclear data for institutional investors only												
No of trades	961,153	4.468	2	8.476	1	2,320	819,932	4.640	2	9.568	1	2,038
Order volume	961,153	4,495	1,261	18,376	1	8,395,000	819,932	4,972	1,549	18,695	1	6,517,000
Order value	961,153	90,707	25,956	328,547	0.0600	154,600,000	819,932	67,165	22,043	249,006	0.0500	108,200,000
Execution time (hrs)	961,153	0.729	0.000278	7.388	0	1,134	819,932	0.730	0.000278	8.022	0	1,492
Rel. eff. Spread	961,153	10.61	4.027	50.76	0	10,041	819,932	14.90	5.068	75.62	0	10,307
Rel. real. Spread	961,153	-1.658	-2.575	41.21	-5,559	5,545	819,932	-2.063	-3.626	58.61	-5,051	5,398
Rel. market impact	961,153	8.881	0	52.82	-5,024	9,811	819,932	12.68	0	79.96	-4,989	10,390
Rel. price impact	961,153	8.485	0	49.42	-1,586	3,598	819,932	11.87	0	69.57	-2,883	6,667
Daily no of issues	961,153	1,163	611	1,354	1	9,398	819,932	1,130	671	1,191	1	6,812
Daily trade volume	961,153	10,880,000	10,130,000	4,428,000	71,765	36,700,000	819,932	9,295,000	8,152,000	3,861,000	53,593	29,800,000
Daily trade value	961,153	201,800,000	185,500,000	78,600,000	565,879	561,300,000	819,932	116,000,000	109,000,000	43,600,000	862,111	340,400,000

Table C Switch from opacity to post-trade broker ID disclosure – Extended Analysis

The following table presents an extended overview about summary statistics of the main parameters used in this study for the third analysed event on 14 April 2009. For all securities but the Top5 traded stocks, the regulations introduced on 2nd June 2008 were reversed. Hence, the market remained opaque for the top traded securities, while post-trade broker ID disclosure was reintroduced for the remaining securities.
Our analysis excludes 5 trading days prior and post the event date and covers a horizon prior and post of 125 trading days, hence from 2nd October 2008 till 16th October 2009. Our data set includes 102 securities which are traded on at least 90% of the trading days before and after the event. The control group includes the: Nokia, Fortum, Stora Enso, UPM and Sampo. Please note, that due to data availability, Sampo is not included in the analyses in Panels B and C e.g. the Euroclear data set. We distinguish between measures for transaction costs, resilience and liquidity, separately computed for the control and the treatment group. Determinants in Panel A were derived by using TRTH data, which was processed by the MQD, which is developed and managed by the CMCRC. Panels B as well as C show the summary statistics for market liquidity parameters computed with the Euroclear data set, which provides additional information as the actual account numbers of the trading participants. Trades are consolidated in a way to simulate the underlying order of an investor, e.g. sequences of trades in the same direction of the same investor are combined, if the time difference between trades is less than 5 days. Minor trades in the opposite direction than the previous and following trade of the same investor were deleted. Hence, we are able to analyse the impact specifically for orders, distinguishing between buyer- and seller-initiated orders. Further, Panel B presents the findings exclusively for individual investors, while Panel C shows the findings for institutional investors only.

	Group	Prior-Event						Post-Event					
		Nobs	Mean	Median	St. dev	Min	Max	Nobs	Mean	Median	St. dev	Min	Max
Panel A: Liqudity efficiency determinants on a daily base derived from TRTH data													
On-market trade volume	Control	432	9,575,000	3,517,000	12,650,000	454,873	89,470,000	432	7,268,000	2,752,000	11,560,000	569,259	147,600,000
	Treatment	11,304	234,587	14,467	587,295	1	8,503,000	11,377	182,187	16,450	439,929	1	7,355,000
On-market trade count	Control	432	5,517	3,578	4,690	961	35,140	432	4,182	2,654	4,126	733	47,558
	Treatment	11,304	353.8	23	766.9	1	9,234	11,377	308.1	26	634.3	1	8,965
On-market value	Control	432	97,260,000	34,640,000	135,700,000	5,909,000	940,300,000	432	71,760,000	26,760,000	114,400,000	6,059,000	1,425,000,000
	Treatment	11,304	1,921,000	42,745	5,192,000	0	77,410,000	11,377	1,732,000	52,556	4,436,000	3	129,600,000
Quoted depth	Control	432	129,833	78,507	103,970	39,875	626,559	432	171,653	108,263	134,971	46,957	688,835
	Treatment	11,304	23,194	10,354	47,338	345.1	654,369	11,377	27,613	12,117	57,389	456.2	639,969
Ask depth	Control	432	65,002	39,277	52,464	12,779	355,418	432	86,117	55,050	67,512	19,191	314,694
	Treatment	11,304	13,475	5,812	31,237	17.30	429,741	11,377	14,712	6,644	31,923	9.470	469,586
Bid depth	Control	432	64,831	40,209	52,547	16,828	308,157	432	85,535	52,409	69,861	18,916	411,330
	Treatment	11,304	9,719	4,172	20,172	6.800	307,197	11,377	12,901	5,207	30,571	11.48	408,628
Rel. realised spread	Control	432	4.061	3.316	7.538	-19.93	55.99	432	3.330	2.917	5.043	-12.99	34.19
	Treatment	11,304	191.0	71.13	412.3	-3,478	6,555	11,377	126.3	51.14	275.1	-888.9	3,496
Rel. effective spread	Control	432	14.15	12.36	6.389	5.514	35.29	432	11.37	8.447	6.034	4.741	28.84
	Treatment	11,304	238.0	121.2	485.8	0	19,070	11,377	153.2	80.11	264.8	0.138	4,213
Rel. price impact	Control	432	10.09	9.563	7.935	-31.10	41.16	432	8.036	6.760	6.217	-10.64	35.84
	Treatment	11,304	47.01	16.07	370.3	-3,009	17,907	11,377	26.85	10.85	124.9	-1,940	3,923
Intraday volatility	Control	432	0.00357	0.00324	0.00137	0.00126	0.0114	432	0.00208	0.00189	0.000808	0.000751	0.00716
	Treatment	11,304	0.00398	0.00314	0.00451	0	0.123	11,377	0.00255	0.00203	0.00332	0	0.171
Implementation shortfall	Control	432	8.343	7.301	3.369	4.222	19.59	432	6.883	5.325	3.366	3.630	16.96
	Treatment	11,304	130.7	66.14	258.3	3.129	9,535	11,377	83.52	44.00	144.2	1.613	2,143
Variance ratio (1-5 min)	Control	432	1.320	1.290	0.217	1.000	1.961	432	1.285	1.253	0.205	1.000	1.960
	Treatment	11,003	1.213	1.133	0.235	1	2.727	11,074	1.203	1.130	0.224	1	2.620

