

# HOW DOES CORPORATE VOLUNTARY DISCLOSURE AFFECT ASYMMETRIC INFORMATION AND ADVERSE SELECTION?

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## Abstract

This paper investigates whether the extent of corporate voluntary disclosure mitigates asymmetric information and adverse selection in the Euronext Paris stock exchange. We apply a disclosure index as a proxy for the extent of voluntary disclosure and use different spread measures to estimate both asymmetric information and adverse selection. Our findings show a negative relationship between the disclosure index and asymmetric information and adverse selection proxies. An analysis of sub-indexes provides additional mixed results. Several asymmetric information measures are negatively related to the volume of financial, non-financial and voluntary governance information in corporate annual reports. Nevertheless, the effect of strategic information volume is statistically significant only for effective bid-ask spreads. On the whole, these results are consistent with the view that high corporate voluntary disclosure is associated with narrow spreads and low adverse selection costs.

**Keywords:** Corporate Voluntary Disclosure, Asymmetric Information, Adverse Selection, Annual Reports, France

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## 1 Introduction

Prior research shows that annual reports are the main source of mandatory and voluntary corporate disclosure (e.g., Wiseman, 1982; Rockness, 1985; Neu et al., 1998). Corporate stakeholders use these reports as an important summary of a firm's performance indicators (Lang and Lundholm, 1996). Among studies that examine disclosure in annual reports, Lang and Lundholm (1993) and Holland (1998) show a positive correlation between disclosure in this basic document and other forms of disclosure. Recently, Zarb (2007) suggested that the amount of information contained in corporate annual reports is the best evidence of the level of firm disclosure.

Recent years have seen an increase in the quantity and quality of corporate annual report content. Information in this basic document has become more abundant and varied. In addition to the mandatory financial information, managers provide governance, strategic, environmental, and social information in annual reports. However, despite the variety of the information, we have observed a dramatic increase in information asymmetries in stock exchange markets and deterioration in environmental transparency. This leads many of us to ask about the relevance of corporate disclosure practices. In our paper, we attempt to ascertain how managers' voluntary disclosure decisions, in particular the volume of voluntary information in annual reports,

influence the degree of information asymmetry in stock exchange markets.

Several studies demonstrate that corporate disclosure decisions, as proxied by earnings quality (e.g., Richardson, 2000; Ascioğlu et al., 2012; Bhattacharya et al., 2012), disclosure policy (e.g., Heflin et al., 2005; Brown and Hillegeist, 2007) or voluntary earnings announcements (e.g., Lakhali, 2008) affect information asymmetry and uncertainty in stock exchange markets. However, much less attention has been paid to the extent of the voluntary disclosure in corporate annual reports. Our paper extends prior studies and interest to the impact of this form of voluntary disclosure on information asymmetry in the French exchange market.

Our paper differs from prior studies in many aspects. Firstly, it aims to verify whether the volume of diversified voluntary information provided by managers in annual reports improves market information symmetry. Secondly, it deepens the analysis of the sub-categories of voluntary information disclosed in annual reports. In addition, it combines classical finance and behavioral finance in order to analyze empirically a major problem in stock exchange markets: the adverse selection problem. We use panel data from 159 commercial and manufacturing firms operating in the French exchange market from 2004 to 2009. The choice of France as the framework of our study was for several reasons. Firstly, a weakness in investor protection rules and the

ineffectiveness of the legal system are characteristics of the French judicial environment (e.g., La Porta et al., 1997; Coffee, 2001; Piot and Janin, 2007). In this context, disclosure decisions are expected to be important in reducing information asymmetry between market participants. Secondly, French managers have increasingly opted for voluntary disclosure in order to report their firms' performances to the market (e.g., Lakhali, 2008). France has witnessed significant development in corporate governance rules, particularly disclosure standards and firm transparency. Despite this increasing tendency, information asymmetry and the illiquidity problem this generates persist in France. Finally, the French market has significant weight in the European market. Therefore, the choice of France as the framework in which to investigate the effects of voluntary disclosure is another distinguishing feature of our study.

The remainder of the paper is organized as follows. Section 2 presents the theoretical background. Section 3 outlines the sample, describes the data and defines the variables used in the empirical analysis. Section 5 reports and discusses the main empirical findings. Section 6 offers some conclusions.

## 2 Theoretical background

Information asymmetry, based on Akerlof's (1970) interpretation, occurs when some investors hold private information about a firm's value. This generates an adverse selection problem in the stock exchange market if these better informed investors use this private information in trading. Several drawbacks are likely to be caused by information asymmetry, such as an increased cost of capital (e.g., Botosan, 1997), illiquidity problems (e.g., Hong and Huang, 2005; Easley, 2010), increased dispersions and errors in analysts' forecasts (e.g., Zhang, 2010) and much more difficult access to market capital (e.g., Frost et al., 2008).

Theoretical literature (e.g., Diamond, 1985; Diamond and Verrecchia, 1991) predicts that a good disclosure policy may mitigate the information asymmetry problem, as it is associated with relatively less well-informed trading. A decrease in information asymmetry can be characterized as narrower bid-ask spreads (e.g., Glosten and Milgrom, 1985). Empirical evidence in Welker (1995), Healy et al. (1999) and Heflin et al. (2005) support this argument. They provide evidence that a better disclosure policy not only reduces information asymmetry and uncertainty, but also prevents stock exchange market failure since it improves market liquidity. Welker (1995) demonstrates a negative relation between disclosure quality and bid-ask spreads. His sample mainly includes large firms and focuses on disclosure activities compiled by the Association for Investment Management and Research (AIMR) between 1983 and 1990. In the same market, Healy et al. (1999) examine the association between disclosure quality as proxied

by AIMR scores and information asymmetry over the period 1980-1990. Similar to Welker (1995), they show that bid-ask spreads are negatively related to corporate disclosure quality. The same view is supported by Leuz and Verrecchia (2000), who adopt a time series approach to examine the association between disclosure quality and information asymmetry. The authors analyze changes in three proxies for information asymmetry (bid-ask spreads, trading volume and price volatility) for a sample of German firms that moved from German Generally Accepted Accounting Principles (GAAP) to International Accounting Standards (IAS) or US GAAP. The authors provide evidence that the improvement in disclosure standards for the firms that switched is associated with decreased information asymmetry among investors.

