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CAN INTERNET-BASED DISCLOSURE REDUCE INFORMATION ASYMMETRY?

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Abbreviated title:

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ABSTRACT

The Internet is widely used by listed companies to manage investor relations. Since January 2007, the French Financial Authority has required companies listed on Euronext-Paris to disclose all mandatory financial information via the Internet in order to enhance information transparency. This paper examines the impact of Internet-based disclosure on the French stock market by analyzing the relationship between information asymmetry and Internet disclosure practices. Extending previous studies on Web-based disclosure, a checklist of 40 items is developed to evaluate the level of Internet-based voluntary disclosure. Measuring information asymmetry by the spread and the probability of informed trading, we show that greater Web-based disclosure lowers information asymmetry in the French financial market.

JEL classification: G14, G15, G32

Keywords: *Internet-based disclosure, Information asymmetry, Spread, PIN.*

1. Introduction

The Internet has triggered a revolution in the area of financial transparency for both listed companies and investors in financial markets. Compared with traditional media, such as the paper-based annual report, the Internet allows firms to aggregate and disseminate different types of information (video, sound, flash, text, etc.) on their websites. Internet disclosure offers firms the opportunity to enhance communication quality, improve reputation, attract potential investors, and reduce information distribution costs (Ettredge, Richardson & Scholz 2002). As a consequence, firms that improve their communication to investors may reduce their cost of capital. The investors may also benefit from Web disclosure, because Internet-based technologies facilitate the information gathering process. Via the Internet, investors can very quickly obtain different types of financial information, which is presented in various formats (Word, Excel or Pdf, etc.) and is directly usable. Web disclosure may also help investors to bridge the information gap between themselves and managers. Moreover, as Web information is widely disseminated, it may be able to reduce the information asymmetry between informed and uninformed investors. As Hodge, Kennedy and Maines (2004) point out, Internet technology helps investors to access, analyze and understand information, which, in turn, leads to better interpretation.

This paper attempts to develop a better understanding of the effects of Internet-based voluntary disclosure on the French stock market. The main purpose is to determine whether Internet disclosure could lead to a reduction in information asymmetry. Based on the works of Pirchegger and Wagenhofer (1999), Debreceny, Gray and Rahman (2001), Ettredge, Richardson and Scholz (2002), Marston and Polei (2004), a checklist of 40 items is developed to assess the level of Web disclosure. Moreover, this checklist takes into account not only the quantity of information available via the Internet, but also the presentation of information on websites. Information asymmetry is measured by the spread, the probability of informed trading (*PIN*) defined by Easley, Kiefer, O'Hara and Paperman (1996) and the adjusted probability of informed trading (*AdjPIN*) extended by Duarte and Young (2009). Our empirical findings show a negative relationship between Internet-based disclosure and information asymmetry.

This paper also extends prior studies on Web-based disclosure in several ways. Firstly, instead of studying the determinants of Web-based disclosure, we focus on the consequences of this new information dissemination channel and try to extend the existing empirical studies on the impact of financial disclosure on information asymmetry. Several researchers have already investigated this relationship, but through using traditional communication channels (annual reports, preliminary announcements, earnings announcements,

financial analysts' information, etc.). For example, Petersen and Plenborg (2006) found a negative relationship between the amount of financial information published via annual reports and information asymmetry. By using the Association of Investment Management and Research (AIMR) total disclosure scores as a proxy for a firm's disclosure quality, Brown and Hillegeist (2007) prove that there is a negative association between disclosure quality and information asymmetry.

Secondly, several empirical papers investigate the impact of electronic communication on asymmetry by analyzing the adoption of XBRL[1]. They show that the technique of XBRL improves financial transparency and reduces information asymmetry in the capital market (Pinsker & Li 2008; Yoon, Zo & Ciganek 2011). Instead of focusing on one single Web disclosure technology, we study the overall level of company website-based disclosure and its impact on the French capital market. A sophisticated checklist is developed to cover not only the content of voluntary disclosure online, but also the presentation of online disclosure.

Thirdly, this paper provides empirical evidence of the impact of Web disclosure on information asymmetry in the French institutional context. Up till now, most empirical studies on information asymmetry and voluntary disclosure have been developed using American samples. Few works, except

those of Leuz and Verrecchia (2000), Hail (2002), Petersen and Plenborg (2006), have focused on European companies, and none have studied French listed companies. As Jaggi and Low (2000) show, the legislative system and culture influence financial practices. Compared with Anglo-American firms, the capital concentration of French firms is relatively high and generally characterized by state, family or cross shareholding. Investor protection is also weaker in France than in the U.S. In light of these differences, it is valuable to examine whether the results obtained through empirical studies using other samples are valid in the case of France. While quarterly earnings announcements are legally required in the US, French firms generally publish semi-annual earnings[2]. Gajewski and Quéré (2013) study the effect of earnings disclosures on information asymmetry in France and the US and prove that the lower frequency of earnings announcements in France induces a steeper decrease of information asymmetry at the time of release of semi-annual earnings.

Lastly, empirical studies on information asymmetry generally use the spread-based measure as a proxy for information asymmetry. This metric lacks precision in the sense that spreads do not only represent adverse selection costs. The paper here estimates the probability of informed trading in order to capture more precisely the extent of information asymmetry on the stock market (Easley, Kiefer, O'Hara & Paperman 1996; Duarte & Young 2009).

The remainder of the article is structured as follows: Section 2 describes the French institutional context of accounting disclosure. Section 3 gives a literature review and develops our hypotheses. Section 4 sets out the methodology chosen for the empirical study, the data selection procedure and the regression models. Section 5 interprets the empirical results and section 6 concludes.

2. The regulation of information disclosure in France

As part of the European continental system, the French accounting disclosure regulation is less equity-outsider oriented than the Anglo-American system (Nobes, 1998). For instance, French regulations do not require firms to publish their results for the first and third quarter, while all four quarterly earnings announcements are legally required in the US. French firms must publish only their sales quarterly and their earnings semi-annually.

In France, Internet financial disclosure has been voluntary and unregulated for many years. In order to guarantee a high level of investor protection and efficient markets, the European transparency directive[3] (2004/109/CE) has established the detailed requirements for disclosure of periodic and on-going information concerning issuers whose securities are already admitted to trading on a regulated market. France has adopted this directive and modified the AMF's General Regulations[4] (Book II: Issuers and financial disclosure). Since

January 2007, all listed companies on Euronext-Paris must ensure that the regulated information is disseminated effectively and in full. Furthermore, the regulated information should be posted "*on its website as soon as it has been disseminated*" and be kept as stored data for at least five years. These new regulations are designed to improve the integrity of the information dissemination system, reduce the opacity of financial statements, and protect investors from accounting fraud. Appendix I provides a summary of regulated financial information for the firms listed on the French capital market.