	Group	Prior-Event						Post-Event					
		Nobs	Mean	Median	St. dev	Min	Max	Nobs	Mean	Median	St. dev	Min	Max
Panel B: Liquidity determinants derived from Euroclear data for individual investors only													
No of trades/order	Control	145,383	2.592	1	5.415	1	500	136,270	2.283	1	4.828	1	486
	Treatment	246,763	1.918	1	4.933	1	863	298,539	1.912	1	3.751	1	742
Order volume	Control	145,383	3,279	800	10,157	1	1,076,000	136,270	2,726	600	11,663	1	2,318,000
	Treatment	246,763	1,420	310	48,718	1	20,300,000	298,539	1,262	350	19,580	1	9,000,000
Order value	Control	145,383	32,148	7,029	102,523	3.130	12,910,000	136,270	25,609	5,920	99,632	3.560	19,820,000
	Treatment	246,763	8,108	2,320	95,208	0.0200	39,180,000	298,539	8,812	2,846	44,802	0.120	15,750,000
Order execution time / hrs	Control	145,383	3.830	0	15.69	0	457.1	136,270	3.798	0	15.51	0	366.0
	Treatment	246,763	3.758	0	17.71	0	1,250	298,539	3.160	0	16.16	0	1,415
Rel. effective spread/order	Control	145,383	30.23	6.254	176.7	0	9,991	136,270	24.10	5.450	186.4	0	9,771
	Treatment	246,763	0.00505	0.00126	0.0138	0	1.110	298,539	0.00368	0.00102	0.00996	0	0.951
Rel. realised spread/order	Control	145,383	14.29	-4.883	118.5	-4,996	5,041	136,270	7.599	-4.869	118.6	-4,997	5,095
	Treatment	246,763	-0.00109	-0.000943	0.0147	-0.971	0.328	298,539	-0.00133	-0.000792	0.0105	-0.586	0.317
Rel. market impact/order	Control	145,383	43.26	0	174.3	-4,479	9,986	136,270	30.25	0	147.5	-4,993	9,563
	Treatment	246,763	0.00395	0	0.0182	-0.267	0.583	298,539	0.00236	0	0.0127	-0.146	0.696
Rel. price impact/order	Control	145,383	43.26	0	174.3	-4,479	9,986	136,270	30.25	0	147.5	-4,993	9,563
	Treatment	246,763	0.00391	0	0.0183	-0.250	0.596	298,539	0.00234	0	0.0128	-0.154	0.667
Daily trade volume	Control	145,383	8,793,000	7,741,000	3,552,000	346,444	29,800,000	136,270	7,577,000	6,612,000	4,132,000	2,054,000	23,720,000
	Treatment	246,763	8,512,000	7,699,000	3,471,000	346,444	29,800,000	298,539	6,870,000	6,382,000	2,806,000	2,054,000	23,720,000
Daily trade value	Control	145,383	74,530,000	67,400,000	29,320,000	774,950	184,700,000	136,270	66,740,000	58,190,000	39,710,000	17,940,000	230,900,000
	Treatment	246,763	72,190,000	66,790,000	26,300,000	774,950	184,700,000	298,539	59,240,000	55,090,000	24,370,000	17,940,000	230,900,000
Daily no of issued orders	Control	145,383	1,773	1,617	1,353	1	7,839	136,270	1,537	964	1,950	6	9,812
	Treatment	246,763	367.4	303	356.9	1	2,275	298,539	264.2	225	235.0	1	1,322
Panel C: Liqudity determinants derived from Euroclear data for institutional investors only													
No of trades/order	Control	315,129	4.911	7.778	1	418	3	227,918	5.388	3	8.364	1	388
	Treatment	300,144	4.758	2	9.891	1	857	292,820	4.927	3	9.286	1	797
Order volume	Control	315,129	8,007	18,882	1	2,192,000	3,106	227,918	9,251	3,400	25,811	1	5,050,000
	Treatment	300,144	2,649	1,000	14,181	1	3,920,000	292,820	2,639	819	68,472	1	35,270,000
Order value	Control	315,129	74,955	157,593	2.900	10,570,000	30,359	227,918	87,342	32,814	251,497	3.790	57,380,000
	Treatment	300,144	23,321	9,972	68,188	0.0300	68,188.36	292,820	25,769	10,136	140,884	0.250	61,720,000
Order execution time / hrs	Control	315,129	0.270	3.055	0	334.0	0.000278	227,918	0.396	0.000278	3.719	0	308.8
	Treatment	300,144	1.408	0.000278	11.16	0	913.2	292,820	1.636	0.000556	11.67	0	1,056
Rel. effective spread/order	Control	315,129	10.71	83.81	0	10,012	5.432	227,918	10.32	5.084	114.7	0	10,049
	Treatment	300,144	21.58	8.244	64.87	0	9,174	292,820	16.27	6.028	49.75	0	3,588
Rel. realised spread/order	Control	315,129	-1.693	52.92	-5,004	4,994	-4.545	227,918	-2.211	-4.643	63.23	-4,999	4,996
	Treatment	300,144	21.58	8.244	64.87	0	9,174	292,820	16.27	6.028	49.75	0	3,588
Rel. market impact/order	Control	315,129	8.856	80.45	-5,000	10,027	0	227,918	7.721	0	89.78	-4,993	10,108
	Treatment	300,144	19.95	0	97.39	-1,711	8,760	292,820	15.37	0	77.80	-1,663	5,707
Rel. price impact/order	Control	315,129	8.466	41.31	-649.9	2,513	0	227,918	6.962	0	35.66	-932.6	2,896
	Treatment	300,144	19.19	0	94.68	-1,698	4,074	292,820	14.99	0	78.22	-2,960	5,728
Daily trade volume	Control	315,129	8,767,000	3,558,000	4,084,000	29,800,000	7,858,000	227,918	7,326,000	6,382,000	3,911,000	2,054,000	23,720,000
	Treatment	300,144	8,518,000	7,717,000	3,364,000	346,444	29,800,000	292,820	6,692,000	5,952,000	2,902,000	2,054,000	23,720,000
Daily trade value	Control	315,129	75,230,000	28,070,000	31,950,000	184,700,000	68,020,000	227,918	64,430,000	55,240,000	37,130,000	17,940,000	230,900,000
	Treatment	300,144	72,020,000	66,790,000	25,390,000	774,950	184,700,000	292,820	57,940,000	53,740,000	25,400,000	17,940,000	230,900,000
Daily no of issued orders	Control	315,129	1,627	1,231	157	7,839	1,407	227,918	1,450	965	1,801	5	9,812
	Treatment	300,144	392.8	335	293.4	1	2,275	292,820	310.6	277	204.7	1	1,322

Table D Switch from opacity to post-trade broker ID disclosure – Impact on daily trading volume for individual and institutional investors