Similar to Welker (1995) and Healy et al. (1999), Heflin et al. (2005) and Brown and Hillegeist (2007) examine the impact of disclosure quality as proxied by AIMR scores for information asymmetry. Heflin et al. (2005) measure information asymmetry using depth-adjusted effective bid-ask spreads. They find that higher disclosure quality is associated with lower trading costs and reduced information asymmetry. Brown and Hillegeist (2007) assess information asymmetry using the probability of informed trade (PIN) developed in Easley et al. (2002). They show that PIN was negatively influenced by the quality of annual reports and the investor relations activities of 423 large firms between 1986 and 1996. Furthermore, their findings show that PIN is positively affected by the quality of quarterly reports. Ultimately, the authors conclude that higher disclosure quality reduces the likelihood of investors accessing private information and trading on the basis of this information, thus reducing information symmetry in stock exchange markets.

Interested in another form of corporate disclosure, Richardson (2000), Ascioğlu et al. (2012) and Bhattacharya et al. (2012) study the link between earnings management and information asymmetry. To measure information asymmetry in a stock exchange market, Richardson (2000) uses closing bid-ask spreads; Ascioğlu et al. (2012) use PIN, Amihud's (2002) illiquidity measure and Kim and Verrecchia's (1994) disclosure quality measure; while Bhattacharya et al. (2012) utilize effective spread and the price impact of a trade as proxies for information asymmetry. The three studies provide evidence that the level of information asymmetry is significantly greater for firms with poor earnings quality. This view is also supported by Bhattacharya et al. (2007), who conclude that poor earnings quality results in higher adverse selection risk and increased trading costs. According to these authors, an increase in information asymmetry is an unambiguous consequence of poor earnings quality.

The investor recognition hypothesis (Merton, 1987) suggests that investors are more likely to trade

in firms which are well known and/or that they judge favorably. Then, since voluntary disclosure increases a firm's visibility (e.g., Bushee and Miller, 2012) and reduces the level of private information (e.g., Diamand, 1985), this may encourage uninformed traders to invest in firms that have higher voluntary information disclosure levels. In light of the above literature review, we anticipated that firms with good disclosure quality, *inter alia*, and a greater extent of voluntary disclosure in their annual reports have narrower bid-ask spreads and a lower adverse selection component.

### 3 Data

#### 3.1 Sample selection and data sources

Our initial sample consisted of all French listed firms belonging to the French SBF 250 Index between 2004 and 2009. As in prior studies, we excluded regulated utilities (SIC code 4900-4999) and financial firms (SIC code 6000-6999), since they are subject to specific legal and regulatory disclosure requirements. We also discarded all firms with missing financial data. This reduced our final data to 159 French commercial and manufacturing firms (954 firm-year observations). Financial data related to, for instance, closed stock prices, bid and ask prices,

return volatility and trading volume were retrieved from the Datastream database. The annual reports used were found in the Worldscope database and downloaded from the French stock market authority (AMF) website.

#### 3.2 Information asymmetry proxies: dependent variables

To test our hypothesis, we computed three measures of information asymmetry: effective bid-ask spread (ESP); quoted bid-ask spread (QSP) and the adverse selection component (ADC).

##### 3.2.1 Bid-ask spread

The relevant literature emphasizes that when information asymmetry between market participants is higher, bid-ask spreads will be wider. Accordingly, we used bid-ask spreads as a proxy for information asymmetry. ESP was calculated as the yearly average of daily effective bid-ask spreads. We followed the studies by Lin et al. (1995) and Heflin et al. (2005) and measured the daily effective spread as twice the absolute value of the difference between a transaction price and the midpoint of the bid and ask prices. This was computed using the following formula:

$$ESP = 2 \left| P_t - \left[ \frac{Ask_t + Bid_t}{2} \right] \right| \quad (1)$$

Where  $Ask_t$  ( $Bid_t$ ) is the best ask (bid) price on day  $t$ .

To assess annual average spread, we divided the sum of daily effective spreads by the total number of trading days during the quotation year.

QSP was calculated as the yearly average of daily quoted bid-ask spreads. The daily quoted bid-ask spread was measured using the following formula:

$$QSP = \frac{Ask_t - Bid_t}{Ask_t + Bid_t} \quad (2)$$

We divided the sum of daily quoted spreads by the total number of trading days during the quotation year in order to obtain the annual average quoted spread.

##### 3.2.2 Adverse selection component

The market microstructure literature (e.g., Stoll, 2000) suggests that a bid-ask spread includes three components: order processing costs, inventory holding costs and adverse selection costs. Information asymmetry or adverse selection costs are reflected in wider bid-ask spreads as market makers expand the spread to recover the expected losses incurred from

trading with better-informed traders (e.g., Benston and Hagerman, 1974; Copeland and Galai, 1983; Glosten and Milgrom, 1985; Kyle, 1985; Glosten and Harris, 1988). We calculated the adverse selection component as a direct measure of information asymmetry costs as bid-ask spread measures also capture fixed and inventory components of trading (e.g., Huang and Stoll, 1994).