3. Literature review and hypotheses

3.1. Literature review on Internet-based disclosure

Studies on Web-based disclosure started in the mid-1990s when the Internet began to have a powerful impact on culture and the business environment. The research from this early stage is generally descriptive, with most studies providing an overall observation of the extent of Internet-based disclosure internationally (Petravick & Gillett 1996; Gray & Debreceny 1997; Trites 1999; Gowthorpe & Amat 1999; Deller, Stubenrath & Weber 1999; Ettredge, Richardson & Scholz 2001).

By extending the earlier descriptive studies on Internet-based disclosure, more recent studies have sought to explain the determinants of Internet-based disclosure (Ashbaugh, Johnstone & Warfield 1999; Craven & Marston 1999;

Pirchegger & Wagenhofer 1999; Ettredge, Richardson & Scholz 2002; Brennan & Hourigan 2000; Debreceny, Gray & Rahman 2002; Marston & Polei 2004, Trabelsi, Labelle & Dumontier 2008). Since the release of information via Internet has been a voluntary choice for listed companies for several years, these studies have introduced agency theory, signal theory and cost-benefits analyses, which are generally used in voluntary disclosure studies. It is assumed that these theories can explain voluntary disclosure via both the traditional media, such as annual reports, and the new channels, such as the Internet (Marston & Polei 2004, Trabelsi, Labelle & Dumontier 2008).

One common finding in prior studies is the positive relationship between firm size and Web reporting. The empirical results from different countries show that firm size is the most important determinant of the Internet used to disseminate information. As Buzby (1975) points out, the cost of information disclosure is relatively low for larger firms. Furthermore, large companies are more exposed to public scrutiny. As a result, they are motivated to enhance information transparency to satisfy the needs of information users.

It is generally accepted that corporate governance factors can influence a company's communication strategy, particularly regarding voluntary disclosure (Gul & Leung 2004; Ajinkya, Bhojraj & Sengupta 2005, Velury & Jenkins, 2006). Kelton and Yang (2008) extend these studies by focusing on

the relationship between governance mechanisms and voluntary Web disclosure. They show that better Internet-based disclosure is positively linked to weaker shareholder rights, lower capital concentration, a higher percentage of independent directors and financial experts on the board, and a greater frequency of audit committee meetings. The findings of Kelton and Yang (2008) emphasize the importance of corporate governance in Web practices. On the contrary, Alali and Romero (2012) find that highly concentrated firms in Argentina disclose more information on their websites than firms with less concentration.

Later, empirical research began to investigate the effects of Internet-based disclosure on the financial market. For example, Cormier et al. (2009) find a negative impact of the web based social and human capital disclosure on stock volatility and Tobin's Q. Yoon, Zo and Ciganek (2011) show that the technique of XBRL improves financial transparency and reduces information asymmetry in the capital market. Blankespoor, Miller and White (2014) find that dissemination via Twitter is negatively associated with information asymmetry. Efendi, Park and Smith (2013) show that XBRL filings can improve informational efficiency because XBRL filings make the financial data easier to use and analyze for all the information users. Chang, D'Anna, Watson and Wee (2008) examine the relationship between information asymmetry and

Internet-based disclosure in Australia. They find that the bid-ask spread is negatively related to disclosure quality, but this relationship becomes weaker in the presence of other factors. Based on the preceding research, higher Internet-based voluntary disclosure should reduce the degree of information asymmetry.

3.2. Development of hypotheses

Situations concerning information asymmetry are more likely to occur when some informed investors possess information that others, the uninformed, do not have. These situations are detrimental to firms when the informed investors trade using this informational advantage, such as through insider trading. These trades lead to an adverse selection problem, because the uninformed will flee the market if they detect such information asymmetry. In order to keep the uninformed in the market and trade with them, the informed would have to revise their bids. This creates an adverse selection problem that could be resolved through increased disclosure, such as Web-based disclosure, by the firms.

Theoretical research shows that the release of public information may, both directly and indirectly, help to reduce information asymmetry. On the one hand, the publication of accounting information should lower the informational advantage of pre-informed agents, and therefore the extent of information

asymmetry. Using this argument, Verrecchia (1982) treats public disclosure as a substitute for private information and shows that private information loses its usefulness when information is published. On the other hand, public information indirectly affects information asymmetry by reducing the incentive for investors to acquire costly private information. The theoretical models of Kim and Verrecchia (1991), Demski and Feltham (1994), McNichols and Trueman (1994) show that some agents are highly motivated to acquire private information before publication of the financial results, and are able to benefit from this advantage before it is neutralized by the corresponding report. But, if firms increase their public disclosure, the incentive for investors to search for costly private information will be reduced (Fama & Laffer 1971; Hakansson 1977; Diamond 1985). Brown and Hillegeist (2007) empirically show that the incentive to collect private information declines with disclosure quality.

The release of public information may also change the trading behavior of uninformed investors on the capital market, according to the investor recognition hypothesis (Merton 1987). Internet-based disclosure can in fact enhance a firm's visibility and mitigate incomplete information. As investors prefer to invest in companies with which they are familiar, more investors will be attracted to trade in the stock (Fishman & Hagerty 1989). As a result, information coverage (analysts, press coverage) will increase, thus leading to a reduction in information asymmetry, *ceteris paribus*. However, the larger the

investor base, the higher the probability of informed trading. Kyle (1985) theoretically demonstrates that the informed could have an incentive to increase their trades when there are more uninformed investors in the market. Their strategies become even less visible with more uninformed investors in the market. Although information asymmetry in the market depends on the balance between the informed and the uninformed, Brown and Hillegeist (2007) empirically prove that the balance between the informed and the uninformed changes in favor of uninformed trading with disclosure quality. This is probably due to limited capital constraints and risk aversion. To sum up, Internet-based voluntary disclosure may reduce situations of information asymmetry, because the informed have less incentive to acquire private information.

Empirically, Heflin, Shaw and Wild (2005) demonstrate that increased disclosure (measured by analysts' evaluations) is associated with lower spreads. Petersen and Plenborg (2006) also prove that quoted companies can reduce the spread by publishing more information voluntarily. Brown and Hillegeist (2007) find a negative relationship between the quality of annual report disclosure and information asymmetry. This negative association becomes stronger when the initial level of information asymmetry between the firm and investors is higher.

