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Citation: Gietzmann, M. & Raonic, I. (2013). Thinly Traded Growth Stocks: A Joint Examination of Transparency in Communication and the Trading Platform. European Accounting Review, 23(2), pp. 257-289. doi: 10.1080/09638180.2013.768802

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Link to published version: https://doi.org/10.1080/09638180.2013.768802

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Thinly Traded Growth Stocks: A Joint Examination of Transparency in Communication and the Trading Platform

ABSTRACT: When thinly traded growth stocks (TTGS) listed on a secondary exchange experience difficulty in gaining investors' attention, one possible solution is to increase the intensity of disclosure. However, if the stock is traded on a quote-driven system, market makers can collude to maintain wide bid-ask spreads that discourage firms from disclosing. As a result, TTGS traded on a quote-driven system can face a liquidity trap that can prevent them from harvesting the benefits of increased disclosure activities. In this paper, we argue that the well-documented negative relation between disclosure and the bid-ask spread is likely to be moderated by the type of protocol chosen by exchanges to handle the trading of TTGS. To test our theory we use a unique setting created by the introduction of a hybrid order-driven protocol for TTGS in the UK. Following an increase in the disclosure activity by a TTGS, we find that the magnitudes of the predicted reductions in the bid-ask spreads are dependent on whether the TTGS switch their trading protocols.

Keywords: Disclosure, Market Microstructure JEL Classification: D82, D83

1. Introduction

This paper examines whether a firm's incentive to make voluntary public disclosures is affected by the exchange market microstructure that is used by investors to trade the stock. When making trading decisions, investors condition on both public information (firm, analyst and news disclosures) about the operating conditions of a candidate firm and also the responses (trades) of other investors in the market. This later conditioning arises because an investor anticipates that other investors' may have access to superior information and so does not want to be exploited by informed traders. How an investor learns about the trades of other investors depends critically upon the particular specification of the trading market microstructure that an exchange has chosen. The present study provides empirical data on two different trading systems which lead firms in equilibrium to make different disclosure decisions because of variation in the way information on trades is made available to investors. The principal contribution of this research is to argue that the observed disclosure practices of firms are driven not only by firm specific variables but also critically by choice (interaction) of the exchange protocol that determines the transparency of investors' trades.

An implication of this is that claims that observed disclosures represent equilibrium responses in a capital market are only valid within the context of the (constrained) exchange trading protocol in use. If that trading protocol was modified, the equilibrium firm disclosure levels could vary and hence the type of information available for pricing assets could be different. In other words, the way stock prices adjust following disclosures could be dependent upon the extent of transparency of the trades in the market. For large cap stocks, exchanges typically adopt similar trading protocols. In contrast, for growth stocks there is more observed variation in the use of different trading protocols. It is for these types of stocks that the interaction between firm disclosure incentives and trading system design are of most concern. In summary, this research looks at what happens to firms' disclosure incentives

when the transparency of investor trades changes. We argue that when the transparency of trades improves, investors' equilibrium bid ask spreads are reduced since investors benefit from observing how other (peer) investors react to firm disclosures. Hence, we predict that improvements in firm disclosures are likely to result in greater reductions in the bid ask spreads when trading is conducted under a more transparent trading protocol.

To empirically analyse how the variation in trading protocols influences the degree to which firms' disclosure activities affect bid ask spread, we exploit a unique setting in which thinly traded growth stocks (TTGS) trading on the London Stock Exchange's Alternative Investment Market (AIM) were able to switch from a quote-driven trading system (SEAQ) to a more (trade) transparent hybrid protocol (SETSmm). We focus our analysis on the 170 firms that switch from SEAQ to SETSmm and distinguish between high- and low-intensity disclosers. In using this setting, our tests are not restricted to observing just the separate effects of disclosure and the type of trading on bid ask spread, but capture their reinforcing or multiplicative effects on spread. The results indicate that firms which switch to SETSmm hybrid trading protocol see significant incremental benefits from high disclosure. Next, we examine the extent to which equivalent improvements in disclosure affect the changes in spread before versus after switching to a more transparent trading system. We find that the threshold at which an increase in disclosure becomes beneficial (in terms of its negative impact on spread) lowers after switching to SETSmm. Finally, we analyse the behaviour of 114 firms that do not switch to SETSmm and find no significant incremental effect of disclosure on spread. Additionally we carry out a bank of sensitivity tests using alternative proxies for disclosure measure and for the bid ask spread, and we also check for endogeneity bias in the model using a two-stage regression approach. These tests corroborate the original findings.

The research is organised as follows. In Section 2 trading protocols are briefly reviewed with emphasis on how trade transparency varies with protocol. Section 3 sets out the principal Hypothesis and discusses the implications for some previous accounting research. Section 4 describes data and methodology. Section 5 contains the empirical analysis with the conclusion being presented in Section 6.

2. Trade Transparency and Market Microstructure

Harris (2003) provides a detailed review of the trading protocols used in financial markets. The wide range of protocols can be broadly classified as being either order- or quote-driven markets with a range of hybrid market possibilities that mix specific features from either polar form. In quote-driven (dealer) markets, trading contracts are based on prices set by designated monopoly liquidity suppliers often called market makers. Sometimes, the possibility exists to negotiate a better price with a market maker, but they have private information on the bids and asks of other traders. In contrast, in a pure order-driven market, the constant flow of orders from traders provides the liquidity, which is transparent to all market participants. In such settings *transparency* is defined by the ability of market participants to obtain information on the trading process (pre or post trade).[1]

These varying forms of trade transparency give rise to different incentives for market makers. A number of early papers[2] argued that market makers (on a dealer market) have in the past acted in collusion to drive bid-ask spreads to wider levels than might result from pure competition. However, with the onset of greater regulatory scrutiny of potentially cooperative agreements, one might now wonder whether such behaviour is still possible. In response, Dutta and Madhaven's (1977:247) theoretical work argues that even when market makers interact in a non-cooperative fashion, spreads in a pure dealer market might still be set above competitive levels. The authors refer to these spreads as the establishment of *implicit*

collusion. Specifically, they argue that this type of collusion can lead to "cases when dealers' pricing strategies under implicit collusion coincide with those under explicit collusion". Hence, bid ask spreads remain large, and as a result incentives for disclosure are reduced. In order to stop market makers from colluding to keep the bid-ask spreads high one response could be to introduce pure order based protocols which limit such behaviour. However thinly traded stocks such as new growth stocks (TTGS) might suffer from extended periods of a lack of liquidity without any input from market makers. In response exchange designers have introduced[3] hybrid microstructures that simultaneously balance the two issues with transparent orders and some limited input from market makers providing continuous liquidity.

3. Hypothesis and Empirical Implications

The accounting literature that explains how increased disclosure lowers the information asymmetries among traders and improves stock liquidity and bid-ask spreads (see e.g., Verrecchia, 2001; Leuz and Verrecchia, 2000; Espinosa, Tapia and Trombetta, 2008; Welker, 1995; Healy, Hutton, and Palepu, 1999; Brown and Hillegeist, 2007) focuses primarily on large companies that trade on order driven markets characterized by high trade transparency. Since all market participants can obtain information on the trading responses of other agents, firms' disclosure activities can be rapidly impounded into prices. Motivated by the literature of Section 2 this research argues here that since in contrast, TTGS may be traded on quote driven markets with less trade transparency, market makers may strategically set wide bid ask spreads which can provide a disincentive for firms to make voluntary disclosures. The following subsection describes an institutional setting in which the trading protocol was redesigned from a quote driven to a hybrid order driven system. This interesting

empirical setting allows us to explore how the firm disclosure decisions were affected by the choice of trading system.

3.1. Disclosure and Trading protocols on the Alternative Investment Market

Our study makes use of the introduction of the hybrid trading structure SETSmm to the London Stock Exchange's Alternative Investments Market (AIM) for TTGS. The Alternative Investments Market has a *simplified* regulatory environment[4] that enables TTGS to raise capital from knowledgeable, mostly institutional, investors without having to incur the costs associated with complying with the stricter regulations for listing on the main market.[5] Since December 2005, AIM firms have been able to trade on the SETSmm trading system that is a hybrid of the SETS and SEAQ. SETS is a purely open order-driven limit book for trading the most liquid securities from the FTSE100 and the FTSE250, and SEAQ is a quote-driven system of market makers for the majority of small- to mid-cap stocks. SETSmm offers greater trade transparency for these stocks relative to the quote-driven system where specialist liquidity suppliers typically have a monopoly on trading and market making. However, SETSmm is not a purely order-driven system because it allows for limited support from market makers that are designed to enhance liquidity and the execution of trades.

With this redesign of the AIM trading system in mind this study investigate whether incentives to improve the disclosure activities of TTGS on AIM were enhanced by using a transparent hybrid trading protocol (SETSmm) instead of a quote-driven system (SEAQ). In other words, we examine whether improved disclosure efforts by TTGS on AIM are likely to result in greater reductions in the bid-ask spreads relative to when the trading is conducted under a quote-driven system. Towards this purpose, we start by observing the behaviour of 284 firms listed on AIM from January 2002 to December 2008. We distinguish between firms that switch to SETSmm from those that do not (i.e., remained on SEAQ). Since hybrid

trading was available to AIM firms only from December 2005, we do not expect to see significant differences between the two groups of firms in terms of reduced bid-ask spreads as a function of disclosure from 2002 to 2005. After the introduction of the hybrid trading, firms that did not switch to SETSmm by definition cannot harvest the benefits from more transparent trading in terms of reduced bid-ask spreads, but we do expect those firms that did switch from SEAQ to SETSmm to experience reduced spreads for an average level of disclosure. Taking into consideration advances in the copious literature (e.g., Leuz and Verrecchia, 2000) that documents lower bid-ask spreads and better stock liquidity for firms with improved disclosures, our key argument here is that the extent to which changing the trading protocol reduces bid-ask spreads varies across high- to low-intensity disclosers. To analyse the combined effects of disclosure *and* the trading protocol on bid-ask spreads, we make a distinction between high- and low-intensity disclosers for each group (switching versus non-switching) of firms. We focus our analysis on the switching group and expect that high disclosers within this group, exhibit greater reductions in bid-ask spreads relative to low disclosers in periods following a switch from SEAQ to SETSmm. In other words, we argue that the impact of relative disclosure intensity (high versus low) on the bid-ask spread is greater in the period after a firm has switched to transparent hybrid trading than in the period before switching. This leads to the following hypothesis:

H1: The association between the level of the disclosure intensity and the bid-ask spread is greater for the switching group in periods after the switch from a quote-driven to a hybrid trading system.

However, in a post-switching period, arguably firms can enter a different phase of their life cycle. For example, they can become larger with more dispersed ownership and with more diversified portfolios of business activities. Both might trigger greater intensity in their disclosure activities that, in turn, might affect the firms' bid-ask spreads. In order to

investigate whether the association between disclosure and the bid-ask spread is determined either by the type of trading or alternatively by firm characteristics related to the stage of the life cycle of a firm, we also control for the behaviour of the non-switching sample before and after the introduction of hybrid trading to AIM. If the strength of the relation between disclosure and the bid-ask spread is influenced by the firm's life cycle, then we expect to also observe a stronger relation between disclosure and the spread for the non-switching group (at a similar point in their life cycle) in the period after December 2005. After collecting data on firm age for both groups we argue that the relation between disclosure and the bid-ask spread is predominantly determined by the trading microstructure, rather than by life cycle considerations. Hence, we do not expect to see any significant difference in the strength of this relation before and after the introduction of SETSmm for the non-switching group of firms.[6]

4. Data and Methodology

The initial sample consists of the 284 firms listed on AIM from January 2002 to December 2008. Out of the 284 AIM firms, 170 firms moved from SEAQ to SETSmm from December 2005 to December 2008 (the switching group, i.e., "Adopters"), while 114 firms remained on SEAQ (the non-switching group, i.e., "Non-adopters"). Our analysis focuses on those 170 firms that switched and we distinguish between firm-quarters before and after an individual firm's move to SETSmm by using an indicator variable SET that equals one for quarters after and zero for quarters before the firm's switch to SETSmm. Within both groups of firms (switching and non-switching), we distinguish between low- and high-intensity disclosers.

4.1. Measurement of the Level of Disclosure Intensity

In this subsection, after providing a brief overview of the general disclosure environment in a secondary market, we describe how the level of disclosure intensity is measured.

The TTGS listed on a less regulated secondary market face some special issues when they attempt to improve their disclosures given their lack of size and low visibility. Traditionally visibility problems can be mitigated by increasing the analyst coverage and moving exchange, but for TTGS, this mitigation might be very costly and difficult to achieve. Before being able to attract the interest of a large number of analysts, many small- and medium-sized stocks engage in disclosure strategies to "wake up" the investor base by increasing press coverage (Bushee and Miller, 2012). Moreover, a proactive approach in building investor relations and public communications are key attributes of small-and medium-sized stocks for increasing their institutional investors' base and analyst following. In particular, the management tries to target the sophisticated institutional investors that have superior abilities to process and interpret the implications of public signals about growth prospects and therefore to enhance their potential for profitable trading opportunities (Kim and Verrecchia, 1994).