To obtain the adverse selection component ( $\lambda$ ), we followed Lin et al.'s (1995) model as developed from Stoll (1989), Lin (1993) and Huang and Stoll (1994). Thus, we estimated the following equation under the OLS method:

$$Q_{i,t+1} - Q_{i,t} = \lambda_{i,t} Z_{i,t} + e_{t+1} \tag{3}$$

Where  $Q_{i,t} = \frac{Ask_{i,t} + Bid_{i,t}}{2}$  is defined as the daily bid-ask midpoint of firm  $i$ .

$Z_{i,t} = P_{i,t} - Q_{i,t}$  is one-half the signed effective spread.

$\lambda_{i,t}$  reflects the quote revision in response to a trade as a fraction of the daily effective spread. It is defined as the daily adverse selection component of the daily effective spread. We calculated the annual average information asymmetry component from daily observations.

Referring to Cheng et al.'s (2006) study, we multiplied each stock's annual average information asymmetry component by the annual average of its effective spread in order to obtain the adverse

selection costs induced by informed trading. Thus, our measure of the adverse selection cost of the effective spread was defined as follows:

$$ADC_i = \hat{\lambda}^* ESP_i \tag{4}$$

### 3.3 Voluntary disclosure score

The explanatory variable is the extent of voluntary disclosure in annual reports measured using self-constructed "disclosure indexes". We developed a disclosure checklist based on relevant existing studies by Meek et al. (1995), Botosan (1997), Chau and Gray (2002), Eng and Mak (2003), Lim et al. (2007) and Francis et al. (2008). It consists of a total of 112 items divided into four general categories: strategic (STG-VD, 30 items), non-financial (NFN-VD, 35 items), financial (FN-VD, 36 items) and governance

information (GOV-VD, 11 items). In line with Cooke (1992), we conducted a content analysis to identify the presence of information in annual reports. The VDScore is the total of the scores awarded for each item in the voluntary disclosure checklist. Table 1 presents a checklist of items included in the disclosure scores. We assigned a value of one when a given item is disclosed and zero otherwise. The total score for each sample firm was computed as an unweighted sum of the scores of all the items in the index.

**Table 1.** The checklist of voluntary disclosure

Checklist of items	References	Checklist of items	References
<b>A - Strategic information</b>		30. Description of capital project committed	A, B, C
<b>A1. General information about the firm</b>		<b>B - No-financial information</b>	
1. Brief history of company	A, B, C, E	<b>B1. Employees information</b>	
2. General description of the business	B, D	1. Geographical distribution of employees	A, C
3. Main products	B, D	2. Number of employees by sex	A, C
4. Main Markets	B, D	3. Number of employees by age	A, C
<b>A2. Corporate Strategy</b>		4. Categories of employees by function	A, C
5. Statement of the main objectives	A, B, C, D, E	5. Number of employees for 2 or more years	A, C, E
6. Statement of the financial objectives	A, C, E	6. Average compensation per employee	A, B
7. Current Strategy	A, B, C, F	7. Added value per employee	A, B
8. Impact of strategy on current results	B	8. Data productivity	A, B, C
9. Future strategy	A, B, C	9. Safety policy	A, B, C
10. Impact of strategy on future results	A, C, E	10. Cost of safety measures	A, C
<b>A3. R &amp; D activities</b>		11. Data on accidents	A, C, E
11. Description of R & D projects	A, C	12. Policy on communication	A, C
12. Corporate policy on R & D	A, C	13. Redundancy information	A, C

Table 2. The checklist of voluntary disclosure (continued)

Checklist of items	References	Checklist of items	References
13. Location of R & D activities	A, C, D	14. Reason for changes in employees' number or categories over time	A, C
14. Number employed in R & D	A, C, E	15. Recruitment problems and related policy	A, C
<b>A4. Analysis and discussion of management Review of projects</b>		<b>B2. Information about the training policy</b>	
15. Review of operations	B	16. Amount spent in training program	A, C, E
16. Competitive environment	B, D	17. Nature of training	A, C, E
17. The most significant events	B, D	18. Policy on training	A, C, E
18. Change in sales and profits	B, D	19. Categories of employees trained	A, C, E
19. Change in cost of goods sold	B, D	<b>B3. Social policy and value-added information</b>	
20. Change in expenses	B, D	20. Safety of products	A, C
21. Change in inventory	B, D	21. Program of environmental protection	A, C, E
22. Change in the share price	B, D	22. Charitable Donations	A, C, E
<b>A5. Future prospects</b>		23. Community programs	A, C, E
23. Future development channels	A, B, C	24. Value added data	A, C, E
24. Qualitative forecast of sales	A, B, C, E	25. Value added ratios	A, C, E
25. Quantitative forecast of sales	A, B, C, D, F	26. Qualitative value-added information	A, C, E
26. Qualitative forecast of profits	A, B, C, D, E, F	<b>B4. Segmental Information</b>	
27. Quantitative forecast of profits	A, B, C, E	27. Geographical distribution of invested capital	A, C, E
28. Assumptions underlying the forecast	A, B, C	28. Geographical distribution of net assets	A, C
29. Review of forecasts	A, B, C	<b>B - No-financial information</b>	
29. Geographical distribution of production	A, C, E	21. Estimates of capital increase	A, B, C
30. Expenditure in the business lines	A, C	22. Earnings estimates	A, B, C
31. Revenue by business line	A, C	23. Effect of inflation currency fluctuations on future operation	A, C
32. Competitor analysis- quantitative	A, C	24. Effect of currency fluctuation of interest rates on future operations	A, C
33. Competitor analysis- qualitative	A, C	<b>C4. Information on exchange rates</b>	
34. Market share analysis-quantitative	A, C	25. Impact of currency fluctuations on current results	A, B, C
35. Market share analysis-qualitative	A, C	26. Impact of currency fluctuations on future operations	A, C, E
<b>C-Financial Information</b>		27. Estimates of currency fluctuations	A, B, C
<b>C1. Performance indicators (without from the financial statements)</b>		28. Exchange rates used in accounting	A, B, C
1. Performance indicators	A, B, C	29. Long-term debt by currency	A, C
2. Financial data for the last five years	A, B, C, D, E	30. Short-term debt by currency	A, C
3. Turnover	A, B, C, D, F	<b>C5. Other financial information</b>	
4. Net income	A, B, C, D, F	31. Share price at year end	A, C
5. Shareholders' equity	A, B, C, D, F	32. Share prices trend	A, C, E
6. Total assets	A, B, C, D, F	33. Market capitalization at year end	A, C, E
7. Earnings per share	A, B, C, F	34. Trend of market capitalization	A, C
8. Dividend payout policy	A, B, C, F	35. Size of shareholdings	A, C
9. Transfer pricing policy	A, B, C, F	36. Forecasted market share	A, C, D, F
10. Impact of any accounting policy changes on results	A, B, C, F	D- Governance information	