Public information disclosure not only concerns content, but also presentation. The adoption of online disclosure enhances a firm's capacity to present information and make its homepage a user-friendly information center. For example, search engines facilitate finding information, especially for novice investors with little experience. Financial data in Excel format facilitate the processing of data. Hyperlinks make it easier for investors to compare firm stock with market indexes. Furthermore, the Internet makes real-time disclosures accessible to all investors, and this is particularly important for foreign investors, who experience greater difficulties with information collection via traditional media. The organization of the website may improve disclosure quality and, as this can reduce information asymmetry, the presentation is a means of lowering this asymmetry.

Prior empirical studies have shown the positive impact of some Web technologies on information asymmetry. For example, the XBRL technique can improve financial transparency and reduce information asymmetry in the capital market (Yoon, Zo & Ciganek 2011). Later, Efendi, Park and Smith (2013) prove that XBRL filings can improve informational efficiency. Based on the preceding arguments and research, greater use of network technology should reduce the level of information asymmetry. This leads to the core hypothesis:

Hypothesis: *There is a negative relationship between information asymmetry and the degree of Internet-based voluntary disclosure.*

4. Research design

The empirical investigation consists of observing the relationship between Internet-based disclosure and information asymmetry. After presenting the research sample (4.1), the measurements of the main variables are set out (4.2). Lastly, the regression models are discussed (4.3).

4.1. Sample description and data collection methods

The initial sample contains publicly traded French companies belonging to the SBF 250 index. We excluded twenty-nine companies in the financial sector due to their disclosure practices, which are heavily influenced by regulatory requirements (Botosan 1997) and subject to different disclosure requirements. Forty-one companies were also rejected for lack of sufficient information. The final sample therefore consists of 180 companies covering nine sectors: Oil and Gas, Basic Materials, Industrials, Consumer Goods, Health Care, Consumer Services, Telecommunications, Utilities and Technology. Table 1 presents the elements of the research sample.

TABLE 1 ABOUT HERE

Data on ownership structure were extracted from *Thomson ONE Banker*. Information on corporate governance was collected from websites and annual

reports. Other financial and accounting data were obtained from *Datastream* and *Worldscope*. All data relate to the 2007 financial year.

4.2. Measurement of variables

4.2.1. Information asymmetry measurement

In order to study the relationship between information asymmetry and firm reporting on the Internet, we first need to assess the extent of information asymmetry in the stock market. Prior research has developed various methods of assessing the level of information asymmetry. Of these, the bid-ask spread (difference between the best selling price and the best buying price for a given security) appears to be the most frequently-used proxy to measure information asymmetry in previous studies on accounting information (Welker 1995; Leuz & Verrecchia 2000; Petersen & Plenborg 2006).

Being consistent with prior works (Petersen & Plenborg 2006; Yoon, Zo & Ciganek 2011), this study also uses the spread as a proxy of information asymmetry and calculates the relative spread (R_Spread) by the following formula:

$$R_Spread = \frac{(Ask\ price - Bid\ price)}{(Bid\ Price + Ask\ Price)/2}. \qquad (1)$$

As stocks in the sample are continuously traded, we compute also time-weighted average bid-ask spreads (W_Spread) and average effective spreads

(E_Spread) from time-stamped data. Assuming that there are N quotation updates in the interval $[t_0;t_N]$, the time-weighted average bid-ask spread is then computed using the following formula:

$$W_Spread = \frac{1}{(t_N - t_0)} \sum_{i=1}^{N} Spread_i \times (t_i - t_{i-1}). \qquad (2)$$

The effective spread is computed by comparing the mid-price to the trading price:

$$E_Spread = 2 \times \left| \frac{Trading\ price - (Bid\ Price + Ask\ Price)/2}{(Bid\ Price + Ask\ Price)/2} \right|. \qquad (3)$$

However, the bid-ask spread measures transaction costs that also include other components. In an order-driven market, there could also be a component linked to inventory costs and another linked to asymmetric information costs. To some extent, spreads do not measure adverse selection costs exactly.

In order to have more robust results, we rely on the model developed by Easley, Kiefer and O'Hara (1997) to measure information asymmetry. Their model allows the probability of informed trading to be estimated from the observation of the order flow. We computed the *PIN* measure defined by Easley, Kiefer, O'Hara and Paperman (1996), which is based on trade direction. The probability of observing *B* buys and *S* sells on a given day can be expressed as follows:

$$L\left((B_t, S_t)\middle|(\alpha, \delta, \mu, \varepsilon)\right) = (1-\alpha)\times e^{-2\varepsilon}\frac{(\varepsilon)^{B_t}}{B_t!}\frac{(\varepsilon)^{S_t}}{S_t!} + \alpha\delta\times e^{-(2\varepsilon+\mu)}\frac{(\varepsilon)^{B_t}}{B_t!}\frac{(\mu+\varepsilon)^{S_t}}{S_t!} + \alpha(1-\delta)\times e^{-(2\varepsilon+\mu)}\frac{(\varepsilon)^{S_t}}{S_t!}\frac{(\mu+\varepsilon)^{B_t}}{B_t!}, \quad (4)$$

where α is the probability of an information event that is bad news with probability δ, and good news with probability 1-δ. The arrival rate of informed trades is μ. ε is the rate of uninformed buy and sell trade arrivals. Over an observation period of *T* days, the likelihood of observing $(B_t, S_t)_{t=1}^{T}$ buys and sells corresponds to the product of the daily likelihoods:

$$L\left((B_t, S_t)_{t=1}^{T} \middle| (\alpha, \delta, \mu, \varepsilon)\right) = \prod_{t=1}^{T} L\left((B_t, S_t) \middle| (\alpha, \delta, \mu, \varepsilon)\right). \qquad (5)$$

In order to estimate the parameters, we maximize the likelihood defined in equation (5), and the *PIN* is calculated as:

$$PIN = \frac{\alpha\mu}{\alpha\mu + 2\varepsilon}. \qquad (6)$$

The *PIN* measure may also include potential effects of liquidity unrelated to information asymmetry. In order to control these effects, we have also computed the adjusted measure of *PIN* developed by Duarte and Young (2009). *AdjPIN* is calculated as:

$$AdjPIN = \frac{\alpha\mu}{\alpha\mu + 2\Delta \times \left(\alpha\theta' + (1-\alpha)\theta\right) + 2\varepsilon}. \qquad (7)$$

where θ measures the probability of an event that is conditional on the absence of private information. θ' is the probability of an event that is conditional on the arrival of private information. Δ measures the additional arrival rate of buys and sells.