At issue then is how to develop a measure that represents the extent to which such stocks are successful at communicating their growth prospects to such investors. A simple numerical count of firm disclosures might be a very noisy measure because a poor communicating firm might find it easier to replicate the number of disclosures of a company with a more effective communication strategy by simply releasing bland reports with little strategic information. In order to deal with this problem of potential costless mimicking, we propose that the news worthiness of any given corporate disclosure can be represented by how many times newswire services report on the original disclosure, such as Regulatory News Service (RNS) release.[7]

Specifically, for each firm in our sample we obtain information from Factiva on the number of press release wires issued daily between January 2002 and December 2008. Overall newswire frequencies responding to a firm's RNS release (disclosure) is our proxy

for the newsworthiness of corporate disclosures.[8] For each firm we sum the number of *all* daily newswires in a quarter and construct a variable labelled WIRES.[9]

WIRES = the quarterly sum of the daily press release wires

Next, separately for each group of firms (switching and non-switching)[10] we develop a measure of the disclosure level, DIS, that is defined by the quintile rankings of sample observations based on the value of the variable WIRES by pooling overall quarter periods for that particular group of companies when making the quintile calculation. Observations within the lowest (highest) 20% of the variable WIRES are assigned the rank of 1 (5).[11]

Panel A of Table 1 provides the summary statistics for the two groups of firms (switching and non-switching) by focusing on those firm observations that fall into the highest quintile of the disclosure rank (high disclosers). Columns 5 to 11 provide the results when we restrict our attention to the 170 AIM firms that switch from the SEAQ to SETSmm during the research period between 2002 and 2008. For this sample, following the introduction of the hybrid trading in the last quarter of 2005, the number of constituents increases monotonically except in the second and third quarters of 2008 and reaches its peak at the end of 2008 at 165 (see column 5). Turning the focus to listings of high disclosers (highest disclosure quintile), columns 6 and 7 show a relatively slow increase from 2002 to the third quarter of 2004. The number of high disclosers doubles between the third and the fourth quarter of 2004, and then again during 2005, a period that coincides with the preparation and introduction of the hybrid trading to AIM. The rise in the number of high disclosers' continues as a steady trend (except in the second quarters of 2006 and 2007

respectively and in the first quarter of 2008) until reaching its peak at 68 (41.21% of the total number of constituents for the switching group) in the last quarter of 2008. Columns 8 to 11 present the breakdown of the high disclosers' constituents into quarters before and after individual firms' move to the hybrid SETSmm protocol. In the quarter in which SETSmm is first introduced to AIM, almost half of the high disclosing firms (18 out of 39) have not yet moved from SEAQ. However, one year later (in the fourth quarter of 2006), the proportion of the high disclosers that have not switched to SETSmm dropped to a level of 21% (12 out of 56), then in the fourth quarter of 2007 to 6% (4 out of 61), and finally during 2008 all firms that are high disclosers are also trading under the hybrid trading protocol.

Compared to the switching (adopting) group, little variation is seen in the proportion of the high disclosers in the non-switching group (column 4) between the first quarter of 2002 and the last quarter of 2008. For example, the fraction of the non-switching firms that are ranked as high disclosers at the beginning of the sample period (2002, first quarter) is 24%, but it is 28% at the end of the period (2008, last quarter) with little variation during the period. The corresponding percentages for the switching sample are 4% and 41% respectively. In addition, we compare the mean and median values of the quarterly disclosure intensity (WIRES) for the two groups of firms before and after the introduction of SETSmm in Panel B of Table 1. The analysis confirms similar patterns to those observed in Panel A. For example, for the switching group, the median (mean) WIRES[12] increases from 9 (164.62) in periods before to 21 (255.55) in periods after the introduction of SETSmm; while for the non-switching group, WIRES increases from 9 (12.34) before to only 12 (18.19) after the fourth quarter of 2005[13]. Hence, the initial descriptive analysis is indicative of a link existing between high disclosure intensity (i.e. press newswire frequency in a quarter) and trading under a more transparent protocol.

4.2. Multivariate Analysis

In order to empirically test our predictions, we develop empirical models with which we examine the effects of the trading protocols and the varying levels of disclosure on the bid-ask spreads after controlling for a number of other independent factors. Although Hypothesis 1 focuses on the association between disclosure and the bid-ask spread *conditional* upon the type of trading protocol, we first assess the unconditional effects of disclosure and the type of trading, respectively, on the bid-ask spreads as a benchmark for our later tests and also to benchmark against prior studies (e.g., Leuz and Verrecchia, 2000) by fitting the following model to the switching sample:

$$Spread_{i,t} = \alpha_0 + \alpha_1 DIS_{i,t} + \alpha_2 SET_{i,t} + \delta' C + \varepsilon_{i,t} . \quad (1)$$

The $Spread_{i,t}$ is a quarterly median of the daily quoted bid-ask spreads measured at the end of each trading day as the absolute difference between the bid and ask price divided by the mid-point, DIS is a quintile ranking of the variable WIRES, $SET_{i,t}$ is a dummy variable defined to be one for the quarters after the firm's switch to hybrid trading and zero otherwise, and C is the vector of the control variables. In selecting a set of control variables, we rely on the literature on cross-sectional determinants of stock liquidity (e.g., Leuz and Verrecchia, 2000; Daske *et al.*, 2008; Amihud and Mendelson, 2008; Lang *et al.*, 2012) that identify the size, dispersed ownership, financial leverage, profitability, financing needs, and the index inclusion as factors that influence the bid-ask spread and liquidity. For example, the higher the firm's financial leverage, the greater the risk to its equity, which leads to greater sensitivity of its share price to new information about the firm. As a result of greater stock-price sensitivity, the potential for informed investors to take advantage of less informed market makers and investors is greater. This advantage in turn leads to wider bid-ask spreads, increased volatility, and lower liquidity. Similarly, the greater the presence of inside shareholders, the greater potential for insiders to trade on the private information they have

about the firm, the greater the compensation required by less informed investors to cover for the risk of trading with more informed counterparties, and the wider the bid-ask spread is. We define size as a market value of equity (SIZE), ownership dispersion as the percentage of widely held shares (OWNERDIS), financial leverage as a ratio of the total financial debt to total assets (FLEV), profitability as a ratio of the operating income to total assets (ROA), and capital intensity as the proportion of long-term assets in total assets as a proxy for financing needs (CAPINT). We also add a dummy variable for the inclusion in the FTSE AIM UK 50 index, because the constituents of the index are likely to have characteristics such as greater visibility and closer investor attention that directly affect the bid-ask spread. Following the established theoretical and empirical evidence on the association between the bid-ask spread and corporate disclosure (e.g., Leuz and Verrecchia, 2000), the coefficient on DIS is expected to be negative. In addition, discussion in Section 3.1 suggests that those firms that switch from the quote-driven to the hybrid type of trading protocol have significantly smaller spreads in the periods following their switch at an average level of disclosure; hence, the coefficient on SET is expected to be negative. However, the main concern of the present study is that the negative effects of hybrid trading on the bid-ask spread might not hold to the same extent across all growth stocks. For example, in a more transparent trading environment, some firms might see greater benefits from increasing their disclosure intensity that in turn further reduces their bid-ask spreads. As a result, the bid-ask spread cannot only be determined by adding the separate effects of disclosure and the trading protocol, but instead the two determining factors are likely to interact with each other and provide a reinforcing or *multiplicative* effect on the bid-ask spread. Hence, the key issue here is to empirically investigate the interactive effect between disclosure and the type of trading on the bid-ask spread. With this in mind, we extend the model to assess the interaction between DIS and SET:

$$Spread_{i,t} = \alpha_0 + \alpha_1 DIS_{i,t} + \alpha_2 SET_{i,t} + \alpha_3 DIS_{i,t} * SET_{i,t} + \delta' C + \varepsilon_{i,t} \quad (2)$$

The interaction coefficient on $DIS_{i,t}$*$SET_{i,t}$ measures the incremental effect of both high disclosure and more transparent trading. If the two variables reinforce each other, then we expect to observe a double transparency effect on the bid-ask spread – not only are trades more transparent but firms also see greater benefits from disclosing more information about their activities (Hypothesis H1). In this case, the coefficient on $DIS_{i,t}$*$SET_{i,t}$ should be significantly negative. In other words, the sum of the coefficients on $DIS_{i,t}$, $SET_{i,t}$, and $DIS_{i,t}$*$SET_{i,t}$ should be significantly smaller than the sum of the coefficients on $DIS_{i,t}$ and $SET_{i,t}$[14]. If this is the case, then the effects of transparency of trading and disclosure intensity are complementary.

Next, in order to further check inferences regarding the association between trading and the disclosure intensity, we add a non-switching group of firms to the analysis and address two important issues.[15] First, we test whether the extent at which disclosure impacts the bid-ask spread is the same for the switching and non-switching groups in the periods before the introduction of SETSmm to AIM. We re-estimate model (2) for the two classes of firms and compare the coefficients on DIS. We predict that the difference in the coefficients should not be significant.[16] Second, we check whether the association between disclosure and the bid-ask spread might be driven by firm characteristics inherent to the life-cycle stage of the individual firm, instead of the type of trading. Hence, for the non-switching group, we now re-estimate model (2) by substituting variable $SET_{i,t}$ with a new dummy variable $POST_{i,t}$ that takes the value of one for quarters following the introduction of SETSmm (last quarter of 2005) and zero otherwise:

$$Spread_{i,t} = \alpha_0 + \alpha_1 DIS_{i,t} + \alpha_2 POST_{i,t} + \alpha_3 DIS_{i,t} * POST_{i,t} + \delta' C + \varepsilon_{i,t} \quad (2a)$$

We compare the impact of disclosure on the bid-ask spread between the periods before and after SETSmm introduction, and predict that for non-adopters, there should not be a significantly incremental effect for disclosure on the bid-ask spread in the periods following the introduction of SETSmm relative to the periods before for the non-switching sample. In this case, the coefficient on $DIS_{i,t}$*$POST_{i,t}$ should not be significantly different from zero.

When empirically assessing the association between voluntary disclosure and the bid-ask spread, we need to recognize that endogeneity might be an issue, because firms can choose to improve their disclosures for reasons that could also affect the spread directly. The endogenous nature of disclosure has been well documented by both economic theory and empirical research (Leuz and Verrecchia, 2000; Nikolaev and van Lent, 2005; Cohen, 2008; Brown and Hillegeist, 2007; Clinch and Verrecchia, 2011; Chen, Matsumoto, and Rajgopal, 2011). These studies argue that there might be unobservable firm characteristics that affect both disclosure and the bid-ask spread that could lead to a spurious association between the two variables. For example, if better disclosure results in lower information asymmetry among investors, which in turn reduces the bid-ask spread, then thinly traded, high information asymmetry firms that wish to improve their stock liquidity and to lower their bid-ask spread might have greater incentives to make more voluntary disclosures. As a result, the disclosure variable could be endogenously determined within the model that attempts to estimate the relation between the bid-ask spread and the disclosure intensity. We address this important concern in two ways. First, in order to control for the unobservable firm-specific characteristics we use fixed effects in both models (1) and (2) and report both OLS and fixed effects models' results, with the emphasis on the latter. Second, in subsection 5.4 we address the endogenous nature of the relation between disclosure and the bid-ask spread, and check the validity of the OLS against the approach with instrumental variables (2SLS).

4.3. Data Description

To perform our analyses, we obtain the financial data from Worldscope, the stocks prices and the number of shares outstanding from Datastream, and the listings of the AIM stocks and AIM50 index constituencies from the London Stock Exchange. Panel C of Table 1 reports descriptive statistics for the switching group over the whole research period (columns 1 to 6) and for quarters before and after the firm's switch from SEAQ to SETSmm respectively (columns 7 to 9). The findings presented in Panel C indicate that a typical switching AIM firm has a market capitalization of approximately 95 million British pounds, is weakly leveraged with less than 4% of debt to total assets ratio, and with somewhat concentrated ownership (with a median dispersed ownership figure at a level of 66% of total shareholdings). In terms of the all-newswire frequencies, we find a positively skewed distribution of the variable WIRES (the median and the mean are 16 and 222 respectively) that indicates that the majority of the observed firms have a relatively small frequency of press-release newswires in a quarter, but the bulk of the firms with a high quarterly frequency of press-release newswires is concentrated in the 90th percentile of the variable WIRES[17]. The descriptive statistics for the two distinct periods before and after switching to the hybrid trading discloses several patterns in the data. After having moved to SETSmm, firms tend to be bigger in size, more profitable, with more dispersed ownership, and greater disclosure relative to firms that have not yet switched to the hybrid trading system.

Panel D of Table 1 sets out the descriptive statistics for the non-switching sample (non-adopters). The findings presented in Panel D indicate that a typical non-switching AIM firm has a market capitalization of approximately 41 million British pounds, with a debt to total assets ratio of approximately 6%, and with a median dispersed ownership at 62% of the total shareholdings. Variables SIZE, ROA, OWNERDIS, and CAPINT are all calculated on a quarterly basis during the research period from January 2002 to December 2008.