**Table 3.** The checklist of voluntary disclosure (continued)

Checklist of items	References	Checklist of items	References
11. Advertising expenditure	A, B, C, E	1. Ownership structure	A, C
12. Effect of inflation on results	A, B, C	2. Organizational Chart	A, B, C, E
13. Effect of inflation on assets	A, B, C	Composition of the board of director	
14. Effect of fluctuating interest rates on the result	A, B, C, E	3. Personal Profile	A, C
<b>C2. Financial ratios</b>		4. Description of the position occupied	A, C
15. Liquidity Ratio	A, B, C, E	5. Duration of belonging to the company	A, B, C
16. Turnover ratio of assets	A, B, C	6. Number of shareholders belonging to the board of directors	A, B, C
17. Debt ratio	A, B, C, E	7. Academic profile of the directors	A, B, C
18. Profitability ratios	A, B, C, E, F	8. Presence of Internal Audit Committee	A, B, C
19. Other useful ratios	A, B, C, E	9. Age of the executives	A, B, C
<b>C3. Forecasted information</b>		10. Profile of the executives	A, B, C
20. Cash flow forecast	A, B, C, D	11. Individual remuneration	A, B, C

A: Meek, Robert, and Gray (1995)

B: Eng and Mak (2003)

C: Chau and Gray (2002)

D: Botosan (1997)

E: Lim, Matolcsy, and Chow (2007)

F: Francis, Nanda, and Olsson (2008)

### 3.4 Control variables

The relevant literature (e.g., Hanley et al., 1993; Welker, 1995; Brockman and Chung, 1999; Heflin and Shaw, 2000; Sarin et al., 2000; Heflin et al., 2005; Chung et al., 2010) suggests that share price, return volatility, trading volume, and firm size are major determinants of bid-ask spreads. Price (PRICE) is defined as the average share price. We measured the return volatility (STD-DV) using the yearly average of standard deviation of daily close-to-close returns. The yearly average of daily trading number is a proxy for

trading volume (TRADVOL). Firm size (TA) is defined as total firm assets.

### 3.5 Regression model

In summary, we modeled information asymmetry as a function of the extent of voluntary disclosure in corporate annual reports and other firm operating characteristics, particularly, share price, return volatility, trading volume and firm size. We transformed the financial variables through a logarithmic function to reduce their disparity. The OLS regression model with firm-fixed effects is as follows:

$$LNINFASS_{it} = \alpha_i + \beta_1 EVD_{it} + \beta_2 LNPRICE + \beta_3 LNTRADVOL + \beta_4 LNSTD.DV + \beta_5 LNNTA + \mu_{it} \quad (5)$$

Where  $i$  and  $t$  are sub-scripts denoting the firm ( $N = 159$ ) and time ( $T = 6$ ), respectively;  $\alpha_i$  is a firm-fixed effect;  $\beta$  is an estimation parameter; and  $\mu_{it}$  is an error term.  $LNINFASS$  is equal to the natural log of one of the three proxies for information asymmetry defined below;  $EVD$  is equal to the global disclosure index, in the first part of our empirical study, and to one of the four sub-indexes in the second part;  $LNPRICE$  is the natural log of a firm's average share price;  $LNTRADVOL$  is the natural log of a firm's average trading volume;  $LNSTD-DV$  is the natural log

of the average standard deviation of stock return; and  $LNNTA$  is equal to the natural log of total assets.

## 4 Analysis and results

### 4.1 Descriptive statistics

Table 2 shows the descriptive statistics for our three information asymmetry measures and their explanatory variables.

**Table 4.** Descriptive statistics

Variables	N	Min	25%	Mean	Median	75%	Max	STD-DV
<b>Dependent variables</b>								
ESP	954	3.2055E-03	0.0015	0.0073	0.0045	0.0093	0.2209	0.0125
QSP	954	3.3068E-03	0.0018	0.0076	0.0052	0.0099	0.2331	0.0115
ADC	954	5.5302E-05	0.0003	0.0013	0.0007	0.0016	0.0381	0.0022
<b>Disclosure variables</b>								
ARVD	954	0.0708	0.3363	0.4040	0.4159	0.4823	0.6461	0.1115
STGVD	954	0.0333	0.3333	0.4505	0.4666	0.5333	0.7666	0.1400
NFNVD	954	0	0.2571	0.3651	0.3714	0.4857	0.7143	0.1476
FNVD	954	0.0541	0.2703	0.3562	0.3514	0.4324	0.6757	0.1225
GOVD	954	0.0909	0.3636	0.5614	0.5454	0.7273	1	0.2204
<b>Control variables</b>								
PRICE	954	0.54	17.3271	46.5539	32	54.705	796.73	70.0138
Ln(TRADVOL)	954	2.5337	7.7003	9.6354	9.5533	11.8503	15.,7451	2.5337
Ln(STD-DV)	954	0.0131	0.0222	0.0295	0.0279	0.3482	0.5994	0.0947
Ln(TA)	954	8.9369	12.8341	14.1376	13.7783	15.4446	18.6094	8.9369

ESP= the effective bid-ask spread; QSP= the quoted bid-ask spread ; ADC= adverse selection component ; ARVD=disclosure score ; STGVD, NFNVD, FNVD and GOVD=sub index disclosures measuring the volume of strategic, non-financial, financial and governance of voluntary information, respectively; PRICE= the average share price; TRADVOL= the average trading volume; STD-DV=the return volatility ; TA= the total firm assets.