4.2.2. Development of the index of Internet disclosure

Two methods are generally used to assess the level of information disclosure. The direct method uses estimates published by professional institutions that regularly assess the supply of information by quoted

companies. For example, the Association for Investment and Management Research (AIMR) publishes an annual ranking of financial transparency in a report giving assessments by analysts on the disclosure practices of firms that has been used as a proxy of disclosure policy in many prior studies. (Lang & Lundholm 1993, 1996; Welker 1995; Sengupta 1998; Bamber & Cheon 1998; Healy, Hutton & Palepu 1999; Botosan & Plumlee 2002; Brown & Hillegeist 2007).

The indirect method uses an assessment index created by researchers. Since the work of Pirchegger and Wagenhofer (1999), the measurement of Internet-based disclosure has become increasingly sophisticated. This can be seen not only in the increase in the number of items on the checklist, but also by the introduction of new criteria in the division of items. Ettredge, Richardson and Scholz (2002) use a checklist of items that distinguishes the SEC[5] required disclosure from voluntary disclosure items and they attempt to analyze the respective determinants separately.

Since no direct measurement of our sample of French listed companies is available, we choose to follow the indirect method. In order to evaluate Internet-based disclosure, an index of 40 items is created on the basis of five prior studies (Deller, Stubenrath & Weber 1999; Debreceny, Gray & Mock 2001; Pirchegger & Wagenhofer 1999; Ettredge, Richardson & Scholz 2002;

Marston & Polei 2004) that have analyzed online disclosure practices. As Wallace, Naser and Mora (1994) indicate in their research, there is no general theory on how to build an index and its content changes from one research to another according to the focus of the study.

We first summarize all the items used in these prior studies on firm reporting via the Internet. In order to limit our study to the field of voluntary disclosure, all the mandatory items (according to the AMF regulations) are excluded from the index. Second, we choose the items according to the focus of the study. The main objective of this study is to test whether the technological features of Internet disclosure can reduce information asymmetry. As a result, all items of this nature in the previous works are given priority consideration. Internet disclosure is generally considered as “timely” and “user-friendly.” In addition, we want to emphasize the “compatibility” of the website. The Internet is a multi-medium that assembles paper-based reports, video and voice documentations, etc. For this reason, some items [6], which are considered to be informational in prior research, can also be treated as an advantage of the Internet disclosure presentation in our study. We also introduce some new items, which have not been used in prior studies but are closely related to the technological features and advantages of Internet disclosure[7].

We assign one point to each item presented on the firm's own website and which is available to the general public. The maximum possible score that a listed firm can obtain is 40 points. For each company, the total score is presented as the percentage of the actual score in relation to the maximum possible score. Therefore, the level of Internet-based disclosure (***Score***) of each company varies between 0 and 1, with 1 being the highest score and 0 the lowest.

We want to point out that only the items presented on a HTML webpage can be considered in the data collection. The information contained in the annual or semester reports (PDF or Word format) was not scored in order to avoid repetition. We have focussed on the investor section which regroups all the important information for investors. However, we also consider the complete firm website because several technological feature items (such as "help site" "site plan", "internal search engine") of our index are designed for the whole website. All the firms' websites in our sample were analyzed during the month of May and June in 2007. The entire index is presented in the Appendix II.

4.3. Analysis method

The main purpose of this study is to analyze how Internet disclosure is related to information asymmetry. When studying this relationship, the reverse

causality between these two factors should be considered. As prior research points out, disclosure can reduce the level of information asymmetry, and firms that experience high information asymmetry may be more persuaded to release information so as to limit the adverse selection problem, *ceteris paribus* (Dye , 1985; Lang and Lundholm, 1993 ; Welker, 1995; Heflin, Shaw and Wild, 2005). To address the potential endogeneity problem, we run a Hausman test in order to choose between the OLS and the 2SLS methods.

A dummy variable governance system is introduced as an instrumental variable in our tests. In fact, French legislation allows domestic publicly-listed companies to choose between a one-tier system[8], mandatory in the Anglo-American system, and a two-tier system, which is mandatory in countries such as Germany or Slovenia for example. This opportunity is unique in Europe. Because the two-tier system clearly separates the functions of management and control, it is supposed to provide a more effective management style. Therefore, the two-tier system should be associated with higher disclosure quality (Charreaux, 1997). Furthermore, no prior literature suggests that the government system may have a direct impact on information asymmetry.

In addition to Internet-based disclosure, a series of variables was also incorporated in the regression model to analyze the determinants of information asymmetry. These include turnover, stock return volatility, share

price and ownership concentration. The selection of the control variables is based on the prior literature (Chang, D'Anna, Watson & Wee 2008; Lang & Lundholm 1993; Leuz & Verrecchia 2000; Petersen & Plenborg 2006, etc.).

- *Trading volume (Turnover)*

From a theoretical point of view, there are several arguments supporting the fact that trading volume should reduce information asymmetry and also the bid-ask spread. Copeland and Galai (1983) study information effects on the spread and show that the bid-ask spread and also information asymmetry is a negative function of measures of trading activity. In their model, the probability of informed trading is higher for thinly traded stocks, because these stocks are on average more closely held. As a consequence of holding the size as constant, low trading volume means less frequent trading. Thus, trading volume is negatively associated with information asymmetry and bid-ask spreads. This explanation holds if the size of transaction remains constant. Moreover, if we focus on information asymmetry, trading volume captures the degree of trading activity and stock market liquidity. It indicates the willingness of market participants to sell and buy shares. Leuz and Verrecchia (2000) suggest that trading activity reflects the attractiveness of a stock. Stocks with higher liquidity are relatively more attractive to investors, and this could improve the degree of public information (analysts, press coverage) and reduce

information asymmetry to this extent. Finally, Ho and Stoll (1981) predict that trading volume should reduce spreads due to economies of scale. Among the different measures of volume, the rotation rate with the best properties would seem to be the metric. Consequently, we define trading volume as:

$$\text{Turnover} = \log \frac{\text{Daily trading volume}}{\text{NOSH} \times \text{NOSHFF}}. \qquad (8)$$

where trading volume is the total number of traded shares on a given day. NOSH is the total number of ordinary shares, NOSHFF is the free-float percentage of total shares available to ordinary investors[9]. All variables were extracted from *Datastream*.

- *Stock return volatility (Volatility)*

Stock return volatility should enlarge the bid-ask spread due to risk-bearing (Roll 1984; Glosten 1987). In the capital market, stock return volatility generally indicates the degree of uncertainty or risk. In this case, the risk of not holding an optimal position increases. As a consequence, higher volatility leads to greater spreads. Copeland and Galai (1983) insist on the role of specific risk in their model. As specific risk increases, information asymmetry should also increase. Stock return volatility is measured by the standard deviation of daily stock returns.

