ASYMMETRIC RESPONSES TO DIVIDEND ANNOUNCEMENTS
A CASE FOR AMBIGUITY

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This paper investigates how changes in the macro-financial environment impact the way in which capital market prices react to dividend announcements. Using a sample of 841 dividend announcements by French companies belonging to the SBF 120 index, we examined the role of changes in the ambiguity (Knightian uncertainty) level around the announcement date (implied volatility – VCAC – is used as an empirical proxy for ambiguity) on the response of investors to a release of dividend information. Based on a global sample and applying interaction methodology, we found that, consistent with ambiguity theory, an increase in VCAC leads investors to place more weight on news of bad dividends than on news of good dividends. When the sample is split, depending on the VCAC sign, results are more complex. We actually obtained an important asymmetric impact between good and bad news for the larger window [-15; +15] but not for the smaller one [-1; +1]. Nevertheless, in this latter case, we observed that, consistent with the ambiguity explanation, the reaction to good (bad) news decreases (increases) dramatically when ambiguity increases, compared to when ambiguity decreases.

Keywords: Ambiguity, Dividend announcements, French market, Knightian uncertainty.

In this paper, we investigate how changes in the macro-financial environment affect the way in which capital market prices react to dividend announcements. More specifically, we posit that the nature and degree of environmental uncertainty has an impact on the way investors react to companies' dividend announcements. We draw on prior research that examines the distinction between two kinds of uncertainty: risk and ambiguity ("Knightian uncertainty", following Knight

(1921)). In ambiguous situations, investors face a set of several probability measures over uncertain states rather than a single measure, as traditionally used in finance theory. According to Brenner and Izhakian (2015), in equity markets, risk refers to conditions where future returns to be realized are unknown with given probabilities, while ambiguity refers to the situation where the probabilities associated with these possible realizations are unknown or not uniquely assigned. In the presence of ambiguity, Ellsberg (1961) shows that ambiguity-averse individuals take a conservative approach when making decisions. Their preferences can be modeled using the maxmin expected utility of Gilboa and Schmeidler (1989), meaning that they make their decisions on the basis of the worst-case scenario (see Chen and Epstein, 2002, and Nishimura and Ozaki, 2007) in the context of continuous finance. Jeong *et al.* (2015) examine the role of ambiguity in capital markets. Their results strongly suggest that a premium exists for bearing market uncertainty separate from the classical risk sources. They found that ambiguity aversion is both economically and statistically significant. Beyond the purely theoretical aspects, ambiguity seems to be present on capital markets and can be an important dimension to explain the reaction of stock prices to corporate financial decisions.

The idea that agent belief, and in particular an increase in ambiguity aversion, could be an important determinant of crises has already been put forward (Caballero and Krishnamurthy, 2008; Easley and O'Hara, 2010; Krishnamurthy, 2010). More generally, Barberis (2011) has proposed a synthesis of the relationship between the psychology of economic agents and the global financial crisis. Taking another perspective, Kozlowski *et al.* (2017) propose a belief-driven business cycle model where transitory shocks have large, persistent effects on real output. Following decision theory, the presence of ambiguity is the source of two kinds of misspecification: (i) model uncertainty conditional on the state, and (ii) uncertainty regarding the correct posterior distribution of the state itself. The first channel has been extensively studied in the literature (see Barillas, Hansen, and Sargent, 2009). However, following Benzoni *et al.* (2015) the second channel is less understood; this is why it is interesting to investigate in this direction. Uhlig (2010) and Dicks and Fulghieri (2018) highlight that the presence of uncertainty-averse investors exacerbates the fall of asset prices following a negative shock in the economy. Boyarchenko (2012) investigates the impact of ambiguity aversion on the U.S. financial crisis of 2007–2009.

Financial crises can increase the ambiguity of an environment because it takes time for investors to understand a new and unfamiliar situation and to interpret news disclosed by companies during these periods (Epstein and Schneider, 2007; Liu *et al.*, 2005). As a consequence of ambiguity aversion, investors will have an asymmetric response to good and bad news during these periods. They will consider that good news is unreliable and bad news is highly reliable. Following ambiguity theory, in periods of ambiguity market reaction to good (bad) news should be lower (higher) than in a traditional risky environment. The main distinctive characteristic of the presence of ambiguity is therefore the asymmetric response of investors to good and bad news.