5. Empirical Analysis

5.1. Difference-in-Difference Analysis

We start our empirical analyses for the switching sample with a univariate comparison of the bid-ask spreads across the high and low disclosers before and after the quarter in which a particular firm switches from SEAQ to SETSmm by using a difference-in-difference design. This simple approach allows us to take into account the variation in the mean spreads between the high and low disclosers in the quarters before and in the quarters after the switch to SETSmm and to compare the relative changes over time. Table 2 reports the results. We find that the high disclosers have significantly lower mean spreads compared to low disclosers both in quarters before (0.04656 versus 0.08179) and after the switch (0.02272 versus 0.03938). However, the decrease in spread between the pre- and post-switch quarters is significantly larger (by around 2%) for the low disclosers than for the high disclosers. In other words, the high disclosers that have not switched yet exhibit a higher mean spread than low disclosers that have already switched (0.04656 vs. 0.03938). These initial findings show that when restricting attention to the sample of pre-switch high disclosers, both before and after their opportunity to switch to SETSmm, this sample exhibits significantly higher bid-ask spreads when trading under the traditional market maker quote based system as compared to when they trade under SETSmm. In order words, despite high-disclosure intensity, firms do not appear to achieve desired benefits in terms of spread reduction if they remain on a quote-driven trading system.

5.2. Multivariate Analysis Results

We continue the empirical analysis by estimating the regression equation (1) that models unconditional effects of disclosure and the type of trading respectively on the bid-ask spread. We report the OLS estimates and correct the standard errors for within-firm correlations in

column 1 of Table 3. The results show a significant unconditional negative relation between disclosure and SPREAD (DIS = -0.090, *p*-value < 0.001). This is consistent with the literature of the effect of disclosure on the capital markets (e.g., Daske *et al*., 2008). The coefficient on SET is negative and statistically significant at the 1% level (SET = -0.387, *p*-value < 0.001).

This result is in line with our baseline prediction discussed in Section 3.1 that bid-ask spreads are significantly smaller in periods 'after' compared to the periods 'before' switching from the quote-driven to the hybrid type of trading at an average level of disclosure

In column 2 of Table 3, we add firm fixed effects in order to control for unobservable firm-specific characteristics. The results from column 2 are consistent with those in column 1, that is, the coefficients on DIS and SET are negative and statistically significant at the 1% level (DIS= -0.052, *p*-value < 0.001; SET= -0.254, *p*-value < 0.001). This significance suggests that the negative associations between disclosure spread, and the type of trading, respectively, are not driven by omitted firm-specific factors.

Next, we replicate the analysis by using an alternative measure of liquidity instead of the bid-ask spread: the price impact of trades (PRIMPACT) that captures the ability of investors to trade in a share without moving its price. The impact is measured as the ratio of the absolute daily stock return to the British pound value of the daily stock trading volume[18] (Amihud, 2002). The ratio assesses liquidity costs or market illiquidity for a particular stock, that is, the trading volume needed to move the stock price. The higher the ratio, the less liquid the stock is. We calculate quarterly medians of the daily ratios. We expect that greater disclosure and more transparent trading, respectively, will result in a greater ability for investors to trade with less of a price impact and with a lower stock illiquidity. Columns 3 and 4 of Table 3 report the results for PRIMPACT. The results from the OLS specification

are in column 3, while column 4 reports the results after adding the firm fixed effects. The results from both types of specifications confirm the negative association between illiquidity, disclosure, and the type of trading respectively. For example, the coefficient on DIS in the fixed effects specification in column 4 is negative and statistically significant at the 5% level, while the coefficient on SET is negative and statistically significant at the 1% level.

Overall, because the results for PRIMPACT confirm those for SPREAD, we conclude that illiquidity decreases with disclosure and more transparent trading, respectively.

5.3 Interaction Effects

The results obtained thus far indicate that the greater transparency of the hybrid trading relative to the quote-driven trading protocol results in significantly lower spreads and improved stock liquidity. In addition, the results confirm the well-documented (e.g., Daske *et al.*, 2008) concept that increased disclosure efforts lead to lower bid-ask spreads and better stock liquidity. Here, we argue that the negative effect of disclosure on the bid-ask spread is likely to be reinforced by the type of trading. In other words, not only that trading under the more transparent protocol results in lower bid-ask spreads, but also firms see greater benefits from disclosing more information to the market. Hence, we hypothesise that the bid-ask spread will be determined by an interactive or *multiplicative* effect of disclosure and the type of trading. Thus, we estimate model (2) to assess the conditional effect of disclosure and the type of trading on the bid-ask spread and liquidity.

Columns 1, 2, 3, and 4 of Table 4 report the results for the bid-ask spread. Column 1 shows the results of an OLS specification and in column 2 we re-estimate model (2) with firm fixed effects. The coefficient of interest is $DIS_{i,t}$*$SET_{i,t}$. While the coefficient from the OLS specification is negative and significant at the 10% level (-0.079, *p*-value < 0.010), after adding firm effects the coefficient increases both in magnitude and statistical significance (-

0.112, *p*-value < 0.001). This result suggests that the omitted unobservable firm characteristics are likely to affect the manner in which disclosure and the type of trading interact with each other, and the manner in which they jointly impact the bid-ask spread[19]. Looking at the separate effects of disclosure and the type of trading on SPREAD, we find that the coefficients on DIS are statistically non-significant both for the OLS and for the fixed effects specifications. The non-significant coefficient on DIS indicates that increased disclosure efforts by firms in periods before their switch to the more transparent trading protocol do not result in significantly improved bid-ask spreads.[20]. The coefficients on SET are negative and statistically significant at the 1% level in all specifications of the model (2) implying that switching the trading protocol reduces the SPREAD at an average level of disclosure. Jointly, the findings indicate that the desired reductions in the spread by means of disclosure are achieved only if firms improve their disclosure activities *in conjunction* with switching to the more transparent trading system.[21]

These findings provide empirical support for Hypothesis H1 that the association between disclosure and the bid-ask spread is reinforced by the type of trading protocol[22]. This reinforcement is demonstrated clearly in Figure 1. For example, for firms from the lowest quintile of disclosure, the spreads before and after firms' switching, are in fact quite similar. On the other hand, the difference in spreads between the two periods increases with the level of disclosure that indicates the stronger degree of association between disclosure and the bid-ask spread in periods after compared to periods before the switch (see the steeper negative slope for "adopters after switch" relative to the slope for "adopters before switch").

To assess the validity of our disclosure measure, we re-estimate model (2) using the (company) RNS release wires instead of all (sources) newswires when computing the disclosure variables WIRES and the corresponding quintile ranking DIS. Columns 3 and 4 report the results from the re-estimated model that uses the OLS and the fixed effect

specifications respectively. The results are similar in magnitude and significance to those in columns 1 and 2. In particular, after controlling for firm fixed effects, the differential coefficient on $DIS_{i,t}$*$SET_{i,t}$ is negative and significant at the 1% level (-0.111, *p*-value < 0.001) that confirms the interacting effects between the disclosure intensity and the hybrid type of trading[23].

In columns 5 and 6, we replicate our analysis in columns 1 and 2 after replacing the dependent variable with PRIMPACT. The results in columns 5 (OLS specification) and 6 (including fixed effects) confirm the negative effect of the interaction between disclosure and the trading on the bid-ask spread (coefficients on $DIS_{i,t}$*$SET_{i,t}$ are negative and statistically significant at the 1% level). In addition, the coefficients on DIS and SET are positive and significant at the 5% level and better in the OLS and fixed effects specifications. The positive and significant coefficients on DIS suggest that illiquidity increases with disclosure in periods before switching to SETSmm.[24] However, this positive effect is reversed in periods after switching, as indicated by the estimate for the combined effect of disclosure and trading of -0.092 (i.e., 0.096 – 0.188) for the fixed effects specification.[25] In this case, the inference is that firms might accrue benefits from increased disclosure intensity, in terms of better liquidity, *provided that* they trade in the transparent trading protocol. The positive and significant coefficients on SET imply that hybrid trading increases PRIMPACT, thus reducing liquidity. This decrease in liquidity is consistent with the literature on market microstructure (Theissen, 2003) that documents that TTGS might experience strong price impacts as a result of moving from non-anonymous "upstairs" dealers to an anonymous "downstairs" market, especially if the trades are large, which is typical of institutional investors' trading.

We have already argued the importance of the trading protocol for reducing the bid-ask spread and the illiquidity can differ between the high- and low-intensity disclosers. The

analysis of the coefficients on SET and DIS*SET provides support for the argument, given that the positive effect of the hybrid trading on illiquidity is significantly lower for high-intensity disclosers (the coefficients on DIS*SET are negative and significant in both specifications of the model) that implies that disclosure exerts the corrective influence on the positive association between the hybrid trading and PRIMPACT.

Based on these results, we infer that liquidity is significantly greater for the high relative to low disclosers in periods *after* compared to the periods *before* switching from the quote driven to the hybrid type of trading. This finding provides further empirical support for Hypothesis H1.

5.3.1. Analysis of Disclosure Improvements

An important related question is, whether in periods *before* switching to the hybrid type of trading, the benefits of increased disclosure (in terms of its impact on spread and liquidity) are too marginal to motivate firms to improve their disclosure levels. In other words, if in certain markets (such as in quote driven market segments), TTGS do not experience benefits from increased disclosure efforts, or the benefits are too marginal, then the concern is whether these companies do not improve their disclosure levels because the trading system prevents them from harvesting the benefits of increased disclosure activities.

To address this question, we carry out the following empirical analysis. We construct a balanced subsample by matching observations by disclosure rank and size across the two periods (pre and post switching to SETSmm), so that the disclosure distributions are comparable before and after the switch. Using this 'matched subsample' we split the observations into those with positive and negative changes in the quarterly press release wires (WIRES). We then examine the extent at which positive 'changes' in WIRES (Δ^{+}WIRES)

affect the changes in spread (Δ SPREAD) before and after switching to SETSmm by fitting a modified version of model (2):

$$\Delta Spread_{i,t} = \alpha_0 + \alpha_1 \Delta^{+} WIRES_{i,t} + \alpha_2 SET_{i,t} + \alpha_3 \Delta^{+} WIRES_{i,t} * SET_{i,t} + \delta' C + \varepsilon_{i,t} \qquad (3)$$

We compute variable WIRES using the RNS release wires as well as all newswires.

If the benefit of increased disclosure on spread does not exist or it is too marginal before switching to SETSmm then the coefficient on Δ^{+}WIRES should be statistically insignificant. If the benefit on spread significantly increases after switching then the coefficient on the interaction variable Δ^{+}WIRES*SET should be negative. The results are reported in Panel A of Table 5. The coefficient estimates on Δ^{+}WIRES are insignificant while the coefficients on Δ^{+}WIRES*SET are significantly negative both in the OLS (Columns 1 and 3) and in the fixed effect models (Columns 2 and 4) and for the both specifications of the WIRES variable (all newswires and RNS), indicating that an *equivalent* increase in disclosure results in significantly larger impact on spread in the post- relative to the pre-switching period, controlling for other factors. In other words, these findings suggest that the threshold at which an increase in WIRES becomes beneficial in terms of its negative impact on the spread lowers after switching to SETSmm.

If this is the case then after switching, firms should be more motivated to increase their disclosure levels and we should observe a higher frequency of improvements in disclosure levels in the post- relative to the pre-switching period. We relax the requirement for constant disclosure distributions in a pre- versus post-switch period and using the full sample of observations[26] we check the frequency of disclosure improvements across the two periods. Disclosure improvements are defined as positive quarterly changes in the two specifications of variable WIRES (RNS and all newswires). As expected, we find (Panel B of Table 5)

higher frequency of disclosure increases in periods 'after' relative to periods 'before' switching to SETSmm. This result corroborates our original descriptive statistics results (reported in Table 1) which show greater disclosure levels 'after' relative to 'before' switching (Panel C of Table 1) and also results reported in Panel A of Table 1 which show an increasing number of high disclosing firms in quarters after switching to SETSmm.

5.3.2. Analysis for Non-adopters

The analysis is continued by estimating model (2a) for the non-switching group, that is, the firms that continue to trade under the quote-driven system after the introduction of SETSmm to AIM (non-adopters).

We report the results in Table 6. We use firm fixed effects to address the concern that disclosure is endogenous due to omitted firm characteristics. To economize on space, we do not report the OLS specification of the model as the results are very similar. In column 1 we analyse the relation between disclosure and the bid-ask spread in periods before and after the introduction of SETSmm. One purpose of this analysis is to test whether the extent to which disclosure impacts spread, is the same for the switching and non-switching groups in periods before the introduction of SETSmm. We re-estimate model (2a) for the switching group and compare the coefficients on DIS between the two groups of firms by using the seemingly unrelated regression models.[27] We find that the effect of disclosure on the bid-ask spread for the non-switching group is not significantly different from the corresponding effect for the switching group.[28] In column 2 we replicate the analysis in column 1 after replacing the dependant variable with PRIMPACT. The results confirm those reported for SPREAD in column 1 (i.e., the difference in coefficients on DIS between non-adopters and adopters is not statistically significant). Another purpose of the analysis is to investigate whether the association between disclosure and the bid-ask spread might be driven by firm characteristics

inherent to the life-cycle stage of an individual firm instead of the type of trading system. We compare the impact of disclosure on the bid-ask spread between the periods before and after SETSmm introduction, and find no significant incremental effect of disclosure on the bid-ask spread in the period following SETSmm introduction (i.e., the coefficient on $DIS_{i,t}$*$POST_{i,t}$ is not significantly different from zero). Column 2 of Table 6 reports the results for PRIMPACT that confirm this finding[29].