- *Stock Price (LnPrice)*

Price level allows for the effect of discreteness to be controlled. Stocks with low price levels tend to be new, smaller in size and above all riskier. This additional risk leads to an enlargement of the bid-ask spread. Stoll (2000) has proved that the relative spread is negatively related to the price level in logarithm. The stock price is therefore measured in logarithm.

- *Ownership concentration (Bloc)*

Agency theory suggests that individual investors are in an unfavorable informational position relative to managers and majority shareholders. Therefore, when ownership structure is more dispersed, the risk of information asymmetry is more likely to be effective. These situations increase agency problems and imply higher monitoring costs. The study of Glosten and Milgrom (1985) point out that large shareholders attempt to trade on their insider information and extract private benefits and firm control. Such an agency problem results in a larger spread and lower stock liquidity. Moreover, Attig et *al.* (2006) provide empirical evidence on the positive relationship between ownership concentration and information asymmetry. Therefore, it is supposed that the ownership concentration is positively linked to the level of information asymmetry. Ownership concentration is measured by the proportion of capital held by blockholders (investors owning 5% or more of a firm's stock).

The next equation summarizes the regression model:

$$\boldsymbol{Information\ asymmetry} = \alpha + \beta_1 Internet_based\ disclosure + \beta_2 Turnover + \beta_3 Volatility + \beta_4 Price + \beta_5 Bloc + \varepsilon. \quad (9)$$

5. Empirical results

5.1. Descriptive statistics

The statistics are set out in Table 2. The results of the overall Internet-based voluntary disclosure (*Score*) indicate that the highest score achieved by any company is 0.85, while the lowest is 0.125. The mean value is 0.422. These results suggest that, across the 180 listed companies in the sample, there is widespread variation in the global level of voluntary disclosure via the Internet.

As far as information asymmetry is concerned, relative spreads vary from 0.04% to a maximum of 4.23%. The means are 0.68 % and 0.70% respectively for three and six months. By comparison, Yoon, Zo and Ciganek (2011) find a mean of 0.7% for the South-Korean market over the period 2007-2008. The mean of the *PIN* estimates over three and six months are respectively equal to 0.1818 and 0.1794, which is consistent with the estimation given by Easley, Hvidkjaer and O'Hara (2002). Duarte and Young (2009) calculate a median for

adjusted *PIN* equal to 0.17, a result confirmed by our estimates of 0.14 and 0.15 respectively for three and six months.

On average, 51.9% of the outstanding shares are held by blockholders. With an American sample, Kelton and Yang (2008) highlight that the average percentage of capital held by block shareholders is about 20%. Marston and Polei's study (2004) shows that the average free-float coefficients of German listed companies is 42.75%. Compared with their counterparts, French companies have a much higher concentration of capital.

TABLE 2 ABOUT HERE

5.2. Correlation analysis

Table 3 - Panel A shows the correlation of a three month period while Panel B presents a six month period. Both show the Pearson correlations between information asymmetry and the explanatory variables. At first, the five measures of information asymmetry (Relative *Spread,* time-weighted quoted spreads, effective spreads, *PIN* and *AdjPIN*) are significantly and positively related one to another. The level of Internet-based voluntary disclosure (*Score*) is negatively related to all these measures of information asymmetry. A higher level of information disclosure through the Internet may lead to a lower level of information asymmetry.

Moreover, variables *Spread, PIN* and *AdjPIN* are also negatively related to the turnover ratio, and to the standard-deviation of stock returns. These results are consistent with previous empirical findings in the field of market microstructure (e.g. Huang and Stoll, 1996; Stoll, 2000; Venkataraman, 2001). The ownership concentration (*Bloc*) is negatively related to the Web disclosure but positively linked to all the 10 information asymmetry measures.

We also find that variable governance is negatively related to the internet-based disclosure. The result suggests that the firms under the one-tier government system release more information via the Internet. It seems that French firms use the two-tier system as a substitute for information transparency. Furthermore, no significant relationship between governance and the information asymmetry measures is observed. We may therefore use governance as an instrumental variable in the regression tests.

TABLE 3 ABOUT HERE

5.3. Regression estimation results

As discussed in the previous section, a reverse causality relationship may exist between information asymmetry and disclosure, and lead to an inconsistent OLS estimator. The Hausman test is therefore introduced to check for this potential endogenous problem. Using ***Governance*** as the instrumental variable, the Hausman test results (Table 4) indicate that the dependent

variables are not affected by the endogeneous effect. The OLS regression model is therefore used in the next analysis.

TABLE 4 ABOUT HERE

As the link between Internet-based disclosure and information asymmetry is analyzed for two different periods (three and six months), the empirical results are presented through two different tables (Tables 5 and 6). Both tables contain five models according to the measure of information asymmetry (Relative *Spread*, time-weighted quoted spreads, effective spreads, *PIN* and *AdjPIN*). Models 1 to 3 are developed using the variations of spread in relation to the Web disclosure, the turnover ratio, the stock return volatility, the ownership concentration and the price level. Models 4 and 5 are developed to refine the analysis by using *PIN* and Adjusted PIN as dependent variables.

TABLES 5 AND 6 ABOUT HERE

We can observe that the coefficients of Score in the first three models are significantly negative at the 1% level. The results indicate that enhanced disclosure via the Internet reduces the level of spread which is in accordance with past research (Petersen and Plenborg 2006). Compared with *Spread*, *PIN* and *AdjPIN* are more precise measures of information asymmetry because they exclude other effects, such as fixed costs, inventory effects or liquidity effects. According to previous research in market microstructure, *PIN* and *AdjPIN* can

better capture information asymmetry. Results in models 4 and 5 show that Web-based disclosure is negatively and significantly related to *PIN* and *AdjPIN*. This confirms our findings in models 1 to 3. The effect of Internet-based disclosure on the spread is only due to information asymmetry. Therefore, models 4 and 5 provide strong support for the impact of Web-based disclosure on the reduction of information asymmetry. This result is proved whatever the period, either three or six months. Therefore, we validate our hypothesis.

Furthermore, we find that the *Turnover* coefficient is significantly negative in all the models. This is consistent with the theory that higher levels of trading volume will improve stock liquidity, therefore leading to a reduction of information asymmetry. We ran the VIF test to control the multicollinearity and the results show that no variance inflation factor values are greater than 1.8. We used the Breusch-Pagan test to control for the potential risk of heteroscedasticity; the results indicate that some models do not satisfy the constant variance assumption. We therefore ran the regression with robust standard errors to control for the heteroscedasticity problem; the results (which are not reported here) indicate that the negative relationship between Internet-based disclosure and information asymmetry are not affected by heteroscedasticity. Our empirical results are therefore robust.