It is well recognized that dividends convey information (the signaling hypothesis) and that capital markets react to dividend announcements, which implies that dividends contain information. Capital markets react favorably to good news (dividend increases) and adversely to bad news (dividend decreases). Dividend announcements are, therefore, good candidates for testing the asymmetric reaction of the market in case of ambiguity. The global financial crisis of 2007-2009 offers a recent example of a major shock to the macro-economic environment. It has generally been recognized that during this period uncertainty increased dramatically. This will allow us to compare market reaction to dividend announcements during periods of high and low uncertainty.

This paper makes four contributions to the dividend announcement literature. First, it provides evidence that, consistent with theories of ambiguity, a shock to the environment ambiguity (measured by an increase of implied volatility) leads investors to react asymmetrically to dividend news. Second, this study contributes to the scarce empirical literature on the role of the presence of ambiguity in capital markets. Consistent with the results of Anderson *et al.* (2009), Jeong *et al.* (2015) and Williams (2015), we suggest that ambiguity can affect market reactions to dividend announcements. Third, this study contributes to the corporate finance literature that examines how markets respond to corporate finance decisions by providing a new explanation for observed market reactions. Finally, our results help formulate managerial recommendations for the communication policy of companies concerning their dividend announcements in a context of a rise in ambiguity.

The paper is organized as follows. Section 1 presents a literature review on the impact of the economic and financial environment on the market reaction to dividend announcements. Section 2 discusses the methodology, variables and sample selection. Section 3 presents results and Section 4 concludes.

1. The role of economic and financial environments on market reactions to dividend announcements

It has been well established, since the seminal studies of Charest (1978) and Aharony and Swary (1980), that dividends contain information about a company's future prospects, which explains why the market reacts to dividend announcements. The so-called signaling hypothesis, initially proposed by Lintner (1956) and Fama, Fisher, Jensen, and Roll (1969) and developed in theoretical models of dividend signaling by Bhattacharya (1979) and John and Williams (1985), states that a firm uses dividends as signaling devices to convey valuable information to the market. Markets react favorably to dividend increase announcements ("good news") and adversely to dividend decrease announcements ("bad news").

A small number of studies take into consideration the role of surrounding economic environments on corporate dividend policies and capital market reactions to these policies. In their survey, Frankfurter and Wood (2002, p.128) state: "Current models of corporate dividend policy by and large ignore behavioural and socioeconomic influences on managerial and shareholders activities". Economic and market conditions can be apprehended along two dimensions: the business cycle (market movements, bull and bear periods) and the degree of uncertainty. These two dimensions have an effect on the company situation (present and future profitability, credit availability and external financing costs) and on the relationship between the company and its shareholders (degree of information asymmetry, agency costs, market sentiment) that in turn can affect the dividend policy of companies and the market reactions to this policy. Veronesi (1999) provides a rational expectation model explaining why firm-specific news that goes against the grain of the recent market direction increases investor uncertainty about the future course of events, causing investors to discount the new information at a higher rate. As a consequence, bad news will generate a larger negative reaction when disclosed in good times than in bad times. Docking and Koch (2005) build on the framework of Veronesi (1999) by suggesting that market volatility can also have an influence on how investors perceive firm-specific news. They suppose a symmetric market reaction: good or bad news generates a greater investor reaction if announced in a more volatile market. In the same vein, Choi (2014) shows that variation in economy-wide uncertainty causes asymmetric stock price responses to firm earnings surprises.

Going beyond rational expectation models, a body of literature deals with the way general investors' sentiment influences stock market reactions to price-sensitive information disclosures. Brown *et al.* (2011) propose that during optimistic periods investors will evaluate managers' disclosures less rigorously and that they will be more meticulous during pessimistic periods. In the same vein, Sankaraguruswamy and Mian (2008) conclude that investors appreciate (penalize) good (bad) news more during optimistic (pessimistic) periods. As we can imagine, since optimistic or pessimistic periods are highly correlated with the general conjuncture, behavioural models can also explain the link between the environment and the market reaction to company-specific information.