The descriptive statistics show that our sampled firms have an average effective spread equal to 0.0073 and an average quoted bid-ask spread equal to 0.0076. The average information asymmetry component of our sample is equal to 0.0013 and ranges from 0.0381 to 5.5301E-05. The total disclosure index has a mean (median) of 0.4040 (0.4159) and ranges from 0.6461 to 0.0708. Despite several disclosure codes motivating firms to publish further information, we documented diversity in the extent of voluntary disclosure in annual reports (with a standard deviation equal to 0.1115). The share price of our sample had an average equal to \$46.5539, higher than that documented by

Heflin et al. (2005) in the North American market (\$36.26).

#### 4.2 Pearson correlation matrix

In this part of our empirical study, we test the possible presence of a multicollinearity problem. This primary analysis is in order to ensure the statistical robustness of our regression model. Indeed, the existence of a high correlation between the explanatory variables in the studied model could influence the estimators. The matrix of Pearson correlations presented in Table 3 shows the correlation coefficients between our explanatory variables.

**Table 5.** Pearson correlation matrix

	ARVD	STGVD	NFNVD	FNVD	GOVD	PRICE	TRAVOL	STD-DV	TA
ARVD	1.0000	0.7785	0.7802	0.8282	0.6545	0.0485	0.2083	-0.0218	0.2101
STGVD		1.0000	0.3955	0.5873	0.4327	0.0582	0.1148	-0.0226	0.1243
NFNVD			1.0000	0.4712	0.3689	0.0053	0.2711	0.0147	0.2761
FNVD				1.0000	0.4667	0.0299	0.0261	-0.0114	0.0677
GOVD					1.0000	0.0109	0.2014	-0.0655	0.1557
PRICE						1.0000	-0.1991	-0.5326	0.2769
TRADVOL							1.0000	0.0760	0.7168
STD-DV								1.0000	-0.3147
TA									1.0000

ESP= the effective bid-ask spread; QSP= the quoted bid-ask spread; ADC= adverse selection component; ARVD=disclosure score; STGVD, NFNVD, FNVD and GOVD= disclosures sub-indexes proxy for the volume of strategic, non-financial, financial and governance voluntary information, respectively; PRICE= the average share price; TRADVOL= the average trading volume; STD-DV=the return volatility; TA= the total firm assets.

According to Kervin (1992), a multicollinearity problem exists when the correlation coefficient between two explanatory variables reaches a critical value of 0.7. Kennedy (1985), among others, extends this value to 0.8. From Table 3, it can be seen that the

correlation coefficients for our explanatory variables<sup>1</sup> are much lower than the threshold of 0.8. Accordingly,

<sup>1</sup> This conclusion does not include the correlation between disclosure indexes since each sub-index is estimated through distinct regression models in order to examine separately the effect of each information sub-category disclosed in the annual reports.

multicollinearity does not present a problem in our study.

### 4.3 Empirical results for the regression analysis

Table 4 presents the regression results of the information asymmetry proxies in the global disclosure index, using stock price, return volatility, trading volume and firm size as control variables.

**Table 6.** The regression results of the relation between information asymmetry measures and global disclosure index

$$LNINFASS_{it} = \alpha_i + \beta_1 ARVD_{it} + \beta_2 LNPRICE + \beta_3 LNTRADVOL + \beta_4 LNSTD.DV + \beta_5 LNTA + \mu_{it}$$

Explanatory variables	Dependent variables : information asymmetry measures					
	LNEBP		LNQSP		LNADC	
	Coefficient	Statistic-t	Coefficient	Statistic-t	Coefficient	Statistic-t
Constant	-1.5625	(-7.1266)***	-1.6062	(-6.6858)***	-3.4772	(-13.8110)***
ARVD	-0.2699	(-2.8829)**	-0.2369	(-2.3095)**	-0.3176	(-2.9524)***
LNPRICE	-0.4089	(-25.5765)***	-0.3863	(-22.0484)***	-0.4341	(-23.8385)***
LNTRADVOL	-0.4205	(-50.7984)***	-0.4094	(-45.2323)***	-0.4339	(-45.9504)***
LNSTD-DV	0.3256	(7.2146)***	0.3173	(6.4174)***	0.3535	(6.8186)***
LNTA	0.0344	(2.9419)***	0.0326	(2.5446)***	0.0556	(4.1699)***
R <sup>2</sup> adjusted	0.9025		0.8766		0.8709	
F-statistic	1458.7586		1120.1684		1279.3999	
(p-value)	(0.0000)		(0.0000)		(0.0000)	
Durbin-Watson statistic	2.0839		2.1185		2.0839	

LNINFASS= one of the three information asymmetry proxies; LNEBP= the natural log of the effective bid-ask spread; LNQSP= the natural log of the quoted bid-ask spread; LNADC= the natural log of adverse selection component; ARVD= global disclosure index; LNPRICE= the natural log of the average share price ; LNTRADVOL= the natural log of the average trading volume; LNSTD.DV=the natural log of the average standard deviation of the stock return; LNTA= the natural log of the total firm assets.