Overall, these results are consistent with the specificities of the French institutional environment. France belongs to the category of code-law countries (by opposition to the category of common-law countries). Code-law countries such as France are characterized by high ownership concentration, a model of corporate governance that is less oriented towards the shareholders and with less information content of accounting information that is reinforced by less frequent disclosure. As a consequence, Web-based disclosure in code-law countries may play a greater role in reducing information asymmetry between managers and shareholders. Furthermore, our findings highlight the importance of the network technology in the reduction of information asymmetry.

6. Conclusion

Firm disclosure is one of the fundamental elements affecting the efficiency of the capital market (Healy & Palepu 2001; Shaw 2003). It is important for managers, investors and regulators to understand the interaction between information disclosure practices and information asymmetry. This paper focuses on online disclosure practices resulting from the rapid growth in the use of the Internet for financial reporting (Marston & Polei 2004; Bollen, Hassink & Bozic 2006). The main objective is to analyze how the use of the Internet for disclosure affects information asymmetry in the capital market.

As an extension of previous research, an index consisting of 40 items is developed in order to assess the information released via the Internet in France. Based on a sample of 180 French listed companies belonging to the SBF 250 index, we observe a strong negative relationship between Internet disclosure and the level of information asymmetry. These findings are consistent with research carried out in other countries, and the characteristics of the French institutional environment. The empirical findings suggest that it is important for French quoted companies to increase information transparency in order to reduce information asymmetry and improve investor relations.

The relationship between financial disclosure and information asymmetry is a classic subject and has been studied in prior research by examining traditional paper-based media such as annual reports. One might ask whether it is necessary to retest this relationship by analyzing the information spread via the Internet. Indeed, the Internet could be treated as an information media, along with other traditional paper-based media. However, certain special features of Internet-based disclosure highlights the necessity to retest the impact of this media. Internet technologies can gather a huge amount of information and this far exceeds traditional paper-based media. Another consequence is that rumors circulate fast online. Is Internet-based disclosure a useful communication tool to reduce the information gap, or is it a costly tool which causes more misunderstandings? Answers to these questions require

more testing. The empirical results of this study prove the positive effect of Web-based disclosure on the reduction of information asymmetry. Although there are some potential drawbacks, Internet-based disclosure can still effectively reduce the problem of information asymmetry. More importantly, our results show that Internet technologies have greatly enriched information presentation methods. And these user-friendly Web technologies, such as financial reports in Excel format, are useful to reduce the information gap. These findings emphasize the need for the normalization of Web disclosure in both content and presentation perceptions.

This research is not without limitations. The negative effects of financial reporting, such as losing an advantage in a competitive market, are not considered in our research. Furthermore, the research only examines certain factors that may influence information asymmetry. Other new factors, such as the role of financial analysts, should be introduced into future research. Lastly, as firms are generally motivated to lower their cost of capital, it would be interesting to determine whether the impact of Web disclosure on information asymmetry helps the firm to benefit from a lower cost of capital over the long term.

APPENDIX I. SUMMARY OF REGULATED INFORMATION IN FRENCH CAPITAL MARKET

The AMF press release of January 22, 2007, summarized the following documents, which are listed in article 221-1 of the AMF's General Regulations, as "regulated information":

- The annual financial report;
- The half-yearly financial report;
- The quarterly financial disclosure;
- The report on internal control procedures and reports from independent auditors on the aforementioned reports;
- The news release concerning fees paid to independent auditors;
- Monthly statement on the total number of voting rights and the number of shares making up the share capital;
- The description of share buy-back programs;
- Privileged information;
- The news release setting out the procedures for providing a prospectus;
- The notice describing the means by which information will be made available to shareholders prior to a shareholders' meeting;

- Information about modifications in the rights attached to different categories of shares and the issuances of new shares.

APPENDIX II-INTERNET-BASED DISCLOSURE INDEX

N	Index	Overlap with prior research
1	**Current share price**	*a,b,c,d,e*
2	**Press releases**	*a,b,c,d,e*
3	**Annual report – interactive version**	*a,b,c,e*
4	**Internal search engine**	*a,b,c,e*
5	**Investor relations e-mail address**	*a,b,c,e*
6	**Newsletters/ Mailing list**	*a,b,e*
7	**Annual report in pdf format**	*a,c,e*
8	**Frequently asked questions**	*a,d,e*
9	**Financial report in Excel format**	*a,e*
10	**Direct e-mail hyperlink to investor relations**	*b,c,e*
11	**Monthly information releases**	*b,c,e*
12	**Site plan**	*b,c,e*
13	**English version of site**	*b,e*
14	**Quick access to financial section (one click)**	*b,e*
15	**Video files**	*b,e*
16	**Images**	*c,e*
17	**Help site**	*c,e*
18	**Site available in text-only format**	*d*
19	**Direct link to Euronext**	*d*
20	**Historical share prices**	*e*
21	**2001-2003 annual reports**	*e*
22	**2004-2006 annual reports**	*e*
23	**Annual report in html format**	*e*
24	**Comparison with benchmark indices (CAC40/SBF120/SBF250)**	*e*
25	**Documentation of financial analysts' conferences**	*e*
26	**Flash**	*e*
27	**Grouping of AMF-regulated financial information**	*e*
28	**Monthly earnings or sales**	*e*
29	**Non-commercial communication**	*e*
30	**Printer-friendly version of site**	*e*
31	**Site loads in less than five seconds**	*e*
32	**Vocal files**	*e*
33	**Ability to download useful software, e.g. pdf/RSS readers**	
34	**Historical dividends**	
35	**Investor club or forum**	
36	**Site available in a choice of third language**	
37	**Financial calendar**	*a, d, e*
38	**Postal address of investor relations**	*b, e*
39	**Telephone number reserved for investor relations**	*e*
40	**Free helpline for shareholders**	

Notes:

Overlap with prior research:

a = Deller, Stubenrath & Weber (1999)

b = Pirchegger & Wagenhofer (1999)

c = Debreceny, Gray & Mock (2002)

d = Ettredge, Richardson & Scholz (2002)

e = Marston & Polei (2004)

NOTES

[1]XBRL: eXtensible Business Reporting Language

[2] The publication of quarterly accounts by French firms on 1st and 3rd quarters is not mandatory. Only turnover publication is required.

[3]Directive 2004/109/CE of the European Parliament and the Council of 15 December, 2004, on the harmonization of transparency requirements in relation to information about issuers whose securities are admitted to trading on a regulated market.

[4] AMF ("Autorité des Marchés Français") stands for French Financial Authority.