The global financial crisis of 2007-2009 offers a unique opportunity to analyze the impact of an environmental shock on the way that investors process information disclosed by companies. The economic and financial shock caused investors to lose confidence in their interpretation of the implications of dividend signals. In this kind of ambiguous environment, and following ambiguity theory, investors should respond more strongly to bad news than to good news, contrary to risky situations where the response is symmetric to dividend announcements.

There are numerous empirical studies that examine stock price reactions to dividend announcements, but very few investigate the impact of environmental characteristics on this relation. Below and Johnson (1996) have examined the differential reaction to dividend announcements with respect to market phases (bear or bull). Their empirical results supported their assumption that investors' expectations vary with market phases. More information is conveyed when the dividend and market variation signs are in opposite directions. Docking and Koch (2005) have tested the impact of the market's past volatility on market reaction to dividend announcements. They found a positive (but non-significant) symmetric reaction of abnormal returns to market volatility.

Akron (2011) examined the impact of business cycles on the market reaction to dividend announcements of large-cap firms in the Tel Aviv Stock Exchange. He found that market reaction was stronger during the crisis period of 2001-2002, compared to the normal or booming period of 2002-2007. However, he did not make the distinction between increasing and decreasing dividends ("good" and "bad' news). His explanation was that dividend announcements in crisis periods might be perceived as a very good signal of company performance.

Bozos *et al.* (2011) also found significant interaction between economic conditions and the information contents of dividends. They explicitly tested the possibility of asymmetrical dividend signaling effects between normal periods and the 2007-2009 crisis period. They found that market reaction is greater, whatever the sign of the variation of dividends, in periods of crisis or when investor sentiment is pessimistic. Contrary to the ambiguity explanation, they did not find the presence of an asymmetric response to the market.

2. Empirical framework

The purpose of our empirical research was to test the influence of market uncertainty (shocks to the economic and financial environment on market reactions to dividend announcements) on investor responses following dividend announcements. According to ambiguity theory, macro shocks can lead investors to operate in an uncertain environment, which can influence their responses to corporate information disclosure (Drechsler, 2013; Illeditsch, 2011; Hansen and Sargent, 2010; Epstein and Schneider, 2007, 2008; Liu *et al.*, 2005). The results of Williams (2015) also point out that the differentiated responses of investors to earnings surprises depend on the magnitude of changes in ambiguity. In order to measure the degree of ambiguity, we used the weighted average implied volatility for the French market (VCAC). The VCAC is the French equivalent of the US VIX. As suggested by the results of Bloom (2009), Drechsler (2013) and Miao, Wei and Zhou (2012), the change in the implied volatility for options would be an accurate empirical proxy of the time-variation in ambiguity.

Inspired by the methodology of Conrad *et al.* (2002) and Williams (2015), we implemented a model able to appreciate differential responses to increases in the dividend rate ($\Delta^{-}\boldsymbol{Div}$) and decreases in the dividend rate ($\Delta^{+}\boldsymbol{Div}$).

2.1. Data

Our sample consists in dividend announcements of French firms listed on the SBF 120 over the period from January 2004 to December 2012. Only events and firms with a complete set of financial variables were included. Companies without cash dividend payments or with zero trading during the estimation window [-265; +15] were also excluded from the sample, leading to a sample of 112 French companies. Finally, we compiled a sample of 841 cash dividend announcements. We obtained information in relation to dividend announcements from Bloomberg. Information about market data, accounting/financial data and the VCAC were extracted from the Datastream database. As shown in Table 1, the number of dividend announcements increased during the period. We also observed that the number of dividend increases decreased dramatically because of the crisis (from 82 in 2008 to 38 in 2009 and then 43 in 2010); in contrast, the number of stable or decreasing dividends rose.

Table 1. Descriptive statistics on dividend announcements

Years	2004	2005	2006	2007	2008	2009	2010	2011	2012	Total
Number of announcements	78	82	87	96	98	95	96	105	104	**841**
Div. increase	53	72	73	80	82	38	43	70	57	**568**
Div. decrease	8	4	7	6	7	28	19	12	16	**107**
Stable Div.	17	6	7	10	9	29	34	23	31	**166**

Source: Authors.