The table below presents the regression coefficients of the logarithmized daily trading volume for the third analysed event on 14th April 2009. For all securities but the Top5 traded stocks, the regulations introduced on 2nd June 2008 were reversed. Hence, the market remained opaque for the top traded securities, while post-trade broker ID disclosure was reintroduced for the remaining securities. To analyse the impact of the event specifically for individual and institutional investors, we compute the underlying order of each investor using the Euroclear data set, which is providing account information. Around the event, 5 trading days were excluded, the sample period before and after are 125 trading days from 2nd October 2008 till 16th October 2009. Our data set includes 102 securities which are traded on at least 90% of the trading days before and after the event. The control group includes Nokia, Fortum, Stora Enso, UPM and Sampo. Our data set did not provide sufficient trades for Sampo, hence the security is not included. Trades are consolidated to simulate the underlying order of an investor, e.g. sequences following securities of trades in the same direction of the same investor are combined, if the time difference between trades is less than 5 days. Minor trades in the opposite direction than the previous and following trade of the same investor were deleted. The daily trading volume is the total of the daily order volume. We run the following model in Panel A:

$$V_{id} = \beta_1 Event_d + \beta_2 Treatment_{itd} + \beta_3 DID_{itd} + \sum_{k=1}^{K=5} \theta_k \, weekday_k + \sum_{i=2}^{I=n} \eta_{itd} \, Investor_{itd} + \varepsilon_{itd}$$

where the logarithmized daily volume V_{id} of security i on day d acts as the dependent variable. Event_d equals 0 prior the event and 1 post the event and $\text{Treatment}_\text{itd}$ refers to a dummy variable equal to one if the security is affected by the policy change and the order is submitted post the event. Otherwise the dummy variable is 0. DID_{itd} is the product of $Event_d$ and $Treatment_{it}$. It measures the difference in the impact of the new regulations between the control and treatment group. We cluster the standard errors by security and control for the week day of the first trade's execution as well as the investor in Panel A. In Panels B and C, this is not applicable.

Panel A presents the regression coefficients when disregarding the type of investor and only distinguishing between seller- and buyer-initiated orders. Panel B shows the findings for individual only, again presenting the overall effect as well as the impact on buyer- and seller- initiated orders. Accordingly, Panel C presents the results for institutional

The t-statistics are presented in parentheses. ***, **, * denotes statistical significance at 1 %, 5 % and 10 %.

	Log. Daily Trade volume	Log. Daily Trade volume	Log. Daily Trade volume
Order type	Any	Buy	Sell
Panel A: Impact on Liquidity measures			
Event	-0.205***	-0.208***	-0.203***
	(-13.309)	(-11.738)	(-15.879)
Treatment	-0.029**	-0.031*	-0.027**
	(-2.018)	(-1.978)	(-2.056)
DID	-0.030*	-0.025	-0.037***
	(-1.843)	(-1.302)	(-2.702)
Observations	1,988,432	1,086,795	901,637
Adj. R^2	0.099	0.098	0.100
F-Test	4,183	2,194	8,516
Panel B: Impact on Market liquidity measures for orders of individual investors only			
Event	-0.187***	-0.193***	-0.179***
	(-8.139)	(-6.479)	(-13.151)
Treatment	-0.033*	-0.034*	-0.031**
	(-1.957)	(-1.810)	(-2.105)
DID	-0.028	-0.020	-0.040**
	(-1.169)	(-0.636)	(-2.534)
Observations	826,955	486,657	340,298
Adj. R^2	0.085	0.085	0.085
F-Test	705.3	340.5	2,964
Panel C: Impact on Market liquidity measures for orders of institutional investors only			
Event	-0.215***	-0.216***	-0.213***
	(-20.686)	(-24.948)	(-17.504)
Treatment	-0.025*	-0.026*	-0.024*
	(-1.833)	(-1.803)	(-1.864)
DID	-0.038***	-0.035***	-0.041***
	(-3.260)	(-3.512)	(-3.048)
Observations	1,136,011	587,012	548,999
Adj. R^2	0.108	0.109	0.108
F-Test	13,351	12,858	10,041

Table E Switch from opacity to post-trade broker ID disclosure – Impact on Liquidity measures for individual and institutional investors

The following table presents the regression coefficient estimates for the third analysed event on 14th April 2009. For all securities but the Top5 traded stocks, NASDAQ OMX Helsinki reversed the regulations introduced on 2nd June 2008. Hence, the market remained opaque for the top traded securities, while post-trade broker ID disclosure was reintroduced for the remaining securities. The approach followed in the table below is the same as in Table 11. It presents the results for the Difference-in-Difference analysis for the control and treatment group in detail. We did not distinguish between liquid and illiquid securities within the treatment group.
Panel A presents the regression coefficients when the type of investor is disregarded and only distinguishes between seller- and buyer-initiated orders. Panel B shows the findings for individual investors only, again presenting the overall effect as well as the impact on buyer- and seller- initiated orders. Accordingly, Panel C presents the results for institutional investors. The t-statistics are presented in parentheses. ***, **, * denotes statistical significance at 1 %, 5 % and 10 %.