Overall, these results are consistent with the predictions discussed in Section 3.1 concerning the association between disclosure and bid ask spread for non-adopters relative to adopters.

Figure 2 clearly illustrates these findings. The similarity in the degree at which disclosure affects the bid-ask spread between non-adopters and adopters in periods before is reflected in similar slopes for the "non-adopters before 2005q4"and for the "adopters before the switch."

Moreover, when we compare the slopes before and after for the two groups of firms (non-adopters versus adopters), the incremental effect of disclosure is evident only for the "adopters group – after the switch."[30]

5.4. Endogeneity Controls

The purpose of this section is to address the concern with regard to the potential endogeneity bias pertinent to models with disclosure and the bid-ask spread as a response variable. In particular, if disclosure is endogenously determined by factors that also affect the bid-ask spread, then the OLS coefficients α_1 and ($\alpha_1+\alpha_3$) in models (1) and (2) that capture the impact of disclosure on SPREAD before and after switching to SETSmm, respectively, will be biased.[31] One approach to address the endogenous relation between DIS and SPREAD is

to estimate a two-stage structural equation model (2SLS) that instruments DIS in the first stage with a set of exogenously determined variables (see Leuz and Verrecchia, 2000). The key issue here is to choose the appropriate instrumental (exogenous) variables that explain disclosure but that are uncorrelated with SPREAD except through the variables controlled for (Larcker and Rusticus, 2010). In choosing instrumental variables, other studies (e.g., Leuz and Verrecchia, 2000; Balakrishnan *et al.*, 2011) rely on the empirical evidence (e.g., Lang and Lunhdolm, 1993; Ahmed and Curtis, 1999; Hail, 2002; Brown and Hillegeist, 2007) with regard to the cross-sectional determinants of corporate disclosure and select firm-specific factors such as ownership dispersion, firm performance, analysts' coverage, and financing needs as suitable exogenous instruments (exclusion restrictions). However, our results so far indicate the factors that are arguably correlated with disclosure are firm-specific characteristics that also affect the bid-ask spread directly. Hence, our approach is to identify a variable(s) that the literature has not yet considered as an exclusion restriction in reduced-form spread regressions. Towards this goal, we use a method that examines the dynamics with which potential instruments affect disclosure and spread respectively (see Balakrishnan *et al.*, 2011). In particular, we investigate the timeline within which disclosure and spread respond to TTGS financial performance.

For the type of TTGS that list on AIM, financial performance is often highly dependent on the success of one or two highly uncertain projects. For instance, during our sample period, a significant number of "extractive industries" are TTGS, such as oil and other mining exploration companies. For these "one big project companies" financial performance typically does not evolve smoothly – there might be a number of periods of little or no results reported followed by a "shock" success or failure reported if the company hits it big with an exploration well or finds nothing after incurring significant costs.

We conjecture that positive reports on financial performance decrease the bid-ask spread contemporaneously as this reflects TTGS' ability to demonstrate realized rather than just promised growth potential. We then investigate whether this decrease in the bid-ask spread is sustained for periods beyond one quarter, and find that while financial performance is associated with a significant decrease in the bid-ask spread contemporaneously, this decrease in the spread does not persist beyond the concurrent quarter. In other words, we find that the lagged performance (in quarters *t= -2* and *t=-1*) does not affect spread in quarter *t=0*. Next, following the research (e.g., Skinner, 1997) that firms might strategically vary the timing of voluntary disclosures, we test to see if TTGS change their disclosure intensity in a timely and sustainable way in response to shocks in project results. We find that TTGS respond to financial performance by changing the frequency of their disclosures and that these changes take effect for a period of beyond one quarter. In other words, disclosure is correlated with contemporaneous (in quarter *t= 0*) and lagged performance (in quarters *t= - 2* and *t= - 1*) measures. Those patterns suggest that while contemporaneous performance violates the exclusion restriction, and thus is not suitable for instrumenting disclosure, the lagged performance measures have the potential to be valid instruments for our disclosure variable. The empirical tests that assess the impact of lagged (in addition to contemporaneous) performance measures on the bid-ask spread are explained in the Appendix.

Having established that the prior period's performance can act as a valid instrumental variable, we re-estimate model (1) for the adopters' sample with the 2SLS technique where we instrument the disclosure variable DIS by using the lagged values of the performance proxy ROA. We do not use the 2SLS approach for model (2), because we do not have a suitable instrument for the interaction variable $DIS_{i,t}$*$SET_{i,t}$.[32] Columns 1 and 2 of Table 7 report the results from the first- and second-stage (reduced form) regressions respectively.

Compared to the results from columns 1 (OLS specification) and 2 (fixed effects specification) in Table 3, the coefficient on DIS in column 2 is no longer statistically significant; but the coefficients on all other explanatory variables are consistent in magnitudes and statistical significance (except for the coefficients on OWNERDIS and VOLAT that are now significant at the 5% level or better). We perform a set of diagnostic tests in order to compare the instrumental variables method with the OLS approach. First, we assess the strength of the instruments.[33] The R-squared of the first-stage regression is 22.6%, while the partial R-squared and a partial F-statistic for the joint significance of the coefficients on instrumental variables are 0.5% and 2.34 respectively (with a *p*-value = 0.0970). Second, we test the exogeneity of the instruments. We perform a test of over-identifying restrictions that accepts the hypothesis of the exogeneity of the instruments (Chi2 is 0.108 with a *p*-value = 0.7428).[34] Finally, using a Durbin-Wu-Hausman test, we test the null hypothesis that the OLS is an appropriate estimation technique, (i.e., the null hypothesis is that DIS is exogenous). The test accepts the null hypothesis (F = 0.581, *p*-value = 0.4460) of the appropriateness of the OLS compared to the 2SLS technique. The tests carried out here confirm the validity of the method approach used to obtain the findings reported in Table 3, and more importantly in Tables 4, 5 and 6 that provide empirical evidence that the extent to which disclosure intensity affects the bid-ask spread and liquidity *varies* across the two types of trading protocols.

6. Conclusion

When the management of thinly traded growth stocks consider increasing the intensity of voluntary disclosures in order to attract additional investors, the success of such efforts depends on the specific market microstructure under which the stock is traded. Under some trading protocols, collusive behaviour by market makers can significantly reduce the potential

gains when companies are considering increasing disclosure intensity. That is, the potential benefits from disclosure cannot be appraised separately without taking account of the chosen trading microstructure. In this research, we provide empirical support for the hypothesis that a hybrid trading protocol can provide greater incentives for management to increase disclosure. We show how AIM stocks that switched to SETSmm hybrid trading system saw significant incremental benefits from being high disclosers, but for the stocks that did not switch the benefits from high disclosure were muted, as Figure 1 illustrates. For TTGS when there is a switch from quote to hybrid market microstructure, we show that there is a significant negative impact on bid-ask spread. This finding implies that the threshold at which a marginal increase in disclosure becomes beneficial (in terms of impact on spread) is lowered.

References

Aboody, D. and Kasznik, R. (2000) CEO stock option awards and the timing of corporate voluntary disclosures. *Journal of Accounting and Economics*, 29, pp. 73-100.

Ahmed, K. and Courtis, J. (1999)Associations between corporate characteristics and disclosure levels in annual reports: a meta-analysis. *British Accounting Review*, 31 (1), pp. 35-61.

Aiken, L.S. and West, S.G. (1991) Multiple regression: testing and interpreting interactions. *Sage Publications*

Amihud, Y. (2002) Illiquidity and Stock Returns .*Journal of Financial Markets*, 5, pp. 31-56.

Amihud, Y. and Mendelson, H. (2008) Liquidity, the value of the firm, and corporate finance. *Journal of Applied Corporate Finance*, 20 (2), pp. 32-45.

Anthony, J.H and Ramesh, K. (1992) Association between accounting performance measures

and stock prices: A test of the life cycle hypothesis. *Journal of Accounting and Economics*, 15 (2-3), pp. 203-227.

Arcot, S., Black, J. and Owen, G. (2007) The rise of aim as a stock market for growing companies. Working paper, London School of Economics.

Balakrishnan, K., Billings, M.,Kelly, B. and Ljungqvist, A. (2011)Shaping liquidity: on the causal effects of voluntary disclosure. Working paper.

Brown, S. and Hillegeist, S. A. (2007) How disclosure quality affects the level of information asymmetry. *Review of Accounting Studies*, 12, pp. 443-77.

Bushee, B. and Miller, G. (2012) Investor relations, firm visibility, and investor following. *The Accounting Review,* forthcoming.

Chen, S., Matsumoto, D. A. and Rajgopal, S. (2011) Is silence golden? An empirical analysis of firms that stop earnings guidance. *Journal of Accounting and Economics*, 51, pp. 134-50.

Clinch, G. and Verrecchia, R. E. (2011) Endogenous disclosure choice. Working paper

Cohen, D. A. (2008)Does information risk really matter? An analysis of the determinants and economic consequences of financial reporting quality. *Asia Pacific Journal of Accounting and Economics*, 15, pp. 69-90,.

Christie, W., Harris, J. and Schultz, P. (1994) Why did *NASDAQ* market makers stop avoiding odd-eighth quotes. *Journal of Finance*, 49 (5), pp. 1813 - 40.

Daske, H., Hail, L., Leuz, C. and Verdi, R. (2008) Mandatory IFRS reporting around the world: early evidence on the economic consequences. *Journal of Accounting Research*, 46 (5), pp. 1085-1142.

De Jong, F. and Rindi, B. (2009) *The Microstructure of Financial Markets*. (location: Cambridge).

Dutta P. K. and Madhaven, A. (1997) Competition and collusion in dealer markets. *Journal of Finance*, 52 (1), pp. 245 –76.

Espinosa, M., Tapia, M. and Trombetta, M. (2008) Disclosure and liquidity in a driven by orders market: empirical evidence from panel data. *Investigaciones Economicas*, 23 (3), pp. 339-70.

Hail, L. (2002) The impact of voluntary corporate disclosures on the ex-ante cost of capital for Swiss firms. *The European Accounting Review*, 11 (4), pp. 747-73.

Hail, L. and Leuz, C. (2006) International differences in the cost of equity capital: do legal institutions and securities regulation matter. *Journal of Accounting Research*, 44 (3), pp. 485–531.

Harris, L.(2003) *Trading & Exchanges: Market Microstructure for Practitioners*.(location: Oxford University Press).

Healy, P.M., Hutton, A. and Palepu, K. (1999)Stock performance and intermediation changes surrounding sustained increases in disclosure. *Contemporary Accounting Research*, 16 (3), pp. 485-520.

Kim, O. and Verrecchia, R. (1994) Market liquidity and volume around earnings announcements. *Journal of Accounting and Economics*, 17 (1/2), pp. 41-67.

Lang, M. and Lundholm, R. (1993)Cross-sectional determinants of analyst ratings of corporate disclosures. *Journal of Accounting Research*, 31 (2), pp. 246-271.

Lang, M., Lins, K.V. and Maffett ,M. (2012)Transparency, liquidity and valuation: international evidence. *Journal of Accounting Research*, forthcoming.

Lapointe-Antunes, P., Cormier, D., Magnan, M. and Gay-Angers, S. (2006)On the relationship between voluntary disclosure, earnings smoothing and the value-relevance of earnings: the case of Switzerland. *European Accounting Review*, 15 (4),pp. 465-505.

Larcker, D. F. and Rusticus, T. O. (2010)On the use of instrumental variables in accounting research. *Journal, of Accounting and Economics*, 49, pp. 186-205.

Leuz, C. and Verrecchia, R. (2000) The economic consequences of increased disclosure. *Journal of Accounting Research*, 38 (3), pp. 91-124.

Mendoza, J.M. (2008) Securities regulation in low-tier listing venues: the rise of the alternative investment market. *Fordham Journal of Corporate and Financial Law*, 13 (2), pp. 257-328.

Nikolaev, V. and van Lent, L. (2005) The endogeneity bias in the relation between cost-of-debt capital and corporate disclosure policy. *European Accounting Review*, 15 (4), pp. 677-724.

Nimalendran, M. and Petrella, G. (2003) Do thinly traded stocks benefit from specialist intervention? *Journal of Banking and Finance*, 27 (9), pp. 1823–54.

Parlour, C. and Seppi, D. (2003) Liquidity based competition for order flow .*Review of Financial Studies*, 16(2), pp. 301-43.

Seppi, D. (1997) Liquidity provision with limit orders and a strategic specialist. *The Review of Financial Studies*, 10(1), pp. 103-50.

Skinner, D. (1997) Earnings disclosures and stockholders lawsuits. *Journal of Accounting and Economics*, 23, pp. 249-82.