2.2. Methodology

Classically, the reaction of capital markets is measured by using event study methodology. The initial data are in the form of closing prices of the stocks and closing values of the market index. The daily return of a stock i at day t is the percentage change in closing price over two successive days $R_{it} = P_i + P_iRM_t + P_{it}$ where R_{it} is the daily return of stock i at day t, while P_{it} is the closing price of stock i at day t. $P_{it\text{-}1}$ is the closing price of stock i at day t-1. Abnormal returns of stock i (AR_{it}) are computed with the market model. The market model equation assumes a linear relationship between the daily returns of a particular security and the market returns over a period.

$$R_{it} = \alpha_i + \beta_i RM_t + \varepsilon_{it} \qquad (1)$$

Parameters of the market model (α_i, β_i) are estimated by using OLS regression techniques to 250 daily returns on the control window

[-265; -16][1] before the announcement date t (*see equation 1*). The SBF 120 index is used as the proxy for the market returns (*RM*).

Thus, the unsystematic/abnormal returns during the event period (*t-k, t+k*), with $t = 0$ the day of the event (dividend announcement) and *k*, the number of days around the day of the event, is obtained from the following equation:

$$AR_{it} = R_{it} - (\alpha_i + \beta_i RM_t) \tag{2}$$

In order to detect if the stock return behaviour inside the window is significantly different from that in other periods, we compute the Cumulative Abnormal Returns (CAR_{it}) using the formula:

$$CAR_{it} = \Sigma^{t}{}_{k} =_{-k} AR_{it} \tag{3}$$

The choice of different window widths, k, is a means to better understand the way market investors process information. Do they anticipate public information (negative *k*) or not? At what speed is the information incorporated in the new equilibrium price? We choose a short length window [-1; +1] in order to isolate the reaction of the market to the specific event under consideration (dividend announcement), and a longer one [-15; +15] that suffers from the risk that investors react to the arrival of other information, but let us observe how the reaction of investors evolves in time.

The influence of uncertainty on the behaviour of stock return should be isolated from other potential causal factors. To get a better insight into the factors that influence the observed abnormal returns surrounding dividend announcements, we performed a cross-sectional analysis. Specifically, the idea consists in examining whether a lack of information (the presence of ambiguity) exacerbates the asymmetric effects of ambiguity. The estimated eight-factor model took the following form:

$$\begin{aligned} CAR_{it} = \beta_0 + \beta_1\, \Delta^{+} Div_{it} = \beta_2\, \Delta^{-} Div_{it} + \beta_3\, Size_{it} + \beta_4\, D_{pre} \\ + \beta_5\, Spread + \beta_6\, Risk + \beta_7\, \Delta TVol + \beta_8\, VCAC + \varepsilon_{it} \end{aligned} \tag{4}$$

Where, CAR_{it}, estimated from *equation 3*, corresponds to the cumulative abnormal return for a firm i (over a specific time window) around the date of dividend announcement $t = 0$.

1. A period of 250 days ending 15 days before the announcement. Rippington and Taffer (1995) recommend considering a long estimation period in order to mitigate the impact of disturbing events on the determination of estimators.