	Log Order volume	Log Order volume	Log Order volume	Log No of trades per order	Log No of trades per order	Log No of trades per order	Log Daily No of issued orders	Log Daily No of issued orders	Log Daily No of issued orders	Order execution time (hrs)	Order execution time (hrs)	Order execution time (hrs)
Order type	Any	Buy	Sell	Any	Buy	Sell	Any	Buy	Sell	Any	Buy	Sell
Panel A: Impact on Liquidity measures												
Event	-0.027	-0.028	-0.029	0.015**	0.008	0.022*	-133.956***	-125.314***	-131.210***	0.119***	0.271**	-0.108
	(-0.477)	(-0.389)	(-0.822)	(2.105)	(0.417)	(1.930)	(-6.663)	(-8.608)	(-4.726)	(4.128)	(2.158)	(-0.439)
Treatment	-0.996***	-0.964***	-1.021***	-0.090***	-0.100***	-0.073***	-644.904**	-685.930**	-613.285**	0.513***	0.409***	0.640***
	(-4.130)	(-3.871)	(-4.549)	(-11.720)	(-6.679)	(-5.768)	(-2.575)	(-2.546)	(-2.571)	(5.685)	(4.724)	(3.212)
DID	-0.037	0.024	-0.133**	-0.004	0.027	-0.048***	82.598***	58.828**	101.094***	-0.270***	0.089	-0.838***
	(-0.544)	(0.306)	(-2.299)	(-0.435)	(1.325)	(-3.160)	(3.566)	(2.619)	(3.436)	(-5.175)	(0.663)	(-2.808)
Observations	1,988,432	1,086,795	901,637	1,988,432	1,086,795	901,637	1,988,432	1,086,795	901,637	1,988,432	1,086,795	901,637
Adj. R^2	0.198	0.200	0.195	0.150	0.155	0.139	0.306	0.276	0.316	0.017	0.012	0.028
F-Test	7.376	5.085	14.97	92.35	47.31	36.85	37.73	30.11	40.53	14.91	26.12	14.30
Panel B: Impact on Market liquidity measures for orders of individual investors only												
Event	-0.132	-0.071	-0.248***	-0.070***	-0.048	-0.115***	-140.858***	-137.517***	-173.360***	-0.013	0.410	-0.816
	(-1.409)	(-0.622)	(-5.342)	(-2.679)	(-1.098)	(-6.354)	(-8.685)	(-4.707)	(-8.916)	(-0.074)	(1.544)	(-0.845)
Treatment	-0.758***	-0.645***	-0.932***	-0.138***	-0.116***	-0.180***	-718.791***	-749.351***	-675.606***	-0.191	0.024	-0.495
	(-3.862)	(-3.135)	(-6.015)	(-5.489)	(-3.479)	(-7.501)	(-2.804)	(-2.736)	(-2.849)	(-1.176)	(0.104)	(-0.879)
DID	0.177*	0.209*	0.117*	0.069**	0.079*	0.053***	81.541***	63.001*	141.350***	-0.487***	-0.006	-1.219
	(1.811)	(1.765)	(1.825)	(2.584)	(1.757)	(2.764)	(3.390)	(1.688)	(5.872)	(-2.689)	(-0.020)	(-1.222)
Observations	826,955	486,657	340,298	826,955	486,657	340,298	826,955	486,657	340,298	826,955	486,657	340,298
Adj. R^2	0.041	0.027	0.074	0.007	0.005	0.015	0.303	0.297	0.355	0.001	0.000	0.006
F-Test	5.819	10.27	41.90	12.11	15.69	65.99	93.21	30.64	280.4	41.05	6.947	75.26
Panel C: Impact on Market liquidity measures for orders of institutional investors only												
Event	0.060	0.039	0.083**	0.060***	0.044***	0.078***	-124.372***	-126.228***	-114.931***	0.115***	0.145***	0.081***
	(1.519)	(0.824)	(2.536)	(14.321)	(7.625)	(5.875)	(-4.152)	(-4.849)	(-3.704)	(3.265)	(3.022)	(3.354)
Treatment	-1.129***	-1.171***	-1.080***	-0.067***	-0.096***	-0.034**	-611.814**	-646.202**	-586.931**	0.885***	0.696***	1.036***
	(-4.102)	(-4.066)	(-4.132)	(-7.800)	(-8.192)	(-2.164)	(-2.469)	(-2.452)	(-2.471)	(5.174)	(5.438)	(4.979)
DID	-0.242***	-0.200***	-0.284***	-0.037***	-0.004	-0.071***	81.926**	69.535**	87.431***	0.085	0.198***	-0.072
	(-4.103)	(-3.026)	(-5.163)	(-4.776)	(-0.356)	(-4.094)	(2.621)	(2.397)	(2.732)	(1.426)	(3.047)	(-0.963)
Observations	1,136,011	587,012	548,999	1,136,011	587,012	548,999	1,136,011	587,012	548,999	1,136,011	587,012	548,999
Adj. R^2	0.138	0.140	0.137	0.003	0.003	0.002	0.284	0.259	0.290	0.008	0.009	0.008
F-Test	13.42	10.45	17.21	219.0	85.14	81.90	15.71	16.41	12.48	29.80	32.25	22.43

Table F Switch from opacity to post-trade broker ID disclosure – Impact on Liquidity measures for liquid securities and individual and institutional investors

The following table presents the regression coefficient estimates for the third analysed event on 14th April 2009. For all securities but the Top5 traded stocks, NASDAQ OMX Helsinki reversed the regulations introduced on 2nd June 2008. Hence, the market remained opaque for the top traded securities, while post-trade broker ID disclosure was reintroduced for the remaining securities. The approach followed in the table below is the same as in Table 11. It presents the results for the Difference-in-Difference analysis for the control and the liquid securities within treatment group in detail.

Panel A presents the regression coefficients when the type of investor is disregarded and only distinguishes between seller- and buyer-initiated orders. Panel B shows the findings for individual investors only, again presenting the overall effect as well as the impact on buyer- and seller- initiated orders. Accordingly, Panel C presents the results for institutional investors. The t-statistics are presented in parentheses. ***, **, * denotes statistical significance at 1 %, 5 % and 10 %.