Theissen, E. (2003) Trader anonymity, price formation and liquidity. *European Finance Review*, 7 (1), pp. 1-26.

Verrecchia, R. (2001) Essays on disclosure. *Journal of Accounting and Economics*, 32 (1/3), pp. 97-180.

Welker, M. (1995) Disclosure policy, information asymmetry, and liquidity in equity markets. *Contemporary Accounting Research*, 11 (2), pp. 801-27.

Table 1. Descriptive statistics

Panel A: Summary statistics for non-adopters and adopters across quarters

Quarter	Non-adopters - total	Non-adopter firms - High disclosers		Adopters listings - total	Adopter firms - High disclosers		Adopters - High disclosers before their switch to SETSmm		Adopters - High disclosers after their switch to SETSmm	
		Number	% (of the total non-adopters listings)		Number	% (of the total adopters listings)	Number	% (of the total adopters listings)	Number	% (of the total adopters listings)
1	2	3	4	5	6	7	8	9	10	11
2002q1	54	13	24.07	49	2	4.08	2	4.08		
2002q2	54	10	18.52	51	2	3.92	2	3.92		
2002q3	56	11	19.64	56	2	3.57	2	3.57		
2002q4	57	13	22.81	57	2	3.51	2	3.51		
2003q1	57	13	22.81	57	6	10.53	6	10.53		
2003q2	57	11	19.30	58	6	10.34	6	10.34		
2003q3	57	11	19.30	56	5	8.93	5	8.93		
2003q4	60	8	13.33	59	5	8.47	5	8.47		
2004q1	62	7	11.29	64	4	6.25	4	6.25		
2004q2	63	12	19.05	70	8	11.43	8	11.43		
2004q3	66	17	25.76	79	9	11.39	9	11.39		
2004q4	71	13	18.31	89	18	20.22	18	20.22		
2005q1	82	12	14.63	100	19	19.00	19	19		
2005q2	87	16	18.39	105	33	31.43	33	31.43		
2005q3	96	20	20.83	117	33	28.21	33	28.21		
2005q4	104	26	25.00	124	39	31.45	18	14.52	21	16.94
2006q1	114	28	24.56	130	42	32.31	16	12.31	26	20
2006q2	114	23	20.18	131	34	25.95	13	9.92	21	16.03
2006q3	114	30	26.32	146	45	30.82	13	8.9	32	21.92
2006q4	114	31	27.19	153	56	36.60	12	7.84	44	28.76
2007q1	114	40	35.09	156	60	38.46	11	7.05	49	31.41
2007q2	114	40	35.09	157	55	35.03	3	1.91	52	33.12
2007q3	114	41	35.96	158	58	36.71	7	4.43	51	32.28
2007q4	114	44	38.60	162	61	37.65	4	2.47	57	35.19
2008q1	114	31	27.19	164	56	34.15			56	34.15
2008q2	114	32	28.07	163	59	36.20			59	36.2
2008q3	114	28	24.56	163	60	36.81			60	36.81
2008q4	114	32	28.07	165	68	41.21			68	41.21
Total	2,451			3,039						

Panel B: Disclosure intensity for adopters versus non-adopters in periods before and after the introduction of SETSmm

	Adopters						Non Adopters					
	Wires (all newswires)			Wires (RNS)			Wires (all newswires)			Wires (RNS)		
	Number	Mean	Median	Number	Mean	Median	Number	Mean	Median	Number	Mean	Median
Before 2005q4	1,126	164.62	9	1,126	31.21	5	1,088	12.34	9	1,088	4.16	3
After 2005q4	1,960	255.55	21	1,960	68.17	8	1,456	18.19	12	1,456	7.22	5
Total	3,086	222.37	16	3,086	54.68	6	2,544	15.69	11	2,544	5.91	4

Panel C: Distribution of variables and correlation matrix - adopters

	1	2	3	4	5	6	7	8	9	10	11	12
							Before switching		After switching		Before- vs. After-switching	
	Number	Mean	Std.Dev	P10	Median	P90	Number	Mean	Number	Mean	Difference (8 - 10)	p-value
SIZE	2,914	175,415	320,906	11,657	95,886	347,072	1,347	105,315	1,567	235,674	-130,359	0.0000
OWNERDIS	2,052	0.6291	0.4780	0.3297	0.6615	0.9847	845	0.5848	1,207	0.6601	-0.0753	0.0004
ROA	2,282	-0.0141	0.1124	-0.0743	0.0065	0.0424	1,011	-0.0254	1,271	-0.0051	-0.0202	0.0000
CAPINTENS	2,356	0.2271	0.2716	0.0067	0.1040	0.6758	1,130	0.2234	1,226	0.2305	-0.0070	0.5297
FLEV	2,368	0.1420	0.2783	0	0.0381	0.3778	1,135	0.1321	1,233	0.1511	-0.0190	0.0968
GROWTH	1,824	1.1096	4.1644	-0.1687	0.2353	1.8850	716	1.5335	1,108	0.8357	0.6978	0.0005
WIRES (All newswires)	3,086	222.37	1,141.16	3	16	93	1,492	151.78	1,594	288.44	-136.6569	0.0009
WIRES (RNS)	3,086	54.68	281.80	1	6	24	1,492	30.71	1,594	77.13	-46.42038	0.0000
SPREAD	2,894	0.0460	0.0571	0.0082	0.0306	0.0952	1,363	0.0622	1,531	0.0315	0.0307	0.0000
PRIMPACT	2,941	0.0062	0.1487	0.0000	0.0000	0.0006	1,403	0.0048	1,538	0.0076	-0.0028	0.6067
ZERORET	2,999	0.3531	0.2688	0.0615	0.2879	0.7538	1,408	0.4973	1,591	0.2256	0.2717	0.0000
VOLAT	3,006	0.0321	0.0549	0.0093	0.0243	0.0577	1,412	0.0289	1,594	0.0349	-0.0061	0.0025
VOLUME	2,941	0.0041	0.0061	0.0005	0.0025	0.0087	1,403	0.0041	1,538	0.0041	0.0001	0.7049
AIM50	3,086	0.2074	0.4055	0	0	1	1,492	0.2011	1,594	0.2133	-0.0122	0.4026

	WIRES (All newswires)		WIRES (RNS)		SPREAD		PRIMPACT		VOLAT		SIZE		OWNERDIS		ROA		CAPINTENS		FLEV		VOLUME		AIM50		SET
WIRES (All newswires)	1.000																								
WIRES (RNS)	0.987	#	1.000																						
SPREAD	-0.050	#	-0.058	#	1.000																				
PRIMPACT	-0.004		-0.004		0.054	#	1.000																		
VOLAT	0.018		0.018		0.127	#	0.038	#	1.000																
SIZE	0.120	#	0.124	#	-0.169	#	-0.023		0.083	#	1.000														
OWNERDIS	0.053	#	0.056	#	-0.111	#	0.023		-0.036		-0.014		1.000												
ROA	0.032		0.037		-0.275	#	0.007		-0.159	#	0.000		0.056	#	1.000										
CAPINTENS	-0.080	#	-0.092	#	-0.061	#	-0.007		-0.044	#	0.078	#	0.045	#	0.023		1.000								
FLEV	-0.044	#	-0.043	#	0.024		0.008		0.020		0.031		0.039		-0.515	#	0.257	#	1.000						
VOLUME	0.007		-0.003		-0.076	#	-0.023		0.074	#	-0.047	#	0.102	#	-0.017		-0.008		0.034		1.000				
AIM50	0.036	#	0.005		-0.190	#	0.019		-0.042	#	0.322	#	0.003		0.122	#	0.157	#	-0.040		0.048	#	1.000		
SET	0.060	#	0.043	#	-0.269	#	0.010		0.055	#	0.203	#	0.078	#	0.089	#	0.013		0.034		-0.007		0.015		1.000

Panel D: Distribution of variables and correlation matrix – non-adopters

	1	2	3	4	5	6	7	8	9	10	11	12
							Before 2005q4		After 2005q4		Before- vs. After-2005q4	
	Number	Mean	Std.Dev	P10	Median	P90	Number	Mean	Number	Mean	Difference (8 - 10)	p-value
SIZE	2,411	82,079	308,524	8,919	41,237	109,916	965	78,344	1,446	84,572	-6,228.64	0.6273
OWNERDIS	1,826	0.6241	0.4200	0.3379	0.6176	0.9858	563	0.6124	1,263	0.6294	-0.0171	0.4230
ROA	2,025	-0.0130	0.0920	-0.0827	0.0060	0.0468	733	-0.0254	1,292	-0.0060	-0.0194	0.0000
CAPINTENS	2,126	0.2203	0.2479	0.0081	0.1105	0.6275	838	0.2142	1,288	0.2242	-0.0101	0.3601
FLEV	2,144	0.1243	0.1713	0.0000	0.0566	0.3358	846	0.0941	1,298	0.1440	-0.0499	0.0000
WIRES (All newswires)	2,544	15.69	17.67	3.00	11.00	31.00	1,088	12.3364	1,456	18.1923	-5.8559	0.0000
WIRES (RNS)	2,544	5.91	7.72	1	4.00	12.00	1,088	4.1572	1,456	7.2246	-3.0674	0.0000
SPREAD	2,415	0.0630	0.0635	0.0218	0.0455	0.1200	970	0.0768	1,445	0.0537	0.0231	0.0000
PRIMPACT	2,459	0.0032	0.0532	0.0000	0.0000	0.0006	1,006	0.0075	1,453	0.0002	0.0073	0.0008
ZERORET	2,462	0.5175	0.2469	0.1385	0.5469	0.8182	1,006	0.5349	1,456	0.5055	0.0294	0.0037
VOLAT	2,462	0.0277	0.0229	0.0087	0.0216	0.0510	1,006	0.0300	1,456	0.0261	0.0039	0.0000
VOLUME	2,459	0.0026	0.0039	0.0004	0.0016	0.0056	1,006	0.0027	1,453	0.0025	0.0002	0.1885
AIM50	2,544	0.0366	0.1877	0	0	0	1,088	0.0441	1,456	0.0309	0.0132	0.0790

	WIRES (All newswires)		WIRES (RNS)		SPREAD		PRIMPACT		VOLAT		SIZE		OWNERDIS		ROA		CAPINTENS		FLEV		VOLUME	AIM50
WIRES (All newswires)	1.000																					
WIRES (RNS)	0.610	#	1.000																			
SPREAD	-0.098	#	-0.072	#	1.000																	
PRIMPACT	-0.037		-0.035		0.133	#	1.000															
VOLAT	0.181	#	0.054	#	0.338	#	0.235	#	1.000													
SIZE	0.040	#	0.042	#	-0.017		-0.015		0.037		1.000											
OWNERDIS	0.056	#	0.035		-0.021		-0.012		0.044		0.012		1.000									
ROA	-0.040		-0.053	#	-0.225	#	0.010		-0.232	#	-0.029		-0.026		1.000							
CAPINTENS	-0.014		-0.028		-0.081	#	0.082	#	-0.017		0.013		-0.109	#	0.152	#	1.000					
FLEV	0.026		0.026		0.032		-0.028		-0.001		-0.034		-0.029		-0.017		0.194	#	1.000			
VOLUME	0.185	#	0.131	#	-0.062	#	-0.037		0.298	#	-0.066	#	0.092	#	-0.130	#	-0.074	#	0.000		1.000	
AIM50	0.180	#	0.108	#	-0.056	#	-0.012		-0.020		0.099	#	0.010		0.029		0.057	#	0.038		0.001	1.000

Notes: Panel A shows the total number of AIM listings for which the data on press release newswire frequency is obtainable from Factiva between 2002 and 2008. Adopters are companies that switched from the SEAQ to SETSmm trading system during the research period. Non-adopters are firms that trade on the SEAQ only. The sample consists of a maximum of 3,086 (2,544) observations from 170 (114) firms during 28 quarters from January 2002 to December 2008 for Adopters (Non-adopters). High disclosers are observations falling into the fifth quintile of the variable WIRES. The WIRES is a quarterly sum of all the daily press release newswires calculated for each firm. Sub-columns labelled "Number" report the number of listings for each quarter for a particular category from that column. Sub-columns labelled "%" report the number of listings for that category as a percentage of the total number of listings for each quarter. Panel B compares the disclosure intensity measured by the variable WIRES between Adopters and Non-adopters in periods before and after the introduction of the hybrid trading system to AIM. Variable is WIRES is computed using two methods: (1) as the quarterly sum of

all daily news wires and, (2) as the quarterly sum of daily RNS wires. Panels C, and D report the distribution of the variables used in the analyses and their correlations for Adopters and Non-adopters respectively. The SIZE is the market value of equity. The OWNERDIS is computed as the percentage of widely held shares. The ROA is calculated as the ratio of operating income to total assets. The CAPINT is the proportion of long-term assets in total assets. The FLEV is the ratio of total financial debt to total assets. The SPREAD is a quarterly median of daily quoted spreads measured at the end of each trading day as the absolute difference between the bid and ask price divided by the mid-point. The PRIMPACT is the quarterly median of the daily ratios computed as the absolute daily stock return divided by the British pound value of the daily trading volume. The VOLAT is the quarterly standard deviation of daily stock returns. The VOLUME is the quarterly median of daily turnover ratio, i.e., the daily number of shares traded divided by the total number of shares outstanding. The AIM50 is the binary variable indicating that the firm is included in the AIM50 index. We delete observations falling in the 1stand 99th percentile for all variables except for the indicator variable. The *,**, and *** indicate statistical significance at the 10%, 5%, and 1% levels respectively for a *t*-test that tests whether the means are equal between the two sub-periods. The$^{\#}$ indicates statistical significance at the 5% level or lower.