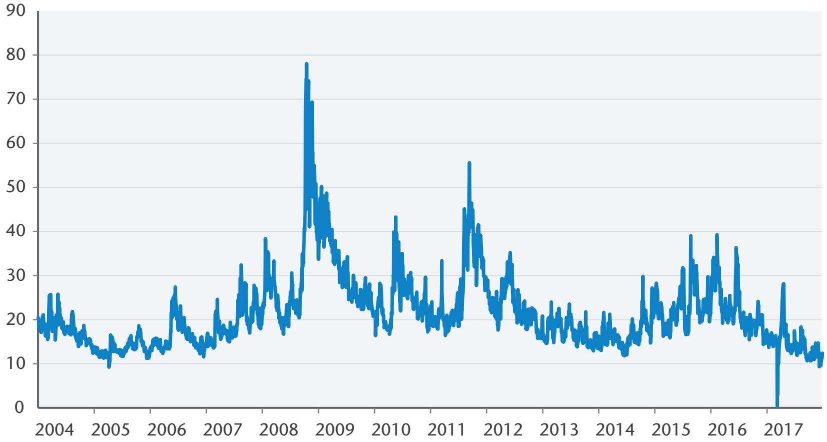
Like Williams (2015) and also Dasilas and Leventis (2011) who studied the market reaction, respectively, to earnings news and dividend announcements in a situation of ambiguity, several control variables were included. It is well known that the larger the firm, the more information is available about its quality. This helps to reduce the level of information asymmetry about its value (Mougoué and Rao, 2003; Dhanani, 2005). Then, the firm size should be negatively related to the market reaction. The *Size* variable, estimated by the market value of the firm's equity at the end of year just before the dividend announcement date *t*, enabled us to bypass the coefficient bias highlighted by Barth and Kallapur (1996). We control for the influence of past dividend payouts, using the amount of the prior year's annual dividend, since this performance is expected to affect market reaction. As regards the D_{pre} factor, it incorporates information about the firm's dividend level over the prior year. We know (Dow and Werlang, 1992; Epstein and Schneider, 2007; Williams, 2015) that the presence of ambiguity should create a wedge between the price agents are willing to pay to go long in an asset (ask price) and the price agents are willing to pay to go short (bid price). This increase in ambiguity (increased spread) reduces market participation by ambiguity-averse investors and the investors' reluctance reverses, as the ambiguity shock is resolved. This implies that the observed behaviour of ambiguity-averse traders depends on how quickly and completely they obtain the relevant missing information that is the underlying driver of the ambiguity. The *Spread* variable represents the bid-ask spread estimated over the retained time window, which we considered as a proxy for the asymmetry of information in the market. Following Ghosh and Woolridge (1988) and Ball and Kothari (1991) or, more recently, Dasilas and Leventis (2011), we introduced the *Risk* variable to mitigate the effects implied by the level of the firm's market betas before the announcement date. Following these authors, systematic risk can be seen as a measure of expected profitability. In consequence, higher betas should be associated with higher abnormal returns. Moreover, following Caroll and Fock (1995), the estimation of betas using OLS could be biased, leading to under/over estimation of abnormal returns. These market betas are calculated by using the market model over the (control window) 250 days before the event (*see comments of equation 1*). Following Beaver (1968), Dow and Werlang (1992), Epstein and Schneider (2007) and Williams (2015), in the context of ambiguity or earnings news, and Richardson, Sefcick, and Thompson

(1986), Gurgul, Mestel, and Schleicher (2003) and Dasilas and Leventis (2011), in the specific context of dividend announcements, and to test this conjecture, we decided to introduce the variation in the trading volume over the dividend announcement event window ($\Delta TVol$) as a proxy for the change in the amount of information available in the market following the event. All these prior studies have shown that trading volume is associated with information arrival and that it is related to the level of ambiguity in environments. Finally, we incorporated the VCAC index over the event window in order to control for the magnitude of the uncertainty on the firm's return. The variation of VCAC estimated over the event window was used to capture the change in uncertainty about the arrival of information due to the dividend announcement. Previous studies have suggested that the degree of uncertainty can influence management behaviour (Houston, Lev, and Tucker, 2010; Kim, Pandit, and Wasley, 2010). As a consequence, the time windows we investigated constitute a small number of days ([-1; +1]; [-15; +15]), in order to limit the ability of the management to respond to the shock and therefore to mitigate the impact of ambiguity. By this method, we tried to mitigate concern that the results are driven by managerial incentives to alter the dividend signal in response to the uncertainty shock.

As illustrated in Figure 1, which presents the evolution of VCAC from 2004 to the end of 2017, a huge increase in uncertainty can be observed in 2008 and 2009. As a consequence, this sharp growth in ambiguity is also identified in Figures 2 and 3, which show, respectively, the 2 307 historical variations of the VCAC on the time window [-15; +15] over the study period and the 841 variations of the VCAC retained in the regression considering the dividend announcement dates.