	Log Order volume	Log Order volume	Log Order volume	Log No of trades per order	Log No of trades per order	Log No of trades per order	Log Daily No of issued orders	Log Daily No of issued orders	Log Daily No of issued orders	Order execution time (hrs)	Order execution time (hrs)	Order execution time (hrs)
Order type	Any	Buy	Sell	Any	Buy	Sell	Any	Buy	Sell	Any	Buy	Sell
Panel A: Impact on Liquidity measures												
Event	-0.009	-0.007	-0.017	0.014	0.009	0.020	-116.692***	-118.575***	-119.583***	0.076**	0.241	-0.172
	(-0.145)	(-0.096)	(-0.412)	(1.865)	(0.405)	(1.450)	(-9.065)	(-7.888)	(-5.480)	(2.945)	(1.824)	(-0.594)
Treatment	-0.839**	-0.835**	-0.792**	-0.068***	-0.088**	-0.021*	-526.002	-538.566	-521.900	0.193	0.092	0.581**
	(-3.120)	(-3.043)	(-3.220)	(-4.580)	(-3.831)	(-2.034)	(-1.891)	(-1.821)	(-2.000)	(1.855)	(0.777)	(3.023)
DID	-0.073	0.003	-0.225	0.017	0.058*	-0.058**	65.809**	40.308	115.047***	-0.277***	0.137	-1.196**
	(-0.567)	(0.023)	(-1.618)	(1.563)	(2.421)	(-3.976)	(2.755)	(1.047)	(5.126)	(-8.361)	(0.665)	(-3.115)
Observations	1,073,264	586,076	487,188	1,073,264	586,076	487,188	1,073,264	586,076	487,188	1,073,264	586,076	487,188
Adj. R^2	0.193	0.217	0.156	0.126	0.139	0.104	0.093	0.090	0.105	0.033	0.021	0.052
F-Test	4.593	3.629	6.824	268.7	234.7	370.5	35.51	23.54	51.46	92.68	10.90	101.6
Panel B: Impact on Market liquidity measures for orders of individual investors only												
Event	-0.133	-0.071	-0.247***	-0.071*	-0.048	-0.115***	-133.634***	-126.057**	-158.740***	-0.013	0.390	-0.802
	(-1.298)	(-0.572)	(-4.872)	(-2.461)	(-1.008)	(-5.829)	(-6.332)	(-3.405)	(-12.437)	(-0.068)	(1.407)	(-0.779)
Treatment	-0.782**	-0.701**	-0.802***	-0.111*	-0.097	-0.099**	-558.447	-573.658	-555.832*	0.053	-0.043	0.779
	(-3.188)	(-2.811)	(-4.471)	(-2.271)	(-1.807)	(-3.245)	(-1.999)	(-1.925)	(-2.140)	(0.167)	(-0.131)	(1.434)
DID	0.150	0.171	0.002	0.096*	0.105	0.044*	68.061	44.651	141.247***	-0.641**	0.132	-2.322*
	(1.436)	(1.314)	(0.024)	(2.321)	(1.544)	(2.080)	(1.944)	(0.788)	(9.398)	(-3.299)	(0.304)	(-2.166)
Observations	395,340	237,979	157,361	395,340	237,979	157,361	395,340	237,979	157,361	395,340	237,979	157,361
Adj. R^2	0.038	0.029	0.059	0.004	0.003	0.007	0.107	0.104	0.132	0.000	0.001	0.004
F-Test	3.731	10.14	40.47	53.51	57.63	259.9	67.48	19.68	465.3	350.7	10.48	99.61
Panel C: Impact on Market liquidity measures for orders of institutional investors only												
Event	0.063	0.041	0.086*	0.061***	0.045***	0.078***	-106.243***	-118.405***	-101.752**	0.116**	0.146**	0.085**
	(1.447)	(0.793)	(2.403)	(13.095)	(7.049)	(5.381)	(-4.471)	(-4.686)	(-3.801)	(3.105)	(2.834)	(3.251)
Treatment	-0.895**	-0.967**	-0.811**	-0.047***	-0.094***	0.009	-507.373	-509.345	-507.789	0.299***	0.257***	0.367***
	(-3.011)	(-3.092)	(-2.896)	(-4.580)	(-7.880)	(0.514)	(-1.847)	(-1.766)	(-1.948)	(4.217)	(4.210)	(4.194)
DID	-0.246	-0.155	-0.343*	-0.024	0.035	-0.089***	64.766*	41.637	98.876**	-0.011	0.076	-0.124
	(-1.371)	(-0.797)	(-2.072)	(-1.220)	(1.159)	(-5.103)	(2.071)	(0.950)	(3.733)	(-0.126)	(1.013)	(-1.025)
Observations	667,280	342,633	324,647	667,280	342,633	324,647	667,280	342,633	324,647	667,280	342,633	324,647
Adj. R^2	0.058	0.060	0.056	0.001	0.002	0.002	0.083	0.079	0.094	0.002	0.003	0.002
F-Test	5.015	4.190	6.911	282.7	92.36	1327	12.08	12.00	11.35	3151	131.2	49.96

Table G Switch from opacity to post-trade broker ID disclosure – Impact on Liquidity measures for illiquid securities and individual and institutional investors

The following table presents the regression coefficient estimates for the third analysed event on 14th April 2009. For all securities but the Top5 traded stocks, NASDAQ OMX Helsinki reversed the regulations introduced on 2nd June 2008. Hence, the market remained opaque for the top traded securities, while post-trade broker ID disclosure was reintroduced for the remaining securities. The approach followed in the table below is the same as in Table 11. It presents the results for the Difference-in-Difference analysis for the control and the illiquid securities within treatment group in detail.
Panel A presents the regression coefficients when the type of investor is disregarded and only distinguishes between seller- and buyer-initiated orders. Panel B shows the findings for individual investors only, again presenting the overall effect as well as the impact on buyer- and seller- initiated orders. Accordingly, Panel C presents the results for institutional investors. The t-statistics are presented in parentheses. ***, **, * denotes statistical significance at 1 %, 5 % and 10 %.

	Log Order volume	Log Order volume	Log Order volume	Log No of trades per order	Log No of trades per order	Log No of trades per order	Log Daily No of issued orders	Log Daily No of issued orders	Log Daily No of issued orders	Order execution time (hrs)	Order execution time (hrs)	Order execution time (hrs)
Order type	Any	Buy	Sell	Any	Buy	Sell	Any	Buy	Sell	Any	Buy	Sell
Panel A: Impact on Liquidity measures												
Event	-0.027	-0.027	-0.029	0.015**	0.008	0.022*	-114.327***	-116.155***	-117.508***	0.120***	0.272**	-0.105
	(-0.476)	(-0.383)	(-0.821)	(2.098)	(0.424)	(1.932)	(-9.192)	(-8.241)	(-5.685)	(4.318)	(2.153)	(-0.432)
Treatment	-1.043***	-0.999***	-1.090***	-0.097***	-0.104***	-0.088***	-688.159***	-732.113***	-636.838***	0.556***	0.472***	0.618***
	(-4.326)	(-3.995)	(-4.905)	(-12.902)	(-6.733)	(-8.028)	(-2.705)	(-2.717)	(-2.667)	(5.295)	(5.403)	(2.848)
DID	-0.027	0.025	-0.104*	-0.007	0.020	-0.044***	67.842***	61.977**	82.306***	-0.256***	0.066	-0.746**
	(-0.393)	(0.309)	(-1.863)	(-0.799)	(1.009)	(-2.774)	(3.263)	(2.560)	(3.273)	(-4.358)	(0.486)	(-2.520)
Observations	1,738,308	945,156	793,152	1,738,308	945,156	793,152	1,738,308	945,156	793,152	1,738,308	945,156	793,152
Adj. R^2	0.203	0.204	0.203	0.149	0.154	0.138	0.281	0.275	0.303	0.017	0.013	0.027
F-Test	7.237	5.397	13.76	102.2	38.69	58.63	34.65	27.79	41.31	13.81	26.44	12.60
Panel B: Impact on Market liquidity measures for orders of individual investors only												
Event	-0.132	-0.071	-0.249***	-0.070***	-0.048	-0.115***	-140.858***	-126.400***	-158.918***	-0.013	0.408	-0.815
	(-1.409)	(-0.622)	(-5.340)	(-2.679)	(-1.097)	(-6.351)	(-8.681)	(-3.710)	(-13.637)	(-0.074)	(1.542)	(-0.844)
Treatment	-0.770***	-0.642***	-0.981***	-0.147***	-0.122***	-0.198***	-764.562***	-805.858***	-702.923***	-0.269*	0.033	-0.796
	(-3.882)	(-3.083)	(-6.324)	(-5.871)	(-3.645)	(-8.825)	(-2.986)	(-2.949)	(-2.963)	(-1.718)	(0.145)	(-1.463)
DID	0.181*	0.208*	0.146**	0.066**	0.074*	0.056***	92.357***	69.111*	124.872***	-0.432**	-0.044	-0.940
	(1.810)	(1.719)	(2.293)	(2.446)	(1.662)	(2.891)	(3.487)	(1.673)	(5.530)	(-2.396)	(-0.153)	(-0.956)
Observations	706,800	412,852	293,948	706,800	412,852	293,948	706,800	412,852	293,948	706,800	412,852	293,948
Adj. R^2	0.043	0.028	0.082	0.009	0.006	0.019	0.315	0.303	0.349	0.001	0.000	0.005
F-Test	5.788	7.427	39.58	14.36	10.09	58.57	92.64	30.60	464.9	33.78	4.679	81.88
Panel C: Impact on Market liquidity measures for orders of institutional investors only												
Event	0.061	0.039	0.084**	0.060***	0.044***	0.078***	-106.337***	-118.509***	-101.419***	0.115***	0.145***	0.080***
	(1.532)	(0.836)	(2.549)	(14.259)	(7.663)	(5.866)	(-4.919)	(-5.231)	(-4.165)	(3.289)	(3.043)	(3.369)
Treatment	-1.205***	-1.239***	-1.164***	-0.073***	-0.097***	-0.046***	-646.704**	-684.172**	-608.268**	1.017***	0.798***	1.190***
	(-4.369)	(-4.280)	(-4.467)	(-8.866)	(-7.826)	(-3.120)	(-2.582)	(-2.599)	(-2.559)	(4.850)	(5.162)	(4.631)
DID	-0.236***	-0.206***	-0.263***	-0.039***	-0.013	-0.065***	66.519**	71.093**	69.632**	0.089	0.209***	-0.074
	(-4.017)	(-3.139)	(-4.899)	(-4.685)	(-1.339)	(-3.532)	(2.597)	(2.549)	(2.584)	(1.266)	(2.941)	(-0.788)
Observations	1,009,341	520,883	488,458	1,009,341	520,883	488,458	1,009,341	520,883	488,458	1,009,341	520,883	488,458
Adj. R^2	0.150	0.152	0.148	0.003	0.004	0.002	0.257	0.253	0.272	0.010	0.011	0.011
F-Test	13.50	11.46	16.22	247.2	75.05	127.2	13.44	13.80	11.57	33.07	29.96	27.13