[5] Securities Exchange Committee

[6]The item "annual reports of former years" is considered as information content in the study of Marston and Polei (2004); we treat it as an advantage of Internet presentation in items 21 and 22.

[7] For example, item 35: Investor club or forum, item 36: Site available in a choice of third language.

[8]Under the one-tier system, a company is operated by one corporate body that undertakes both the management and monitoring functions. Under the two-tier system, a company is governed by two separate bodies: the board of directors takes the function of management while the supervisory board assures the

function of control and supervision. One-tier firms are coded 0, while two-tier firms are coded 1.

[9]As we discard days with no trading activity, the logarithm of volume is always defined.

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Table 1-Sample by sector

Sector	Number	Percentage
Oil and Gas	6	3.33%
Basic Materials	4	2.22%
Industrials	41	22.78%
Consumer Goods	38	21.11%
Health Care	14	7.78%
Consumer Services	34	18.89%
Telecommunications	2	1.11%
Utilities	6	3.33%
Technology	35	19.44%
Total	**180**	**100.00%**

Table 2 - Descriptive statistics

Window	Variable	Mean	Std. Dev.	Min	Max
	Score	0.4219	0.1262	0.1250	0.8500
	LnPrice	3.6830	0.9044	0.0807	6.4629
	Bloc	0.5192	0.2394	0.0000	1.0000
	Governance	0.2889	0.4545	0.0000	1.0000
	R_Spread	0.0068	0.0066	0.0005	0.0406
	E_Spread	0.0047	0.0046	0.0004	0.0245
	W_Spread	0.0089	0.0063	0.0022	0.0472
3 months	***PIN***	0.1818	0.1121	0.0000	0.7071
	AdjPIN	0.1578	0.0996	0.0000	0.7071
	Turnover	-12.8326	1.0501	-15.4618	-10.6601
	Volatility	0.6970	2.8034	0.0102	31.4317
	R_Spread	0.0070	0.0069	0.0004	0.0423
	E_Spread	0.0049	0.0048	0.0004	0.0266
	W_Spread	0.0091	0.0063	0.0023	0.0462
6 months	***PIN***	0.1794	0.0979	0.0002	0.5461
	AdjPIN	0.1636	0.0805	0.0000	0.5461
	Turnover	-12.8634	1.0423	-15.4525	-10.7184
	Volatility	0.5281	2.0663	0.0116	21.3918

Note: *The number of observations is equal to 180;* ***Score*** is the level of Internet-based disclosure; ***R_Spread*** is the average quoted spread; ***W_Spread*** is the time-weighted average quoted spreads; ***E_Spread*** is the average effective spread; ***PIN*** is the probability of informed trading defined by Easley et al. (1996); ***AdjPIN*** is the adjusted PIN developed by Duarte and Young (2009); ***Turnover*** is the rotation rate of stocks; ***Volatility*** is measured by the standard deviation of daily stock returns; ***LnPrice*** is the stock price measured in logarithm; ***Bloc*** represents the proportion of capital held by blockholders (those owning 5% or more of a firm's stock); ***Governance*** is a binary variable defined to

measure the governance system: one-tier firms are coded 0, while two-tier firms are coded 1.

Table 3 - Pearson correlation coefficients

Panel A – three month study period (July to September 2007)

	Score	*R_Spread*	*E_Spread*	*W_Spread*	*PIN*	*AdjPIN*	*Turnover*	*Volatility*	*LnPrice*	*Bloc*
R_Spread	**-0.581** ***									
E_Spread	**-0.5812** ***	**0.9821** ***								
W_Spread	**-0.5537** ***	**0.9497** ***	**0.9252** ***							
PIN	**-0.4382** ***	**0.4726** ***	**0.4542** ***	**0.4718** ***						
AdjPIN	**-0.4279** ***	**0.4067** ***	**0.4033** ***	**0.3864** ***	**0.6161** ***					
Turnover	**0.5573** ***	**-0.7529** ***	**-0.753** ***	**-0.6738** ***	**-0.468** ***	**-0.5485** ***				
Volatility	**0.1208**	**-0.1202**	**-0.122**	**-0.1289** *	**-0.1303** *	**-0.1547** **	**0.1248** *			
LnPrice	**0.0593**	**0.029**	**-0.0186**	**0.0039**	**-0.025**	**0.0125**	**-0.1017**	**0.0566**		
Bloc	**-0.3768** ***	**0.4044** ***	**0.3871** ***	**0.4337** ***	**0.3071** ***	**0.451** ***	**-0.4717** ***	**-0.1819** **	**0.1307** *	
Governance	**-0.1476** **	**0.0873**	**0.0719**	**0.1009**	**-0.0138**	**0.063**	**-0.1273** *	**-0.0765**	**0.0804**	**-0.0858**

Panel B – six month study period (July to December 2007)

	Score	R_Spread	E_Spread	W_Spread	PIN	AdjPIN	Turnover	Volatility	LnPrice	Bloc
R_Spread	**-0.5845** ***									
E_Spread	**-0.5822** ***	**0.9838** ***								
W_Spread	**-0.5638** ***	**0.9549** ***	**0.9336** ***							
PIN	**-0.4552** ***	**0.5663** ***	**0.5377** ***	**0.534** ***						
AdjPIN	**-0.4726** ***	**0.5316** ***	**0.5123** ***	**0.5074** ***	**0.7064** ***					
Turnover	**0.5632** ***	**-0.7706** ***	**-0.7739** ***	**-0.7016** ***	**-0.57** ***	**-0.6147** ***				
Volatility	**0.1207**	**-0.1279** *	**-0.1317** *	**-0.1361** *	**-0.1737** **	**-0.1294** *	**0.1293** *			
LnPrice	**0.0593**	**0.0079**	**-0.0472**	**-0.0195**	**0.0074**	**0.0376**	**-0.0814**	**0.058**		
Bloc	**-0.3768** ***	**0.4189** ***	**0.3934** ***	**0.4374** ***	**0.3644** ***	**0.4155** ***	**-0.491** ***	**-0.1794** **	**0.1307** *	
Governance	**-0.1476** **	**0.0807**	**0.0706**	**0.0931**	**0.0543**	**0.0067**	**-0.1115**	**-0.0799**	**0.0804**	**-0.0858**

Note: *The number of observations is equal to 180; * indicates Significance at the 10% level, ** at the 5% level, *** at the 1% level*

Score is the level of Internet-based disclosure; ***R_Spread*** is the average quoted spread; ***W_Spread*** is the time-weighted average quoted spread; ***E_Spread*** is the average effective spread; ***PIN*** is the probability of informed trading defined by Easley et al. (1996); ***AdjPIN*** is the adjusted PIN developed by Duarte and Young (2009); ***Turnover*** is the rotation rate of stocks; ***Volatility*** is

measured by the standard deviation of daily stock returns; ***LnPrice*** is the stock price measured in logarithm; ***Bloc*** represents the proportion of capital held by blockholders (those owning 5% or more of a firm's stock); ***Governance*** is a binary variable defined to measure the governance system: one-tier firms are coded 0, while two-tier firms are coded 1.