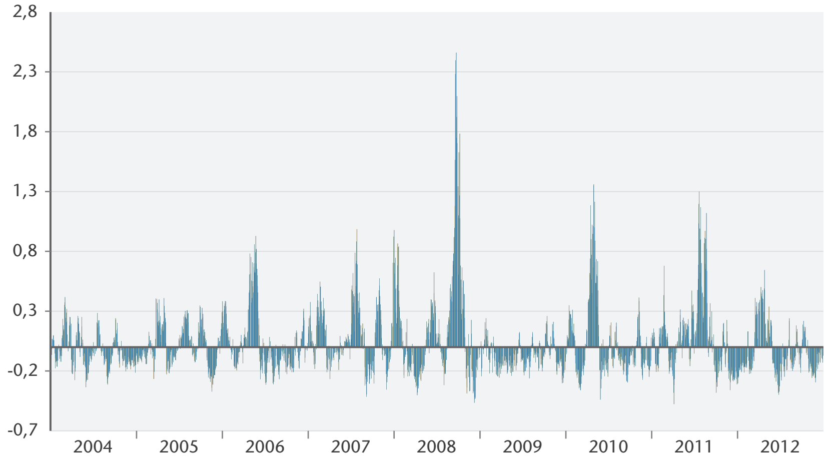
As explained above, we made the choice to evaluate the potential impact of uncertainty on abnormal returns by partitioning our sample based on changes in the VCAC. Therefore, we implemented our model on each VCAC partition estimated, first, from increases in the VCAC ($\Delta^+ VCAC$) and decreases in the VCAC ($\Delta^- VCAC$) and, second, from quintiles of changes in the VCAC. This last partition aims to check if the largest changes in ambiguity, which are more likely associated with uncertain environments, modify investors' reactions when facing an increase or a decrease in the dividend rate.

Figure 1. Evolution of the VCAC index from January 2004 to December 2017



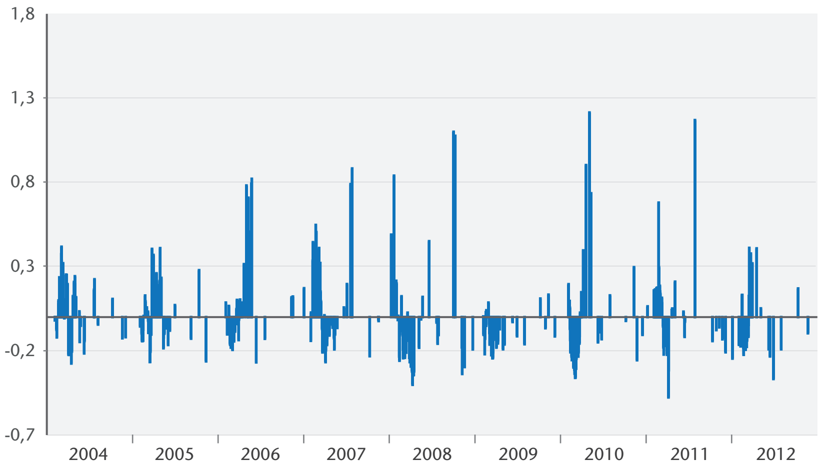
Source: Authors.

Figure 2. Historical variation of the VCAC on the time window [-15; +15] over the study period (N = 2 307 observations)



Source: Authors.

Figure 3. Variation of the VCAC retained in the regression on the time window [15; +15] around the date of dividend announcement (N = 841 observations)



Source: Authors.

The choice to partition the sample can also be justified from the descriptive statistics presented in Table 2. Over the two specific event windows, we noticed that the distributions of *CAR* were significantly different within each VCAC partition ($\Delta^{+} VCAC$ and $\Delta^{-} VCAC$), suggesting that investor responses to dividend announcements depend on the change in uncertainty. The mean returns were significantly higher when the ambiguity decreased. Whereas the means of *CAR* were 0.0165 and 0.0095 in the $\Delta^{-} VCAC$ partition, respectively, over windows [-15; +15] and [-1; +1], they were only -0.0019 and 0.0023 in the $\Delta^{+} VCAC$ partition. Because the distributions of $\Delta^{+} Div$ and $\Delta^{-} Div$ are statistically similar across $\Delta^{-} VCAC$ and $\Delta^{+} VCAC$, it seems that investors react less strongly to the announcement of a decrease in the dividend amount when uncertainty decreases.

To investigate if problems of collinearity could affect the results, Pearson correlation coefficients for each window and sub-samples ($\Delta^{-} VCAC$ and $\Delta^{+} VCAC$) are presented in Tables 3 and 3b, which are completed by the VIF (Variance Inflation Factor) analysis exposed in Table 3c. Except for *Risk* and *VCAC* factors, one can see that correlations between independent variables are low, whatever the signs of VCAC variation and the length of the window. In order to appreciate the potential problem of multicollinearity between *Risk* and *VCAC* variables that can affect the relevance of regression results, the measure of the VIF was implemented on the different partitions. Table 3c highlights the absence of multicollinearity between independent variables. In accordance with recommendations issued by Chatterjee *et al.* (2000), each variable has a VIF that is widely lower than 10, and the average VIF across all variables is also under 2. Consequently, we can consider including them simultaneously in a regression without introducing bias in estimated regression coefficients.