Table H Switch from opacity to post-trade broker ID disclosure – Impact on transaction costs for individual and institutional investors

The following table presents the regression coefficient estimates for the third analysed event on 14th April 2009. For all securities but the Top5 traded stocks, NASDAQ OMX Helsinki reversed the regulations introduced on 2nd June 2008. Hence, the market remained opaque for the top traded securities, while post-trade broker ID disclosure was reintroduced for the remaining securities. The approach followed in the table below is the same as in Table 12. It presents the results for the Difference-in-Difference analysis for the control and treatment group in detail. We did not distinguish between liquid and illiquid securities within the treatment group.

Panel A presents the regression coefficients when the type of investor is disregarded and only distinguishes between seller- and buyer-initiated orders. Panel B shows the findings for individual investors only, again presenting the overall effect as well as the impact on buyer- and seller- initiated orders. Accordingly, Panel C presents the results for institutional investors. The t-statistics are presented in parentheses. ***, **, * denotes statistical significance at 1 %, 5 % and 10 %.

	Relative Effective Spread	Relative Effective Spread	Relative Effective Spread	Relative Realised Spread	Relative Realised Spread	Relative Realised Spread	Relative Market Impact	Relative Market Impact	Relative Market Impact	Relative Price impact	Relative Price impact	Relative Price impact
Order type	Any	Buy	Sell	Any	Buy	Sell	Any	Buy	Sell	Any	Buy	Sell
Panel A: Impact on transaction costs												
Event	-2.846***	-1.591***	-4.526**	-0.631***	0.163	-1.774	-3.363***	-1.436	-6.009**	-3.371***	-1.589	-5.838**
	(-4.098)	(-2.683)	(-2.506)	(-2.898)	(0.166)	(-1.561)	(-6.183)	(-1.019)	(-2.134)	(-6.869)	(-1.096)	(-2.134)
Treatment	12.891***	11.488***	15.015***	-7.886***	-6.729***	-9.285***	4.430***	4.128***	5.192**	4.244***	4.359***	4.396**
	(4.543)	(4.584)	(4.353)	(-3.357)	(-3.039)	(-3.573)	(3.460)	(3.272)	(2.466)	(3.339)	(3.447)	(2.147)
DID	-3.748***	-1.124	-7.810***	0.221	1.461	-1.734	-3.352***	0.434	-9.250***	-3.157***	0.690	-9.023***
	(-3.296)	(-1.045)	(-3.455)	(0.305)	(1.218)	(-1.121)	(-4.304)	(0.282)	(-2.826)	(-4.329)	(0.438)	(-2.825)
Observations	1,988,432	1,086,795	901,637	1,988,432	1,086,795	901,637	1,988,432	1,086,795	901,637	1,988,432	1,086,795	901,637
Adj. R^2	0.050	0.043	0.065	0.009	0.012	0.012	0.011	0.005	0.025	0.011	0.006	0.024
F-Test	22.95	8.681	29.12	6.924	3.822	21.41	93.57	5.522	60.77	96.11	6.028	59.37
Panel B: Impact on transaction costs for orders of individual investors only												
Event	-6.099***	-2.256*	-10.344**	-4.567***	-0.764	-8.476	-10.482***	-3.079	-18.096*	-10.519***	-3.170	-18.017*
	(-4.878)	(-1.660)	(-2.075)	(-5.043)	(-0.421)	(-1.613)	(-4.858)	(-0.978)	(-1.795)	(-4.987)	(-0.996)	(-1.798)
Treatment	18.501***	16.043***	19.281***	-22.456***	-16.278***	-27.613***	-5.529*	-2.420	-10.799*	-5.358	-1.675	-11.880**
	(4.076)	(4.095)	(3.597)	(-4.268)	(-3.859)	(-4.654)	(-1.699)	(-0.766)	(-1.965)	(-1.655)	(-0.537)	(-2.150)
DID	-4.657**	-0.484	-9.599*	2.512	2.822	1.702	-1.502	2.847	-6.888	-1.389	2.998	-6.608
	(-2.265)	(-0.220)	(-1.785)	(1.076)	(1.221)	(0.293)	(-0.588)	(0.853)	(-0.664)	(-0.551)	(0.889)	(-0.641)
Observations	826,955	486,657	340,298	826,955	486,657	340,298	826,955	486,657	340,298	826,955	486,657	340,298
Adj. R^2	0.014	0.019	0.022	0.020	0.021	0.035	0.003	0.000	0.015	0.003	0.000	0.015
F-Test	22.42	6.906	34.23	36.12	5.894	62.51	90.83	0.347	109.3	90.54	0.346	110.8
Panel C: Impact on transaction costs for orders of institutional investors only												
Event	-1.242***	-0.754***	-1.778***	-0.202	-0.132	-0.296*	-1.516***	-0.989**	-2.096***	-1.493***	-1.140**	-1.902***
	(-4.218)	(-3.235)	(-4.527)	(-0.677)	(-0.306)	(-1.727)	(-8.938)	(-2.510)	(-7.354)	(-7.517)	(-2.563)	(-9.409)
Treatment	9.927***	8.286***	11.778***	-0.516	-0.054	-1.105	9.938***	8.723***	11.236***	9.558***	8.601***	10.552***
	(4.630)	(4.734)	(4.554)	(-0.861)	(-0.106)	(-1.541)	(5.572)	(5.785)	(5.324)	(5.581)	(5.779)	(5.304)
DID	-3.316***	-1.996***	-4.792***	1.066***	1.514***	0.456	-2.410***	-0.613	-4.543***	-2.135***	-0.327	-4.274***
	(-5.067)	(-3.815)	(-5.344)	(2.865)	(2.943)	(1.476)	(-4.499)	(-0.964)	(-5.507)	(-4.081)	(-0.492)	(-5.551)
Observations	1,136,011	587,012	548,999	1,136,011	587,012	548,999	1,136,011	587,012	548,999	1,136,011	587,012	548,999
Adj. R^2	0.021	0.017	0.027	0.000	0.001	0.000	0.009	0.008	0.010	0.008	0.008	0.009
F-Test	27.07	17.45	29.99	5.368	11.41	2.331	47.19	12.26	64.02	39.22	12.18	84.00