The results of the regression model confirm our predictions. The ARVD coefficients are negative and statistically significant for three information asymmetry proxies. The extent of the voluntary disclosure in annual reports reduces the quoted bid-ask spreads, particularly the adverse selection component. These findings are consistent with prior studies, such as those by Lang and Lundholm (1993), Welker (1995), Healy et al. (1999), Heflin et al. (2005) and Lakhali (2008). These other studies show evidence that high voluntary disclosure plays a significant role in reducing information asymmetry between investors and mitigating adverse selection problems. Our results confirm the theoretical suggestions of Diamond (1985) and Diamond and Verrecchia (1991) that disclosing further voluntary information to the market reduces the level of private information about outstanding share quality and the incentive of investors to acquire private information, thus

decreasing adverse selection costs and improving information symmetry between market participants.

To explain our results we also refer to Bushee and Miller (2012), in that voluntary disclosure increases firm visibility, and Merton's (1987) finding that investors are more likely to invest in firms about which they know more. The evidence suggests that firms that disclose further information in their annual reports can encourage investor confidence and uninformed traders are more likely to invest in their shares. Information asymmetry, where there is greater voluntary disclosure, seems to be less troublesome for shareholders.

Tables 5, 6, 7 and 8 present the regression results of the three information asymmetry proxies for the disclosure sub-indexes for strategic, financial, non-financial and governance information and the control variables as previously defined.



**Table 7.** The regression results of the relation between information asymmetry measures and sub-index of strategic disclosure

$$LNINFASS_{it} = \alpha_i + \beta_1 STGVD_{it} + \beta_2 LNPRICE + \beta_3 LNTRADVOL + \beta_4 LNSTD.DV + \beta_5 LNTA + \mu_{it}$$

Explanatory variables	Dependent variables : information asymmetry measures					
	LNEBP		LNQSP		LNADC	
	Coefficient	Statistic-t	Coefficient	Statistic-t	Coefficient	Statistic-t
Constant	-1.5782	(-7.1774)***	-1.6165	(-6.7015)***	-3.5009	(-13.8053)***
STGVD	-0.1349	(-1.6923)*	-0.1259	(-1.4387)	-0.1267	(-13762)
LNPRICE	-0.4097	(-25.5979)***	-0.3867	(-22.0237)***	-0.4349	(-23.7390)***
LNTRADVOL	-0.4211	(-50.7977)***	-0.4099	(-45.1611)***	-0.4349	(-45.7731)***
LNSTD-DV	0.3231	(7.1669)***	0.3151	(6.3723)***	0.3498	(6.7264)***
LNTA	0.0328	(2.8079)***	0.0311	(2.4273)**	0.0533	(3.9817)***
R <sup>2</sup> <sub>adjusted</sub>	0.9026		0.8765		0.8700	
F-statistic	1461.6406		1119.3386		1268.9236	
(p-value)	(0.0000)		(0.0000)		(0.0000)	
Durbin-Watson statistic	2.0846		2.1197		2.0846	

LNINFASS= one of the three information asymmetry proxies; LNEBP= the natural log of the effective bid-ask spread; LNQSP= the natural log of the quoted bid-ask spread; LNADC= the natural log of adverse selection component; STGVD = disclosure sub-index proxy for the volume of strategic voluntary information; LNPRICE= the natural log of the average share price; LNTRADVOL= the natural log of the average trading volume; LNSTD.DV=the natural log of the average standard deviation of the stock return; LNTA= the natural log of the total firm assets.

**Table 8.** The regression results of the relation between information asymmetry measures and sub-index of non-financial disclosure

$$LNINFASS_{it} = \alpha_i + \beta_1 NFNVD_{it} + \beta_2 LNPRICE + \beta_3 LNTRADVOL + \beta_4 LNSTD.DV + \beta_5 LNTA + \mu_{it}$$

Explanatory variables	Dependent variables : information asymmetry measures					
	LNEBP		LNQSP		LNADC	
	Coefficient	Statistic-t	Coefficient	Statistic-t	Coefficient	Statistic-t
Constant	-1.5757	(-7.1735)***	-1.6060	(-6.6794)***	-3.4841	(-13.8104)***
FNVD	-0.1941	(-2.1965)**	-0.2139	(-2.2109)**	-0.2491	(-2.4536)**
LNPRICE	-0.4119	(-25.7746)***	-0.3888	(-22.2263)***	-0.4371	(-24.0067)***
LNTRADVOL	-0.4234	(-51.2371)***	-0.4121	(-45.6588)***	-0.4373	(-46.3875)***
LNSTD-DV	0.3251	(7.1940)***	0.3172	(6.4146)***	0.3527	(6.7948)***
LNTA	0.0348	(2.9759)***	0.0333	(2.5977)***	0.0559	(4.1840)***
R <sup>2</sup> <sub>adjusted</sub>	0.9022		0.8766		0.8706	
F-statistic	1454.6942		1119.6005		1275.2595	
(p-value)	(0.0000)		(0.0000)		(0.0000)	
Durbin-Watson statistic	2.0793		2.1161		2.0793	

LNINFASS= one of the three information asymmetry proxies; LNEBP= the natural log of the effective bid-ask spread; LNQSP= the natural log of the quoted bid-ask spread; LNADC= the natural log of adverse selection component; FNVD =disclosure sub-index proxy for the volume of financial voluntary information; LNPRICE= the natural log of the average share price; LNTRADVOL= the natural log of the average trading volume; LNSTD.DV=the natural log of the average standard deviation of the stock return; LNTA= the natural log of the total firm assets.