Table 2. Descriptive statistics of variables across $\Delta^{-}VCAC$ and $\Delta^{+}VCAC$

	Event window [-15; +15]						
	$\Delta^{-}VCAC$ (N = 519)		$\Delta^{+}VCAC$ (N = 322)		Difference		
	Mean	*Std Dev.*	*Mean*	*Std Dev.*	*t*	*Pr > |t|*	*Mann-Whitney test (U)*
CAR	0.0165	0.0971	-0.0019	0.0851	0.0184	***	91 269 **
$\Delta^{+}Div$	0.0063	0.0326	0.0050	0.0109	0.0013		79 651
$\Delta^{-}Div$	-0.0044	0.0226	-0.0025	0.0113	-0.0019		81 299
Size	8.4174	1.3646	8.6076	1.3604	-0.1902	*	69 983 *
DIV_{pre}	1.1982	1.1126	1.2064	1.1315	-0.0082		67 512 **
Spread	0.0883	0.4051	0.0452	0.4281	0.0431		91 309 **
Risk	0.0207	0.0076	0.0183	0.0067	0.0024	*	99 552 ***
Δ ***TVol***	-0.1181	1.2464	0.1161	1.0050	-0.2342	*	71 920 ***
VCAC	735.1191	278.0227	631.8255	209.1598	103.29	*	106 251 ***
	Event window [-1; +1]						
	$\Delta^{-}VCAC$ (N = 505)		$\Delta^{+}VCAC$ (N = 336)		Difference		
	Mean	*Std Dev.*	*Mean*	*Std Dev.*	*t*	*Pr > |t|*	*Mann-Whitney test (U)*
CAR	0.0095	0.0503	0.0023	0.0444	0.0072	**	82 274 *
$\Delta^{+}Div$	0.0059	0.0085	0.0054	0.0432	0.0005		81 974
$\Delta^{-}Div$	-0.0042	0.0223	-0.0030	0.0128	-0.0012		82 895
Size	8.4746	1.3671	8.5158	1.3643	-0.0412	*	75 220 *
DIV_{pre}	1.2756	1.1652	1.1621	1.0388	0.1134	**	71 822 **
Spread	0.0150	0.1780	0.0071	0.0096	0.0080		85 319
Risk	0.0200	0.0072	0.0194	0.0075	0.0006		90 786 *
Δ ***TVol***	0.3378	1.1643	0.5209	1.1782	-0.1831	**	79 861 *
VCAC	65.7328	24.3156	69.4102	27.2735	-3.6774	*	77 196 **

*** , ** and * means significant respectively at the 1% level, 5% level and 10% level.

Table 3a. Pearson correlation coefficients across $\Delta^- VCAC$ and $\Delta^+ VCAC$

$\Delta^- VCAC$	*CAR* [-1; +1]	$\Delta^+ VCAC$	$\Delta^- VCAC$	*Size*	Div_{pre}	*Spread*	*Risk*	Δ *TVol*	*VCAC*
CAR [-1; +1]	1	0.053	-0.050	-0.077	-0.045	-0.064	0.105	0.038	0.078
$\Delta^+ Div$	0.053	1	0.109	-0.106	-0.054	0.005	-0.026	0.035	-0.130
$\Delta^- Div$	-0.050	0.109	1	0.088	-0.164	0.004	-0.208	0.042	-0.280
Size	-0.077	-0.106	0.088	1	0.145	0.045	-0.138	-0.039	-0.074
Divpre	-0.045	-0.054	-0.164	0.145	1	0.005	0.048	-0.019	0.103
Spread	-0.064	0.005	0.004	0.045	0.005	1	0.044	0.033	-0.005
Risk	0.105	-0.026	-0.208	-0.138	0.048	0.044	1	0.066	0.604
Δ *TVol*	0.038	0.035	0.042	-0.039	-0.019	0.033	0.066	1	-0.007
VCAC	0.078	-0.130	-0.280	-0.074	0.103	-0.005	0.604	-0.007	1