Table 4 - Hausman's Specification Test Results

Period	Dependent Variable	F	Prob>F
3 months	***R_Spread***	0.21	0.6494
	E_Spread	0.59	0.4437
	W_Spread	0.09	0.763
	PIN	1.6	0.2072
	AdjPIN	0.1	0.7546
6 months	***R_Spread***	0.17	0.6823
	E_Spread	0.41	0.5228
	W_Spread	0.05	0.8186
	PIN	0.05	0.8259
	AdjPIN	1.07	0.3031

Note:

R_Spread is the average quoted spread; ***W_Spread*** is the time-weighted average quoted spread; ***E_Spread*** is the average effective spread; ***PIN*** is the probability of informed trading defined by Easley et al. (1996); ***AdjPIN*** is the adjusted PIN developed by Duarte and Young (2009).

Table 5 - Regression results for the 3 month study period

	Dependent Variable									
	R_Spread		***E_Spread***		***W_Spread***		***PIN***		***AdjPIN***	
	Coef.	***t***	**Coef.**	***t***	**Coef.**	***t***	**Coef.**	***t***	**Coef.**	***t***
Score	**-0.01176**	*-3.8* ***	**-0.00809**	*-3.8* ***	**-0.01152**	*-3.5* ***	**-0.20507**	*-2.9* ***	**-0.09912**	*-1.7* *
Turnover	**-0.00384**	*-10* ***	**-0.00278**	*-10* ***	**-0.00293**	*-7.2* ***	**-0.03238**	*-3.6* ***	**-0.03518**	*-4.8* ***
Volatility	**-0.00002**	*-0.2*	**-0.00002**	*-0.2*	**-0.00003**	*-0.3*	**-0.00193**	*-0.7*	**-0.00177**	*-0.8*
LnPrice	**-0.00017**	*-0.5*	**-0.00037**	*-1.5*	**-0.00033**	*-0.9*	**-0.00610**	*-0.7*	**-0.00490**	*-0.7*
Bloc	**0.00088**	*0.57*	**0.00029**	*0.27*	**0.00310**	*1.91* *	**0.03461**	*0.98*	**0.09331**	*3.18* ***
_cons	**-0.03734**	*-6.8* ***	**-0.02631**	*-6.8* *0*	**-0.02424**	*-4.2* *0*	**-0.14154**	*-1.1*	**-0.28133**	*-2.7* ***
R²	**0.60620**		**0.61060**		**0.51320**		**0.27320**		**0.36580**	
Adj R²	**0.59480**		**0.59890**		**0.49920**		**0.25220**		**0.34750**	
F	**53.26000**		**54.15000**		**36.48000**		**13.00000**		**19.96000**	
sig	**<0.0001**		**<0.0001**		**<0.0001**		**<0.0001**		**<0.0001**	

Note:

*The number of observations is equal to 180; * indicates Significance at the 10% level, ** at the 5% level, *** at the 1% level*

Score is the level of Internet-based disclosure; ***R_Spread*** is the average quoted spread; ***W_Spread*** is the time-weighted average quoted spread; ***E_Spread*** is the average effective spread; ***PIN*** is the probability of informed trading defined by Easley et al. (1996); ***AdjPIN*** is the adjusted PIN developed by Duarte and Young (2009); ***Turnover*** is the rotation rate of stocks; ***Volatility*** is measured by the standard deviation of daily stock returns; ***LnPrice*** is the stock price measured in logarithm; ***Bloc*** represents the proportion of capital held by blockholders (those owning 5% or more of a firm's stock).

Table 6 - Regression results for the 6 month study period

	Dependent Variable											
	R_Spread			***E_Spread***			***W_Spread***			***PIN***			***AdjPIN***		
	Coef.	*t*		**Coef.**	*t*		**Coef.**	*t*		**Coef.**	*t*		**Coef.**	*t*	
Score	**-0.01147**	*-3.7*	***	**-0.00761**	*-3.5*	***	**-0.01112**	*-3.5*	***	**-0.13604**	*-2.3*	**	**-0.10293**	*-2.2*	**
Turnover	**-0.00420**	*-11*	***	**-0.00307**	*-11*	***	**-0.00319**	*-7.9*	***	**-0.03980**	*-5.4*	***	**-0.03550**	*-6.1*	***
Volatility	**-0.00004**	*-0.3*		**-0.00004**	*-0.4*		**-0.00006**	*-0.4*		**-0.00382**	*-1.3*		**-0.00109**	*-0.5*	
LnPrice	**-0.00026**	*-0.7*		**-0.00047**	*-1.9*	*	**-0.00042**	*-1.2*		**-0.00265**	*-0.4*		**-0.00043**	*-0.1*	
Bloc	**0.00081**	*0.52*		**-0.00001**	*-0*		**0.00257**	*1.62*		**0.03344**	*1.14*		**0.04160**	*1.8*	*
_cons	**-0.04164**	*-7.3*	***	**-0.02959**	*-7.5*	***	**-0.02698**	*-4.7*	***	**-0.28123**	*-2.7*	***	**-0.26923**	*-3.2*	***
R²	**0.62900**			**0.63860**			**0.54500**			**0.36450**			**0.41380**		
Adj R²	**0.61830**			**0.62820**			**0.53190**			**0.34600**			**0.39690**		
F	**58.67000**			**61.14000**			**41.45000**			**19.73000**			**24.42000**		
sig	**<0.001**			**<0.001**			**<0.0001**			**<0.0001**			**<0.0001**		

Note:

*The number of observations is equal to 180; * indicates Significance at the 10% level, ** at the 5% level, *** at the 1% level*

Score is the level of Internet-based disclosure; ***R_Spread*** is the average quoted spread; ***W_Spread*** is the time-weighted average quoted spread; ***E_Spread*** is the average effective spread; ***PIN*** is the probability of informed trading defined by Easley et al. (1996); ***AdjPIN*** is the adjusted PIN developed by Duarte and Young (2009); ***Turnover*** is the rotation rate of stocks; ***Volatility*** is measured by the standard deviation of daily stock returns; ***LnPrice*** is the stock price measured in logarithm; ***Bloc*** represents the proportion of capital held by blockholders (those owning 5% or more of a firm's stock)