**Table 9.** The regression results of the relation between information asymmetry measures and sub-index of financial disclosure

$$LNINFASS_{it} = \alpha_i + \beta_1 FNVD_{it} + \beta_2 LNPRICE + \beta_3 LNTRADVOL + \beta_4 LNSTD.DV + \beta_5 LNTA + \mu_{it}$$

Explanatory variables	Dependent variables : information asymmetry measures					
	LNESP		LNQSP		LNADC	
	Coefficient	Statistic-t	Coefficient	Statistic-t	Coefficient	Statistic-t
<b>Constant</b>	-1.6445	(-7.5387)***	-1.6730	(-6.9930)***	-3.5667	(-14.2285)***
<b>NFVD</b>	-0.2525	(-3.4525)***	-0.1658	(-2.0661)**	-0.26480	(-3.1483)***
<b>LNPRICE</b>	-0.4108	(-25.7741)***	-0.3880	(-22.1969)***	-0.4367	(-24.0348)***
<b>LNTRADVOL</b>	-0.4206	(-50.9788)***	-0.4099	(-45.4012)***	-0.4346	(-46.1447)***
<b>LNSTD-DV</b>	0.3339	(7.3948)***	0.3220	(6.5032)***	0.3605	(6.9451)***
<b>LNTA</b>	0.0375	(3.1932)***	0.0343	(2.6634)***	0.0589	(4.3925)***
R <sup>2</sup> <sub>adjusted</sub>	0.9027		0.8767		0.8711	
F-statistic	1463.6755		1121.5281		1281.2347	
(p-value)	(0.0000)		(0.0000)		(0.0000)	
Durbin-Watson statistic	2.0853		2.1203		2.0853	

LNINFASS= one of the three information asymmetry proxies; LNESP= the natural log of the effective bid-ask spread; LNQSP= the natural log of the quoted bid-ask spread; LNADC= the natural log of adverse selection component; NFVD =disclosure sub-index proxy for the volume of financial voluntary information ; LNPRICE= the natural log of the average share price; LNTRADVOL= the natural log of the average trading volume; LNSTD.DV=the natural log of the average standard deviation of the stock return; LNTA= the natural log of the total firm assets.

**Table 10.** The regression results of the relation between information asymmetry measures and sub-index of governance disclosure

$$LNINFASS_{it} = \alpha_i + \beta_1 FNVD_{it} + \beta_2 LNPRICE + \beta_3 LNTRADVOL + \beta_4 LNSTD.DV + \beta_5 LNTA + \mu_{it}$$

Explanatory variables	Dependent variables : information asymmetry measures					
	LNESP		LNQSP		LNADC	
	Coefficient	Statistic-t	Coefficient	Statistic-t	Coefficient	Statistic-t
<b>Constant</b>	-1.5407	(-6.9734)***	-1.5625	(-6.4588)***	-3.4411	(-13.5422)***
<b>GOVD</b>	-0.1179	(-2.4159)**	-0.1363	(-2.5493)**	-0.1460	(-2.6007)***
<b>LNPRICE</b>	-0.4107	(-25.7367)***	-0.3875	(-22.1727)***	-0.4357	(-23.9284)***
<b>LNTRADVOL</b>	-0.4199	(-50.4007)***	-0.4081	(-44.8183)***	-0.4327	(-45.4259)***
<b>LNSTD-DV</b>	0.3147	(6.9607)***	0.3053	(6.1675)***	0.3393	(6.5229)***
<b>LNTA</b>	0.0322	(2.7566)***	0.0302	(2.3651)**	0.0523	(3.9195)***
R <sup>2</sup> <sub>adjusted</sub>	0.9025		0.8769		0.8707	
F-statistic	1459.9195		1123.1817		1276.4010	
(p-value)	(0.0000)		(0.0000)		(0.0000)	
Durbin-Watson statistic	2.0819		2.1178		2.0819	

LNINFASS= one of the three information asymmetry proxies; LNESP= the natural log of the effective bid-ask spread; LNQSP= the natural log of the quoted bid-ask spread; LNADC= the natural log of adverse selection component; GOVD =disclosure sub-index proxy for the volume of governance voluntary information ; LNPRICE= the natural log of the average share price; LNTRADVOL= the natural log of the average trading volume; LNSTD.DV=the natural log of the average standard deviation of the stock return; LNTA= the natural log of the total firm assets.

Table 5 provides the results of the relationship between the extent of strategic disclosure and the three information asymmetry proxies. The coefficient for the strategic disclosure sub-index is negative, but statistically significant only for the ESP. The findings show that the three information asymmetry measures (QSP, ESP and ADC) are significantly and negatively associated with the volume of voluntary financial,

non-financial and governance information provided by managers in annual reports. The results given in Table 6 suggest that additional financial information is useful for investors to appreciate better firm performance, thus confirming prior studies (e.g., Hossain and Marks, 2005; Zarb, 2007) and emphasizing the significance of additional financial information for firm assessment. In addition, our

results shown in Table 7 demonstrate that investors include non-financial information, *inter alia*, about firms' human capital, social responsibilities and environmental policies in their evaluation. This confirms the added value of non-financial information and the benefits of encouraging managers to provide further non-financial information. Table 8 shows that the extent of voluntary governance disclosure reduces information asymmetry and mitigates the adverse selection problem. These findings are coherent with prior studies such as that by Cormier et al. (2010).

Firm size and the average standard deviation are positively and significantly related to the three information asymmetry measures. These findings suggest that large firms with a more volatile stock return are more exposed to the risk of adverse selection and, therefore, subject to more information asymmetry problems. The results linked to volatility are consistent with previous literature (e.g., Welker, 1995; Heflin et al., 2005). However, the results linked to firm size contrast with the findings of prior studies. In general, large firms have a complex managerial structure and various stakeholders, which imply more agency problems (e.g., Jensen and Meckling, 1976) and reinforce conflicts between insiders and outsiders,

thus accentuating information asymmetry for these firms.