Table 2. Difference in spreads before and after switching to SETSmm across high and low disclosers – adopters

SPREAD		Low disclosers (a)	High disclosers (b)	Difference (a) - (b)	t stat	*p*-value
Before switch(1)	Number of observations	462	139			
		0.0818	0.0466	0.0352	4.5826	0.0000
After switch (2)	Number of observations	169	415			
		0.0393	0.0227	0.0167	4.5984	0.0000
					Difference-in-difference	*p*-value
	Difference (1) - (2)	0.0424	0.0238		0.0185	0.0270
	t stat	6.0731	6.0044			
	p-value	0.0000	0.0000			

Notes: Adopters are companies that switch from the SEAQ to SETSmm trading system during the research period. The sample consists of a maximum of 3,086 observations from 170firms during 28 quarters from January 2002 to December 2008. High (Low) disclosers are observations falling into the fifth (first) quintile of the variable WIRES. The WIRES is a quarterly sum of all daily press release newswires calculated for each firm. The SPREAD is a quarterly median of the daily quoted spreads measured at the end of each trading day as the absolute difference between the bid and ask price divided by the mid-point.

Table 3. The effects of the disclosure intensity and the type of trading on the bid-ask spread and liquidity

	Dependent variable			
	SPREAD 1	SPREAD 2	PRIMPACT 3	PRIMPACT 4
DIS	**-0.090*** **	**-0.052*** **	**-0.012***	**-0.008** **
	(-2.757)	**(-2.928)**	**(-1.762)**	**(-1.974)**
SET	**-0.387*** **	**-0.254*** **	**-0.227*** **	**-0.202*** **
	(-5.337)	**(-5.626)**	**(-12.107)**	**(-19.801)**
Controls				
Ln(SIZE)	-0.261***	-0.509***	-0.035***	-0.080***
	(-3.469)	(-20.116)	(-2.883)	(-14.072)
Ln(VOLUME)	-0.299***	-0.183***	-0.057***	-0.030***
	(-9.427)	(-7.888)	(-7.466)	(-5.680)
Ln(VOLAT)	0.238***	0.042	-0.086***	-0.099***
	(4.228)	(1.254)	(-5.897)	(-13.123)
Ln(OWNERDIS)	-0.177**	0.088	-0.045**	0.014
	(-2.287)	(1.466)	(-2.326)	(1.030)
FLEV	-0.036*	-0.075***	0.002	-0.007**
	(-1.830)	(-5.394)	(0.611)	(-2.358)
CAPINT	0.104	1.036***	0.007	0.154***
	(0.580)	(5.809)	(0.209)	(3.823)
AIM50	-0.189*	-0.014	-0.040**	0.008
	(-1.733)	(-0.220)	(-2.066)	(0.549)
ROA	-1.765***	-1.006	-0.182	-0.346**
	(-2.707)	(-1.548)	(-1.207)	(-2.353)
Constant	-1.319*	1.052***	0.205	0.773***
	(-1.828)	(3.532)	(1.558)	(11.488)
Observations	1169	1169	1173	1173
R-squared	0.457	0.478	0.617	0.623
Regression type	OLS	Fixed effects	OLS	Fixed effects

Notes: Ordinary least squares and firm fixed effects specifications of disclosure and the type of trading are regressed on SPREAD and PRIMPACT respectively. The sample consists of the unbiased panel of 170 firms that switch from the quote-driven to the hybrid trading protocol during the research period between 2002 and 2008 (Adopters). The dependant variable in columns 1 and 2 is SPREAD that is computed as the quarterly

median of daily quoted spreads measured at the end of each trading day as the absolute difference between the bid and ask price divided by the mid-point. The dependent variable in columns 3 and 4 is PRIMPACT, the quarterly median of the daily ratios computed as the absolute daily stock return divided by the British pound value of the daily trading volume. The DIS is the quintile ranking based on the variable of disclosure, WIRES, that is computed as the quarterly sum of all the daily news wires. The SET is the binary indicator that takes the value of one for firm-quarters after switching to the hybrid trading structure (SETSmm) and zero otherwise. The SIZE is the market value of equity. The VOLUME is the quarterly median of the daily turnover ratio, i.e., the daily number of shares traded divided by the total number of shares outstanding. The VOLAT is the quarterly standard deviation of the daily stock returns. The OWNERDIS is computed as the percentage of widely held shares. The FLEV is the ratio of the total financial debt to the total assets. The CAPINT is the proportion of long-term assets in the total assets. The AIM50 is the binary variable indicating that the firm is included in the AIM50 index. The ROA is calculated as the ratio of the operating income to the total assets. The specification in columns 2 and 4 include firm fixed effects. The standard errors are adjusted for the group correlation at the firm level in the regressions without firm fixed effects. We delete observations falling in the 1stand 99th percentile for all the variables except for the indicator variable. Robust *t*-statistics are reported in the parenthesis. The *,**, and *** indicate statistical significance at the 10%, 5%, and 1% levels respectively.

Table 4. Interaction effects of the disclosure intensity and the type of trading on the bid-ask spread and liquidity

	Dependent variable					
	SPREAD 1	SPREAD 2	SPREAD 3	SPREAD 4	PRIMPACT 5	PRIMPACT 6
DIS	-0.041	0.007	0.058	0.043*	0.126***	0.096**
	(-0.908)	(0.310)	(1.192)	(1.860)	(2.749)	(2.340)
SETS	-0.380***	-0.229***	-0.421***	-0.241***	1.487***	1.479***
	(-5.393)	(-5.084)	(-5.254)	(-5.338)	(7.068)	(8.830)
DIS * SETS	**-0.079***	**-0.112*****	**-0.075**	**-0.111*****	**-0.183*****	**-0.188*****
	(-1.869)	**(-4.138)**	**(-1.411)**	**(-3.930)**	**(-3.108)**	**(-4.080)**
Controls (C)						
Ln(SIZE)	-0.264***	-0.516***	-0.284***	-0.523***	-1.031***	-0.936***
	(-3.457)	(-20.511)	(-3.478)	(-20.918)	(-27.797)	(-22.484)
Ln(VOLUME)	-0.299***	-0.183***	-0.333***	-0.188***	-0.905***	-0.821***
	(-9.378)	(-7.948)	(-10.129)	(-8.142)	(-26.040)	(-21.837)
Ln(VOLAT)	0.241***	0.043	0.215***	0.045	1.101***	1.118***
	(4.278)	(1.300)	(3.875)	(1.331)	(17.564)	(21.235)
Ln(OWNERDIS)	-0.176**	0.102*	-0.171**	0.114*	0.040	0.080
	(-2.274)	(1.714)	(-2.198)	(1.905)	(0.552)	(0.796)
FLEV	-0.036*	-0.074***	-0.034*	-0.075***	0.020	0.016
	(-1.825)	(-5.353)	(-1.718)	(-5.390)	(1.265)	(0.708)
CAPINT	0.094	1.081***	0.124	1.111***	-0.083	0.259
	(0.524)	(6.097)	(0.684)	(6.256)	(-0.770)	(0.884)
AIM50	-0.180*	0.005	-0.230*	0.006	0.012	-0.030
	(-1.662)	(0.073)	(-1.899)	(0.091)	(0.180)	(-0.320)
ROA	-1.695**	-0.889	-1.611**	-0.707	0.882	-0.080

	(-2.561)	(-1.377)	(-2.604)	(-1.086)	(1.526)	(-0.081)
Constant	-1.527*	0.992***	-1.600*	1.032***	0.069	-0.411
	(-1.921)	(3.378)	(-1.816)	(3.498)	(0.163)	(-0.862)
Observations	1169	1169	1169	1169	953	953
R-squared	0.460	0.487	0.446	0.483	0.822	0.686
Regression type	OLS	Fixed effect	OLS	Fixed effect	OLS	Fixed effect

Notes: Ordinary least squares and firm fixed effects specifications of disclosure and the type of trading are regressed on SPREAD and PRIMPACT respectively. The sample consists of the unbiased panel of 170 firms that switch from the quote-driven to the hybrid trading protocol during the research period between 2002 and 2008 (Adopters). The dependant variable in columns 1, 2, 3, and 4 is SPREAD that is computed as the quarterly median of daily quoted spreads measured at the end of each trading day as the absolute difference between the bid and ask price divided by the mid-point. The dependent variable in columns 5 and 6 is PRIMPACT, the quarterly median of the daily ratios computed as the absolute daily stock return divided by the British pound value of the daily trading volume. DIS is the mean adjusted quintile ranking based on the disclosure variable WIRES. Variable WIRES is computed using two alternative methods. In Columns 1, 2, 5 and 6 it is computed as the quarterly sum of all daily news wires, whereas in Columns 3 and 4 it is computed as the quarterly sum of daily RNS wires. The SET is the binary indicator that takes the value of one for firm-quarters after switching to the hybrid trading structure (SETSmm) and zero otherwise. The SIZE is the market value of equity. The VOLUME is the quarterly median of the daily turnover ratio, i.e., the daily number of shares traded, divided by the total number of shares outstanding. The VOLAT is the quarterly standard deviation of the daily stock returns. The OWNERDIS is computed as the percentage of widely held shares. The FLEV is the ratio of the total financial debt to the total assets. The CAPINT is the proportion of long-term assets in the total assets. The AIM50 is the binary variable indicating that the firm is included in the AIM50 index. The ROA is calculated as the ratio of the operating income to the total assets. The specification in Columns 2 and 4 include firm fixed effects. Standard errors are adjusted for group correlation at the firm level in regressions without firm fixed effects. We delete observations falling in the 1st and99thpercentile for all the variables except for the indicator variable. Robust t-statistics are reported in the parenthesis. The *,**, and *** indicate statistical significance at the 10%, 5%, and 1% levels respectively.

Table 5 Panel A. Interaction effects of the disclosure improvements and the type of trading on the bid-ask spread

	Dependent variable			
	ΔSPREAD	ΔSPREAD	ΔSPREAD	ΔSPREAD
	WIRES is based on all newswires	WIRES is based on all newswires	WIRES is based on RNS	WIRES is based on RNS
	1	2	3	4
Δ^{+}WIRES	-0.051	0.011	0.306*	0.295
	(-0.274)	(0.054)	(1.737)	(1.516)
SETS	0.624	0.501	0.282	0.311
	(1.081)	(0.884)	(0.605)	(0.650)
Δ^{+}WIRES * SETS	**-0.437****	**-0.425***	**-0.682*****	**-0.654****
	(-2.095)	**(-1.775)**	**(-2.885)**	**(-2.528)**
Controls (C)				
Ln(SIZE)	-0.449*	-0.469**	-0.227	-0.244
	(-1.914)	(-2.328)	(-1.448)	(-1.452)
Ln(VOLUME)	-0.187	-0.034	-0.381***	-0.363**
	(-1.017)	(-0.182)	(-3.668)	(-2.557)
Ln(VOLAT)	0.619***	0.693**	0.406*	0.377*
	(2.836)	(2.222)	(1.743)	(1.703)
Ln(OWNERDIS)	1.417	1.320***	-0.021	-0.053
	(1.522)	(3.338)	(-0.071)	(-0.156)
FLEV	-0.074	-0.063	-0.011	-0.017
	(-1.042)	(-0.645)	(-0.130)	(-0.192)
CAPINT	-0.575	-0.718	-0.414	-0.393
	(-0.771)	(-0.892)	(-0.648)	(-0.675)
AIM50	0.463	0.826	-0.155	-0.092
	(0.912)	(1.594)	(-0.382)	(-0.235)
ROA	0.163	-0.602	-2.515	-2.893
	(0.092)	(-0.193)	(-1.014)	(-0.925)
Constant	2.303	3.873	-3.936**	-3.806*
	(0.633)	(1.519)	(-2.016)	(-1.785)
Observations	110	110	98	98
R-squared	0.286	0.302	0.300	0.308
Regression type	OLS	Fixed effect	OLS	Fixed effect

Table 5 Panel B. Frequency of disclosure improvements before and after the switch

Δ^{+}WIRES	Before		After	
	Frequency	Mean	Frequency	Mean
All newswires	730	40.79589	761	49.72142
RNS	649	14.2188	704	19.16761

Notes: In Panel A, a reduced sample of Adopters is constructed by matching observations by disclosure rank and then by size across the two periods (pre and post SETSmm), so that the disclosure distributions are comparable before and after switching to SETSmm. The dependant variable is the change in variable SPREAD. SPREAD is computed as the quarterly median of daily quoted spreads measured at the end of each trading day as the absolute difference between the bid and ask price divided by the mid-point. Δ^{+}WIRES is the positive change in variable WIRES. WIRES is computed using two alternative methods. In Columns 1 and 2 it is computed as the quarterly sum of all daily news wires, whereas in Columns 3 and 4 it is computed as the quarterly sum of daily RNS wires. The SET is the binary indicator that takes the value of one for firm-quarters after switching to the hybrid trading structure (SETSmm) and zero otherwise. The SIZE is the market value of equity. The VOLUME is the quarterly median of the daily turnover ratio, i.e., the daily number of shares traded, divided by the total number of shares outstanding. The VOLAT is the quarterly standard deviation of the daily stock returns. The OWNERDIS is computed as the percentage of widely held shares. The FLEV is the ratio of the total financial debt to the total assets. The CAPINT is the proportion of long-term assets in the total assets. The AIM50 is the binary variable indicating that the firm is included in the AIM50 index. The ROA is calculated as the ratio of the operating income to the total assets. The specification in Columns 2 and 4 include firm fixed effects. Standard errors are adjusted for group correlation at the firm level in regressions without firm fixed effects. We delete observations falling in the 1st and 99th percentile for all the variables except for the indicator variable. Robust t-statistics are reported in the parenthesis. The *,**, and *** indicate statistical significance at the 10%, 5%, and 1% levels respectively. In Panel B a full range of unmatched sample observations is used consisting of all firms that switch from the quote-driven to the hybrid trading protocol during the research period between 2002 and 2008.