Table I Switch from opacity to post-trade broker ID disclosure – Impact on transaction costs for liquid securities and individual and institutional investors

The following table presents the regression coefficient estimates for the third analysed event on 14th April 2009. For all securities but the Top5 traded stocks, NASDAQ OMX Helsinki reversed the regulations introduced on 2nd June 2008. Hence, the market remained opaque for the top traded securities, while post-trade broker ID disclosure was reintroduced for the remaining securities. The approach followed in the table below is the same as in Table 12. It presents the results for the Difference-in-Difference analysis for the control and the liquid securities within treatment group in detail.

Panel A presents the regression coefficients when the type of investor is disregarded and only distinguishes between seller- and buyer-initiated orders. Panel B shows the findings for individual investors only, again presenting the overall effect as well as the impact on buyer- and seller- initiated orders. Accordingly, Panel C presents the results for institutional investors. The t-statistics are presented in parentheses. ***, **, * denotes statistical significance at 1 %, 5 % and 10 %.

	Relative Effective Spread	Relative Effective Spread	Relative Effective Spread	Relative Realised Spread	Relative Realised Spread	Relative Realised Spread	Relative Market Impact	Relative Market Impact	Relative Market Impact	Relative Price impact	Relative Price impact	Relative Price impact
Order type	Any	Buy	Sell	Any	Buy	Sell	Any	Buy	Sell	Any	Buy	Sell
Panel A: Impact on transaction costs												
Event	-2.284***	-1.225*	-3.875*	-1.236***	-0.317	-2.690	-3.618***	-1.599	-6.655*	-3.615***	-1.706	-6.500*
	(-4.073)	(-2.432)	(-2.342)	(-11.801)	(-0.354)	(-1.718)	(-5.906)	(-1.136)	(-2.025)	(-6.493)	(-1.181)	(-2.028)
Treatment	2.456	1.651	4.637	-0.623	-0.813	0.490	1.946	0.990	5.261	1.916	1.089	4.976
	(1.220)	(0.994)	(1.956)	(-0.548)	(-0.681)	(0.514)	(0.668)	(0.382)	(1.668)	(0.657)	(0.415)	(1.607)
DID	-2.837**	-0.651	-7.198**	0.260	2.280	-3.784*	-2.512**	1.841	-11.092**	-2.425**	1.939	-10.944**
	(-3.656)	(-1.250)	(-3.289)	(0.553)	(1.585)	(-2.192)	(-3.640)	(0.966)	(-2.817)	(-3.774)	(1.016)	(-2.816)
Observations	1,073,264	586,076	487,188	1,073,264	586,076	487,188	1,073,264	586,076	487,188	1,073,264	586,076	487,188
Adj. R^2	0.027	0.016	0.049	0.017	0.005	0.040	0.024	0.011	0.049	0.024	0.011	0.049
F-Test	89.26	608.2	33.60	55.32	42.75	170.6	2711	0.955	88.76	1925	1.138	79.25
Panel B: Impact on transaction costs for orders of individual investors only												
Event	-5.705***	-1.961	-9.057	-4.731***	-0.764	-8.480	-10.475***	-2.775	-17.723	-10.516***	-2.841	-17.624
	(-4.371)	(-1.683)	(-1.855)	(-4.376)	(-0.387)	(-1.481)	(-4.457)	(-0.894)	(-1.643)	(-4.580)	(-0.908)	(-1.646)
Treatment	0.636	0.402	3.606	-3.060	-2.570	-1.932	-2.232	-2.364	2.029	-2.120	-2.117	1.676
	(0.161)	(0.156)	(1.003)	(-0.926)	(-0.982)	(-0.757)	(-0.305)	(-0.484)	(0.322)	(-0.290)	(-0.432)	(0.270)
DID	-2.479	0.614	-9.391	0.189	3.770	-6.313	-2.210	4.631	-15.994	-2.210	4.620	-15.827
	(-1.424)	(0.468)	(-1.816)	(0.157)	(1.398)	(-1.070)	(-0.758)	(1.149)	(-1.417)	(-0.763)	(1.145)	(-1.412)
Observations	395,340	237,979	157,361	395,340	237,979	157,361	395,340	237,979	157,361	395,340	237,979	157,361
Adj. R^2	0.003	0.001	0.012	0.002	0.001	0.008	0.002	0.000	0.010	0.002	0.000	0.010
F-Test	135.3	12.21	71.24	748.3	30.80	133.1	313.2	1.854	103.4	304.0	1.656	98.37
Panel C: Impact on transaction costs for orders of institutional investors only												
Event	-1.220***	-0.802**	-1.721***	-0.197	-0.128	-0.325	-1.508***	-0.990*	-2.108***	-1.499***	-1.120*	-1.927***
	(-4.069)	(-3.606)	(-4.193)	(-0.610)	(-0.272)	(-1.708)	(-8.478)	(-2.491)	(-6.669)	(-7.328)	(-2.514)	(-8.326)
Treatment	3.564*	2.745*	4.465*	0.891*	1.049**	1.003**	4.812**	4.044**	5.563**	4.685**	4.010**	5.308**
	(2.239)	(2.127)	(2.309)	(2.466)	(2.876)	(2.866)	(2.995)	(2.855)	(3.082)	(2.950)	(2.812)	(3.044)
DID	-2.609**	-1.680**	-3.654**	0.976*	1.170*	0.510	-1.804**	-0.567	-3.212***	-1.616**	-0.371	-3.048***
	(-3.539)	(-3.127)	(-3.716)	(2.279)	(2.385)	(1.113)	(-3.354)	(-0.925)	(-5.353)	(-2.671)	(-0.549)	(-4.746)
Observations	667,280	342,633	324,647	667,280	342,633	324,647	667,280	342,633	324,647	667,280	342,633	324,647
Adj. R^2	0.005	0.003	0.007	0.001	0.001	0.001	0.003	0.002	0.003	0.003	0.003	0.003
F-Test	16.94	13.08	20.62	3.641	27.61	2.777	45.58	7.738	65.38	39.56	6.221	85.71