The coefficients of share price were significantly negative for all our regressions, suggesting that lower-priced shares have a greater spread and adverse selection component and, consequently, a lower degree of information asymmetry. Results for trading volume showed a negative and significant relationship between yearly average trading volume and the three proxies of information asymmetry. The results suggest that a lower trading volume demonstrates a higher degree of information asymmetry.

#### 4.4 Robustness tests

We also needed to check the robustness of our results. For this reason, we estimated our model using simultaneous equations. The objective of this test was to check, firstly, whether the sign and the significance of our estimator changed with the estimation method; secondly, to examine the existence of simultaneity between voluntary disclosure and information asymmetry proxies as provided in prior studies (e.g., Welker, 1995). Table 9 presents the results of our robustness tests using simultaneous equations models.

**Table 11.** Results of robustness tests

<b>Regression 1. Dependent variables : information asymmetry measures</b>				
	LNQSP		LNESP	
	<b>Coefficient</b>	<b>Statistic-t</b>	<b>Coefficient</b>	<b>Statistic-t</b>
<b>Constant</b>	-1.5939	-6.231***	-1.7632	-6.5***
<b>ARVD</b>	-0.3025	-2.672***	-0.3448	-2.872***
<b>LNPRICE</b>	-0.4261	-22.59***	-0.4449	-22.24***
<b>LNTRADVOL</b>	-0.4176	-42.32***	-0.4318	-41.26***
<b>LNSTD-VD</b>	0.3455	6.549***	0.3527	6.304***
<b>LNTA</b>	0.0435	3.171***	0.0616	4.235***
<b>R<sup>2</sup> adjusted</b>	0.8666		0.8553	
<b>Regression 1. Dependent variables : voluntary disclosure index</b>				
	<b>Coefficient</b>	<b>Statistic-t</b>	<b>Coefficient</b>	<b>Statistic-t</b>
<b>Constant</b>	0.2801	7.979***	0.2761	7.863***
<b>LNQSP</b>	-0.0224	-3.109***	-	-
<b>LNESP</b>	-	-	-0.0221	-3.155***
<b>LNMVE</b>	-0.0003	-0.0893	0.0001	0.0319
<b>LNDEBT</b>	0.0069	1.917*	0.0066	1.840
<b>LNROE</b>	-5.5289 <sup>E</sup> -06	-0.2921	-5.8881 <sup>E</sup> -06	-0.3009
<b>LNANF</b>	0.0153	1.797*	0.0143	1.654*
<b>INDUSTRY</b>	-0.0234	-1.891*	-0.0238	-1.924*
<b>R<sup>2</sup> adjusted</b>	0.0695		0.0698	
<b>Sargan-test</b>	17.976		17.976	

LNESP= the natural log of the effective bid-ask spread; LNQSP= the natural log of the quoted bid-ask spread; LNADC= the natural log of adverse selection component; ARVD = global disclosure index; LNPRICE= the natural log of the average share price; LNTRADVOL= the natural log of the average trading volume; LNSTD-DV=the natural log of the average standard deviation of the stock return; LNTA= the natural log of the total firm assets; LNMVE=the natural log of market value of equity at the fiscal year end; LNDEBT=the natural log of the firm leverage rate; LNROE= the natural log of the return of equity; LNANF= the natural log (1+number of financial analysts following the firm share); Industry= is binary variable equal to 1, when the firm's industry is Technology otherwise 0.

The findings show that the estimators of the determinants of both price spreads keep the same sign and statistical significance, thus confirming the robustness of our results. The findings also suggest that causality can run in both directions.

## 5 Conclusion

The current paper aims to shed some light on the role of voluntary disclosure in market information asymmetry. In particular, we intended to verify whether the extent of voluntary information in annual reports plays a significant role in reducing the level of information asymmetry between investors and in attenuating the adverse selection problem. Our empirical study used panel data for 159 French commercial and manufacturing firms listed in the SBF 250 Index from 2004 to 2009 (954 firm-year observations).

The relevant literature (e.g., Benston and Hagerman, 1974; Copeland and Galai, 1983; Glosten and Milgrom, 1985; Kyle, 1985; Glosten and Harris, 1988) emphasizes that greater information asymmetry is reflected in wider bid-ask spreads to recover the expected losses incurred from trading with better-informed traders. Accordingly, we used effective and quoted bid-ask spreads and the adverse selection component of the effective spread as proxies for information asymmetry in the French market. We considered our information asymmetry proxies as the extent of voluntary disclosure measured using self-constructed “disclosure indexes” developed under four general categories: strategic, financial, non-financial and governance information. We controlled for firm particularities including other determinants of bid-ask spreads. Referring to prior studies (e.g., Hanley et al., 1993; Welker, 1995; Brockman and Chung, 1999; Heflin and Shaw, 2000; Sarin et al., 2000; Heflin et al., 2005; Chung et al., 2010) we used share price, stock return volatility, trading volume and firm size as control variables.

The results show that the three information asymmetry proxies used - effective and quoted bid-ask spreads and the adverse selection component - are negatively and significantly associated with the global disclosure index. The results highlight the benefit of voluntary disclosure in annual reports, as a higher volume of voluntary information in this document is associated with a lower level of information asymmetry in the financial market.

The study of sub-indexes effects provided mixed results. The effective and quoted bid-ask spreads and the adverse selection component are negatively related to the volume of voluntary financial, non-financial and governance information disclosed in annual reports. These findings provide evidence that additional information about the financial situation, corporate governance practices, and corporate social and environmental policies are useful for investors in the stock exchange market. They are consistent with prior studies that suggest the significance of governance (e.g., Cormier et al., 2010) and non-financial (e.g., Jorion and Talmor, 2001) information in the capital

market. Hence, the main message of our study is that an information market that is more opaque than transparent and characterized by fewer voluntary disclosures aggravates information asymmetry problems and increases adverse selection costs.

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