Table 6. The effects of disclosure intensity on bid-ask spread and liquidity before and after the introduction of SETSmm – non-adopters

	Dependant variable	
	SPREAD	PRIMPACT
	1	2
DIS	-0.014	0.003
	(-0.931)	(0.042)
POST	-0.038	-0.000
	(-0.681)	(-0.002)
DIS * POST	**0.005**	**0.013**
	(0.326)	**(0.188)**
Controls (C)		
Ln(SIZE)	-0.407***	-0.796***
	(-19.974)	(-9.601)
Ln(VOLUME)	-0.143***	-0.872***
	(-9.716)	(-13.493)
Ln(VOLAT)	0.274***	1.235***
	(13.216)	(13.032)
Ln(OWNERDIS)	0.052	-0.046
	(1.178)	(-0.272)
FLEV	-0.034***	0.014
	(-3.621)	(0.363)
CAPINT	-0.204	-0.403
	(-1.494)	(-0.801)
AIM50	0.037	-0.533
	(0.468)	(-1.120)
ROA	-2.348***	-0.814
	(-4.814)	(-0.398)
Constant	1.369***	-1.343
	(6.331)	(-1.477)
Observations	1181	590
R-squared	0.548	0.590
Regression type	Fixed effect	Fixed effect

Notes: Firm fixed effects specification of disclosure regressed on SPREAD and PRIMPACT respectively in periods before and after the introduction of the hybrid trading system to AIM. The sample consists of unbiased panel of 114 firms that traded under the quote-driven trading protocol during the research period between 2002 and 2008 (Non-adopters). The dependant variable in Column1 is SPREAD that is computed as the quarterly median of daily quoted spreads measured at the end of each trading day as the absolute difference between the bid and ask price divided by the mid-point. The dependent variable in Column 2 is PRIMPACT, the quarterly

median of the daily ratios computed as the absolute daily stock return divided by the British pound value of the daily trading volume. The DIS is the mean adjusted quintile ranking based on the variable disclosure WIRES that is computed as the quarterly sum of all the daily news wires. The POST is the binary indicator that takes the value of one for firm quarters after the introduction of SETSmm (last quarter in 2005) and zero otherwise. The SIZE is the market value of equity. The VOLUME is the quarterly median of daily turnover ratio, i.e., the daily number of shares traded divided by the total number of shares outstanding. The VOLAT is the quarterly standard deviation of the daily stock returns. The OWNERDIS is computed as the percentage of widely held shares. The FLEV is the ratio of the total financial debt to the total assets. The CAPINT is the proportion of long-term assets in total assets. The AIM50 is the binary variable indicating that the firm is included in the AIM50 index. The ROA is calculated as the ratio of the operating income to total assets. We delete observations falling in the 1st and 99th percentile for all variables except for the indicator variable. Robust *t*-statistics are reported in the parenthesis. The *,**, and *** indicate statistical significance at the 10%, 5%, and 1% levels respectively.

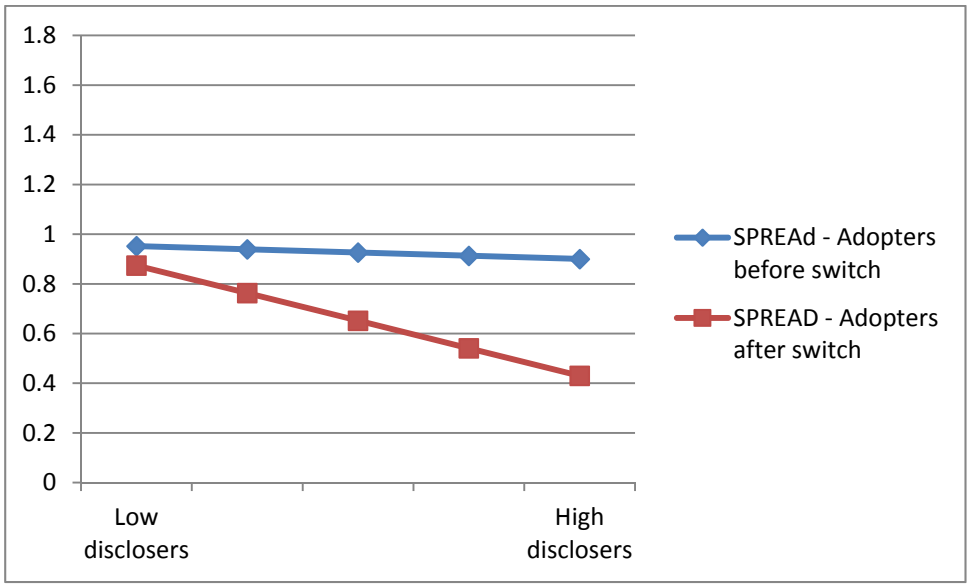
Table 7. Disclosure, trading and the bid-ask spread: the instrumental variables approach

	2SLS	
	DIS	SPREAD
	1	2
DIS		0.111
		(0.390)
SETS	0.448***	-0.456***
	(4.896)	(-3.354)
Controls		
Ln(SIZE)	0.189***	-0.322***
	(4.693)	(-5.443)
Ln(VOLUME)	0.383***	-0.381***
	(9.599)	(-3.474)
Ln(VOLAT)	0.225***	0.203***
	(3.538)	(2.623)
Ln(OWNERDIS)	-0.098	-0.144**
	(-1.194)	(-2.509)
FLEV	-0.019	-0.030**
	(-0.917)	(-2.257)
CAPINT	-0.213	0.192*
	(-1.416)	(1.742)
AIM50	0.482***	-0.212
	(4.534)	(-1.404)
ROA (at t=0)	-4.430*	-1.655***
	(-1.657)	(-3.712)
Exclustion restrictions		
ROA (at t=-1)	7.466**	
	(2.123)	
ROA (at t=-2)	-1.608	
	(-1.102)	
Constant	3.846***	-1.850
	(8.339)	(-1.630)
Observations	1037	1037
R-squared	0.226	0.367
Adjusted R-squared	0.217	
Partial F-statistic	2.34 (p=0.0970)	
Partial R-squared	0.005	
Overidentifying restrictions test		Chi2 = 0.108 (p=0.7428)
Durbin-Wu-Hausman		F= 0.58120 (p=0.4460)
Regression type	First stage IV	Reduced form

	with fixed effects	(Second stage) with fixed effects

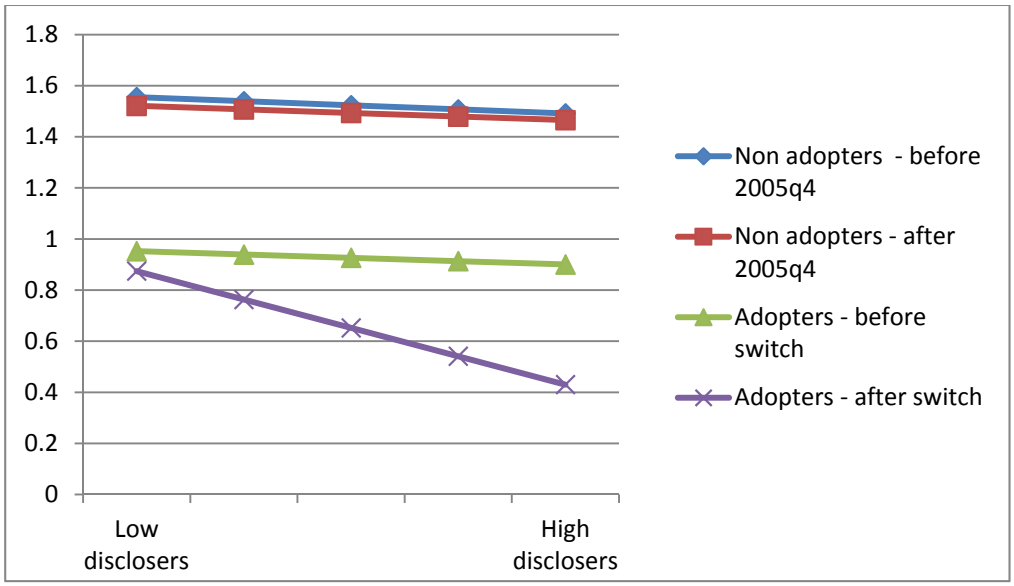
Notes: The sample consists of the unbiased panel of 170 firms that switch from the quote-driven to the hybrid trading protocol during the research period between 2002 and 2008 (Adopters). All specifications are estimated using firm fixed effects. In columns 1 and 2 we estimate the 2SLS regression with firm fixed effects. In Column 1 we report the first stage of an instrumental variables (IV) regression with ROA in quarters $t = -1$ and $t = -2$ as instruments for the disclosure intensity (DIS). In Column 2 we report the results of the reduced-form equation (second stage). SPREAD is computed as the quarterly median of the daily quoted spreads measured at the end of each trading day as the absolute difference between the bid and ask price divided by the mid-point. The DIS is the quintile ranking based on the variable disclosure WIRES that is computed as the quarterly sum of all of the daily news wires. The SET is the binary indicator that takes the value of one for firm-quarters after switching to the hybrid trading structure (SETSmm) and zero otherwise. The SIZE is the market value of equity. The VOLUME is the quarterly median of the daily turnover ratio, i.e., the daily number of shares traded divided by the total number of shares outstanding. The VOLAT is the quarterly standard deviation of the daily stock returns. The OWNERDIS is computed as the percentage of widely held shares. The FLEV is the ratio of the total financial debt to the total assets. The CAPINT is the proportion of long-term assets in the total assets. The AIM50 is the binary variable indicating that the firm is included in the AIM50 index. The ROA is calculated as the ratio of operating income to total assets. We delete the observations falling in the 1^{st} and 99^{th} percentile for all variables except for the indicator variable. Robust t-statistics are reported in the parenthesis. The *,**, and *** indicate statistical significance at the 10%, 5%, and 1% levels respectively.

Figure 1. The effects of disclosure intensity on bid-ask spread before and after the switch from SEAQ to SETSmm for adopters



Notes: On the y-axis, SPREAD is computed as the quarterly median of the daily quoted spreads measured at the end of each trading day as the absolute difference between the bid and ask price divided by the mid-point. On the x-axis, low (high) disclosers correspond to the lowest (highest) quintile ranking of the variable WIRES, computed as the quarterly sum of daily all news wires. The adopters are companies that switch from the SEAQ to SETSmm trading system during the research period.

Figure 2.The effects of the disclosure intensity on the bid-ask spread before and after the introduction of SETSmm(switch from SEAQ to SETSmm) to non-adopters (adopters)



Notes: On the y-axis, SPREAD is computed as the quarterly median of the daily quoted spreads measured at the end of each trading day as the absolute difference between the bid and ask price divided by the mid-point. On the x-axis, low (high) disclosers correspond to the lowest (highest) quintile ranking of the variable WIRES, computed as the quarterly sum of daily all news wires. The adopters are companies that switch from the SEAQ to SETSmm trading system during the research period. The non-adopters are firms that trade on the SEAQ only.

Appendix

To empirically assess the impact of lagged (in addition to contemporaneous) performance measures on the bid-ask spread, we extend model (1) by adding two lagged values for the performance proxy ROA. The results reported in column 1 of Table A show that, while lagged values of ROA dated $t = -2$ and $t = -1$ are not statistically significant, the contemporaneous ROA (at $t=0$) exhibits a negative and significant effect on SPREAD as predicted. Next, we check whether firms disclose more in response to contemporaneous and lagged performance. Results reported in column 2 of Table A show a negative and significant contemporaneous effect of performance on disclosure (the coefficient on ROA in $t=0$ is -6.655 with a p-value < 0.001). On the other hand, the first lag of ROA has a significantly positive impact on disclosure (the coefficient on ROA at $t = -1$ is 7.122 with a p-value < 0.05), while the second lag of ROA is negative but weakly significant.