Table J Switch from opacity to post-trade broker ID disclosure – Impact on transaction costs for illiquid securities and individual and institutional investors

The following table presents the regression coefficient estimates for the third analysed event on 14th April 2009. For all securities but the Top5 traded stocks, NASDAQ OMX Helsinki reversed the regulations introduced on 2nd June 2008. Hence, the market remained opaque for the top traded securities, while post-trade broker ID disclosure was reintroduced for the remaining securities. The approach followed in the table below is the same as in Table 12. It presents the results for the Difference-in-Difference analysis for the control and the liquid securities within treatment group in detail.

Panel A presents the regression coefficients when the type of investor is disregarded and only distinguishes between seller- and buyer-initiated orders. Panel B shows the findings for individual investors only, again presenting the overall effect as well as the impact on buyer- and seller- initiated orders. Accordingly, Panel C presents the results for institutional investors. The t-statistics are presented in parentheses. ***, **, * denotes statistical significance at 1 %, 5 % and 10 %.

	Relative Effective Spread	Relative Effective Spread	Relative Effective Spread	Relative Realised Spread	Relative Realised Spread	Relative Realised Spread	Relative Market Impact	Relative Market Impact	Relative Market Impact	Relative Price impact	Relative Price impact	Relative Price impact
Order type	Any	Buy	Sell	Any	Buy	Sell	Any	Buy	Sell	Any	Buy	Sell
Panel A: Impact on transaction costs												
Event	-2.284***	-1.225*	-3.875*	-1.236***	-0.317	-2.690	-3.618***	-1.599	-6.655*	-3.615***	-1.706	-6.500*
	(-4.073)	(-2.432)	(-2.342)	(-11.801)	(-0.354)	(-1.718)	(-5.906)	(-1.136)	(-2.025)	(-6.493)	(-1.181)	(-2.028)
Treatment	2.456	1.651	4.637	-0.623	-0.813	0.490	1.946	0.990	5.261	1.916	1.089	4.976
	(1.220)	(0.994)	(1.956)	(-0.548)	(-0.681)	(0.514)	(0.668)	(0.382)	(1.668)	(0.657)	(0.415)	(1.607)
DID	-2.837**	-0.651	-7.198**	0.260	2.280	-3.784*	-2.512**	1.841	-11.092**	-2.425**	1.939	-10.944**
	(-3.656)	(-1.250)	(-3.289)	(0.553)	(1.585)	(-2.192)	(-3.640)	(0.966)	(-2.817)	(-3.774)	(1.016)	(-2.816)
Observations	1,073,264	586,076	487,188	1,073,264	586,076	487,188	1,073,264	586,076	487,188	1,073,264	586,076	487,188
Adj. R^2	0.027	0.016	0.049	0.017	0.005	0.040	0.024	0.011	0.049	0.024	0.011	0.049
F-Test	89.26	608.2	33.60	55.32	42.75	170.6	2711	0.955	88.76	1925	1.138	79.25
Panel B: Impact on transaction costs for orders of individual investors only												
Event	-5.705***	-1.961	-9.057	-4.731***	-0.764	-8.480	-10.475***	-2.775	-17.723	-10.516***	-2.841	-17.624
	(-4.371)	(-1.683)	(-1.855)	(-4.376)	(-0.387)	(-1.481)	(-4.457)	(-0.894)	(-1.643)	(-4.580)	(-0.908)	(-1.646)
Treatment	0.636	0.402	3.606	-3.060	-2.570	-1.932	-2.232	-2.364	2.029	-2.120	-2.117	1.676
	(0.161)	(0.156)	(1.003)	(-0.926)	(-0.982)	(-0.757)	(-0.305)	(-0.484)	(0.322)	(-0.290)	(-0.432)	(0.270)
DID	-2.479	0.614	-9.391	0.189	3.770	-6.313	-2.210	4.631	-15.994	-2.210	4.620	-15.827
	(-1.424)	(0.468)	(-1.816)	(0.157)	(1.398)	(-1.070)	(-0.758)	(1.149)	(-1.417)	(-0.763)	(1.145)	(-1.412)
Observations	395,340	237,979	157,361	395,340	237,979	157,361	395,340	237,979	157,361	395,340	237,979	157,361
Adj. R^2	0.003	0.001	0.012	0.002	0.001	0.008	0.002	0.000	0.010	0.002	0.000	0.010
F-Test	135.3	12.21	71.24	748.3	30.80	133.1	313.2	1.854	103.4	304.0	1.656	98.37
Panel C: Impact on transaction costs for orders of institutional investors only												
Event	-1.220***	-0.802**	-1.721***	-0.197	-0.128	-0.325	-1.508***	-0.990*	-2.108***	-1.499***	-1.120*	-1.927***
	(-4.069)	(-3.606)	(-4.193)	(-0.610)	(-0.272)	(-1.708)	(-8.478)	(-2.491)	(-6.669)	(-7.328)	(-2.514)	(-8.326)
Treatment	3.564*	2.745*	4.465*	0.891*	1.049**	1.003**	4.812**	4.044**	5.563**	4.685**	4.010**	5.308**
	(2.239)	(2.127)	(2.309)	(2.466)	(2.876)	(2.866)	(2.995)	(2.855)	(3.082)	(2.950)	(2.812)	(3.044)
DID	-2.609**	-1.680**	-3.654**	0.976*	1.170*	0.510	-1.804**	-0.567	-3.212***	-1.616**	-0.371	-3.048***
	(-3.539)	(-3.127)	(-3.716)	(2.279)	(2.385)	(1.113)	(-3.354)	(-0.925)	(-5.353)	(-2.671)	(-0.549)	(-4.746)
Observations	667,280	342,633	324,647	667,280	342,633	324,647	667,280	342,633	324,647	667,280	342,633	324,647
Adj. R^2	0.005	0.003	0.007	0.001	0.001	0.001	0.003	0.002	0.003	0.003	0.003	0.003
F-Test	16.94	13.08	20.62	3.641	27.61	2.777	45.58	7.738	65.38	39.56	6.221	85.71