Collectively, the findings in columns 1 and 2 are consistent with the conjecture that managers rapidly step up disclosure activities in response to the contemporaneous reports of performance failures (as indicated by the negative coefficient on ROA at $t=0$ in column 2), especially if these performance reports might be picked up by investors instantly, triggering particularly large impacts on their bid-ask spreads (significantly negative coefficient on ROA at $t=0$ in column 1). For example, earlier research suggests that executives of firms strategically manage the timing of voluntary disclosures for a number of reasons. In particular, Skinner (1997) shows that management is more likely to accelerate the disclosure of adverse news to try and reduce potential litigation costs. On the other hand, the significantly positive effect of lagged performance on the current disclosure is in line with the view that firms release good news with a delay. For example, a potential reason for strategic timing is because management can influence the value of stock-based compensation plans if they rush forward bad news and delay good news around award dates (Aboody and Kasznik,

2000). For growth stocks, stock-based compensation is often the main form of compensation to management and so we expect the type of strategic disclosure strategies identified by Aboody and Kasznik (2000) to apply to TTGS.

The results set out in columns 1 and 2 suggest that the current disclosure appears to increase in response to the prior period's performance success (good news) and contemporaneous performance failure (bad news). As for the current bid-ask spread, it is affected by contemporaneous disclosure (negative and significant coefficient on DIS in column 1) and contemporaneous performance (negative and significant coefficient on ROA at *t=0* in column 1), but not lagged performance. This is consistent with the proposition that the prior period's performance affects the bid-ask spread through the current disclosure channel.

Table A. The instrumental variables approach: assessment of the validity of instruments

	Dependent variable	
	SPREAD	DIS
	1	2
DIS	-0.051***	
	(-2.622)	
SETS	-0.230***	0.295***
	(-4.544)	(3.460)
Controls		
Ln(SIZE)	-0.530***	0.280***
	(-18.078)	(5.727)
Ln(VOLUME)	-0.183***	0.303***
	(-6.932)	(6.933)
Ln(VOLAT)	0.019	0.191***
	(0.510)	(3.089)
Ln(OWNERDIS)	0.107	-0.100
	(1.611)	(-0.887)
FLEV	-0.079***	-0.002
	(-5.245)	(-0.070)
CAPINT	1.056***	-0.998***
	(5.180)	(-2.891)
AIM50	0.006	-0.196*
	(0.085)	(-1.709)
ROA (at t=0)	-3.796***	-6.655***
	(-2.590)	(-2.682)
ROA (at t=-1)	2.374	7.122**
	(1.437)	(2.545)
ROA (at t=-2)	0.071	-3.380*
	(0.082)	(-1.861)
Constant	1.193***	2.672***
	(3.522)	(4.708)
Observations	1037	1041
R-squared	0.455	0.154
Regression type	Fixed effects	Fixed effects

Notes: The sample consists of the unbiased panel of 170 firms that switch from the quote-driven to the hybrid trading protocol during the research period between 2002 and 2008 (Adopters). In Column 1 we relate SPREAD to contemporaneous and up to two lags of performance proxy ROA and to a set of control variables. In Column 2 we relate DIS to contemporaneous and up to two lags of ROA and to a set of controls. All specifications are estimated using firm fixed effects. SPREAD is computed as the quarterly median of the daily quoted spreads measured at the end of each trading day as the absolute difference between the bid and ask price divided by the

mid-point. The DIS is the quintile ranking based on the variable disclosure WIRES that is computed as the quarterly sum of all of the daily news wires. The SET is the binary indicator that takes the value of one for firm-quarters after switching to the hybrid trading structure (SETSmm) and zero otherwise. The SIZE is the market value of equity. The VOLUME is the quarterly median of the daily turnover ratio, i.e., the daily number of shares traded divided by the total number of shares outstanding. The VOLAT is the quarterly standard deviation of the daily stock returns. The OWNERDIS is computed as the percentage of widely held shares. The FLEV is the ratio of the total financial debt to the total assets. The CAPINT is the proportion of long-term assets in the total assets. The AIM50 is the binary variable indicating that the firm is included in the AIM50 index. The ROA is calculated as the ratio of operating income to total assets. We delete the observations falling in the 1st and 99th percentile for all variables except for the indicator variable. Robust t-statistics are reported in the parenthesis. The *,**, and *** indicate statistical significance at the 10%, 5%, and 1% levels respectively.

[1]Significant literature exists on the modelling of how the transparency of the trading mechanism affects price formation – see for instance Chapter 10 of De Jong and Rindi (2009). That literature focuses upon the relative gains to various types of traders under various transparency settings and not the potential benefits to firms, which is our main concern here.

[2]See for instance Christie *et al.* (1994).

[3] Interestingly, Nimalendran and Petrella (2003) analyse the introduction of a hybrid (order protocol with market makers) market to Italy.

[4] See for instance Mendoza (2008).

[5]For example, AIM firms are not required to have had prior trading nor do they have to seek prior shareholder approval for transactions, there is no minimum market capitalization or minimum public float. The only disclosure obligation for firms is the "general duty of disclosure requiring information which the issuer reasonably considers necessary to enable investors to form a full understanding of the financial position of the applicant." Considering that AIM firms predominantly target institutional investors with specialist knowledge, disclosure strategies of AIM firms tend to relate to voluntary dissemination of relevant information to those investors.

[6] In order to additionally check whether the firm's life-cycle stage (age) might differentially affect the bid-ask spread for the switching subsample, we hand collect the data on all the firms' births (i.e., on the year of business inception). We find that the average life cycle (age) of the two subsamples is not statistically significantly different, that is, differences in age are not driving differences in spread.

[7]In the UK, firms are required to list information on a primary information provider like the Regulatory News Service (RNS) before talking to individual investors. The RNS is the primary timely source of information that news wire contributors use to base a report.

[8] See Bushee and Miller (2012).

[9]In order to test the validity of our disclosure measure, we also use the RNS release instead of all newswires to compute the variables WIRES. We are thankful to the anonymous referee for this suggestion.

[10] By ranking firms into quintiles of the variable WIRES separately for each subsample of firms (switchers and non-switchers) and pooling over all quarterly periods for that particular subsample, we are able to use firms as their own controls in the regression models estimated separately for switchers and non-switchers. In this way, we are able to analyze the effect of disclosure intensity on the bid-ask spread before and after the quarter in which a particular firm switches to SETSmm (in the regression of switchers), or before and after the quarter of the introduction of SETSmm (in the regression of non-switchers)

[11] This type of calculation means that the number of high disclosers is always 20% over the whole sample period, but within a particular quarter it can differ.

[12] Defined in terms of all newswires.

[13] Variable WIRES measured by RNS exhibits similar behaviour.

[14] Note that the coefficient on SET is the partial derivative of SPREAD with respect to SET, holding DIS constant at zero and that DIS=0 is outside the data range. Hence, in order to provide a more meaningful interpretation of the coefficient on SET, in the interaction models, we carry out the centering of variable DIS by subtracting the sample mean of DIS from DIS values in each observation, so that the mean of DIS is now zero. This way, the coefficient on SET now shows the difference in SPREAD between pre- and post-switching periods at the mean value of DIS. Also, note that the slope coefficients, their standard errors and t-test are the same in centered as in uncentered equations (Aiken and West, 1991).

[15] We thank the anonymous referee for this suggestion.

[16] Since the period of estimation is before the introduction of SETSmm, variables SET and DIS*SET take the value of zero by construction.

[17] We observe similar patterns in data for the RNS specification of variable WIRES.

[18]Datastream expresses daily trading volume in thousands of GBPs. Hence, the construct PRIMPACT captures the percentage by which a share price moves in £1,000 of daily trading volume.

[19] In order to check whether the life cycle might be a correlated omitted variable, we include the age of the firm as an additional covariate (unreported) and find that it does not affect our results. However, we recognize that the age of the firm might not be an appropriate proxy for lifecycle as market conditions might differ for firms of a similar age but from different industries, so we collect information on the SIC industry classification for each firm and compare the industry compositions between pre- and post-switching periods. We find that the observations are fairly evenly spread among the industries. To further check the possibility that firms before and after the switch might be in a different life cycle, we collect the data on turnover growth (see the study by

Anthony and Ramesh, 1992 on using turnover growth as a proxy for life cycle) for all companies over the key SETSmm adoption period from 2005 to 2007 and find statistically insignificant difference in mean growth rates between the pre- and post-switching periods. Moreover, in unreported analyses, we include three additional firm-level controls simultaneously in the model: (1) turnover growth, (2) its interaction with DIS which should capture the differential behaviour between low and high growth companies (i.e., between firms in early versus those in the later stages of life cycle) in terms of their disclosures' impact on SPREAD, and (3) in order to test whether potential life cycle differences between firms before and after their switch to SETSmm influence how their disclosure activities affect spread we add a three-way interaction between growth, DIS and SET. We find that our original results continue to hold and that the life cycle does not appear to influence how disclosure affects spread either pre- or post-switching to SETSmm. We confirm the conjecture that the type of trading is the main mechanism through which TTGS seem to reinforce the effects of their disclosure activities on bid-ask spread.

[20] In order to address a potential concern that disclosure levels are significantly different before compared to after the introduction of SETSmm (i.e, it is theoretically possible that majority of low (high) disclosers are concentrated in periods before (after) the switch to SETSmm), which might bias the results from regression (2), we construct a balanced sample where the disclosure distributions are comparable before and after the switch. Within each disclosure rank (1 to 5) and across the two periods (pre and post SETSmm) we match observations by size so that the disclosure quintile composition is constant across the two periods. Using the matched sample we re-estimate model (2) and find that our original findings continue to hold and that they do not appear to be driven by differences in disclosure distributions before and after the switch. The unreported results indicate that a comparable extent of disclosure activity after switching to SETSmm affects spread in a more pronounced manner relative to the period before.

[21]The estimate for the combined effect of disclosure and trading (from the fixed effects specification) that is computed as the sum of the coefficients on DIS and DIS*SET is -0.105 (i.e., 0.007 – 0.112) with a *p*-value of 0.05 (not reported in Table 4).

[22] In unreported analysis which re-estimates model (2) by replacing levels in SPREAD and DIS with their respective changes, we confirm the reinforcing or multiplicative association between disclosure and hybrid type of trading.

[23] Our results continue to hold if we include the life cycle proxies and their interactions with DIS and DIS and SET, respectively.

[24]This result is consistent with the concept that for small and less frequently traded stocks, changes in the disclosure strategy might actually increase volatility and illiquidity (Leuz and Verrecchia, 2000).

[25]The estimate for the combined effect of disclosure and trading computed as the sum of the coefficients on DIS and DIS * SET has a *p*-value of 0.001 (not reported in Table 4).

[26] The requirement for comparable distributions of disclosure level in quarters before and after the switch is appropriate for the regression analysis that tests the strength of the impact of disclosure on spread pre- versus post-switch. This requirement is now relaxed and the full range of sample observations is used in order to obtain a total number of frequencies of disclosure improvements.

[27] The results for the switching group (adopters) are not reported as they are not materially different from those obtained estimating model (2) and reported in Table 4.

[28]The test of the significant difference between the coefficients on DIS across the two classes of firms using the seemingly unrelated regression model is based on the Chow test (not reported) with a *p*-value of 0.273.

[29] Our results remain robust if we include turnover growth as a life cycle proxy and its interactions with DIS and POST, respectively. Hence, taken together with the results concerning adopters (see endnote 18) these findings alleviate concerns that potential life cycle differences between adopting and non-adopting groups might affect our original results.

[30] We obtain almost identical estimates of the slope and intercept coefficients for the Adopters sample if we employ model (2a) instead of (2). In other words, if we replace "Adopters before (after) switch" with "Adopters before (after) 2005q4".

[31] The direction of the bias depends on the response variable (market outcome) in question. For example, consider a scenario where a thinly traded risky start-up AIM firm chooses *not* to publicly disclose information on a new project in the pipeline due to high proprietary costs. Thus, ignoring factors (such as the riskiness of operations) that determine a firm's disclosure activities and also affect its bid-ask spread would yield a downwards bias in the OLS coefficients that exaggerate the effect of disclosure on the bid-ask spread.

[32] Note that although the focus of the paper is on the interaction between DIS and SET, the purpose of the analysis in subsection 5.4 is to check for the endogeneity of the disclosure variable and to validate the method's approach used in models (1) and (2).

[33]The R-squares of the first-stage regression indicate the strength of the correlation between the endogenous variable in question and the set of instruments. Higher values indicate stronger instruments, and instrumental variable estimators exhibit less bias when the instruments are strongly correlated with the endogenous variable. If the correlation is weak, then the 2SLS approach can produce biased estimates if the instrumental variables are even slightly endogenous (Larcker and Rusticus, 2010).

[34]In this test, the null hypothesis is that the instruments are uncorrelated with the disturbance term ε from the equation (1). If this hypothesis is rejected, one or more instruments do not appear to be uncorrelated with the error ε and are deemed endogenous.