$\Delta^+ VCAC$	*CAR* [-1; +1]	$\Delta^+ VCAC$	$\Delta^- VCAC$	*Size*	Div_{pre}	*Spread*	*Risk*	Δ *TVol*	*VCAC*
CAR [-1; +1]	1	0.028	0.071	-0.061	0.017	-0.033	-0.039	0.011	-0.102
$\Delta^+ Div$	0.028	1	0.042	-0.052	-0.013	0.004	-0.070	0.089	-0.005
$\Delta^- Div$	0.071	0.042	1	-0.051	-0.291	-0.011	-0.392	-0.029	-0.276
Size	-0.061	-0.052	-0.051	1	0.169	-0.500	-0.048	0.025	0.062
Div_{pre}	0.017	-0.013	-0.291	0.169	1	-0.045	0.145	0.004	0.254
Spread	-0.033	0.004	-0.011	-0.500	-0.045	1	-0.021	-0.036	0.001
Risk	-0.039	-0.070	-0.392	-0.048	0.145	-0.021	1	-0.087	0.593
Δ *TVol*	0.011	0.089	-0.029	0.025	0.004	-0.036	-0.087	1	-0.074
VCAC	-0.102	-0.005	-0.276	0.062	0.254	0.001	0.593	-0.074	1

Table 3b. Pearson correlation coefficients across $\Delta^- VCAC$ and $\Delta^+ VCAC$

$\Delta^- VCAC$	*CAR* [-15; +15]	$\Delta^+ VCAC$	$\Delta^- VCAC$	*Size*	Div_{pre}	*Spread*	*Risk*	Δ *TVol*	*VCAC*
CAR **[-15; +15]**	1	-0.025	-0.057	-0.153	-0.011	0.045	0.065	-0.061	0.061
Δ^+ ***Div***	-0.025	1	0.038	-0.055	-0.022	-0.004	-0.062	0.030	-0.037
Δ^- ***Div***	-0.057	0.038	1	0.076	-0.206	-0.022	-0.230	0.033	-0.246
Size	-0.153	-0.055	0.076	1	0.147	-0.175	-0.103	0.014	0.013
Divpre	-0.011	-0.022	-0.206	0.147	1	-0.005	0.095	0.005	0.166
Spread	0.045	-0.004	-0.022	-0.175	-0.005	1	0.035	0.003	0.000
Risk	0.065	-0.062	-0.230	-0.103	0.095	0.035	1	0.051	0.594
Δ ***TVol***	-0.061	0.030	0.033	0.014	0.005	0.003	0.051	1	-0.004
VCAC	0.061	-0.037	-0.246	0.013	0.166	0.000	0.594	-0.004	1

$\Delta^+ VCAC$	*CAR* [-15; +15]	$\Delta^+ VCAC$	$\Delta^- VCAC$	*Size*	Div_{pre}	*Spread*	*Risk*	Δ *TVol*	*VCAC*
CAR **[-15; +15]**	1	0.046	0.040	0.045	0.142	-0.009	-0.014	-0.025	-0.006
Δ^+ ***Div***	0.046	1	0.102	-0.047	-0.031	0.023	-0.040	0.067	-0.048
Δ^- ***Div***	0.040	0.102	1	-0.044	-0.189	-0.024	-0.346	0.023	-0.247
Size	0.045	-0.047	-0.044	1	0.186	-0.034	-0.071	0.013	0.022
Div_{pre}	0.142	-0.031	-0.189	0.186	1	-0.058	0.049	0.007	0.170
Spread	-0.009	0.023	-0.024	-0.034	-0.058	1	0.024	0.070	-0.011
Risk	-0.014	-0.040	-0.346	-0.071	0.049	0.024	1	-0.035	0.574
Δ ***TVol***	-0.025	0.067	0.023	0.013	0.007	0.070	-0.035	1	-0.027
VCAC	-0.006	-0.048	-0.247	0.022	0.170	-0.011	0.574	-0.027	1

Table 3c. Multicollinearity test: Variance Inflation Factor (VIF)

	[-15 ; + 15]				[-1 ; + 1]			
	$\Delta - VCAC$		$\Delta + VCAC$		$\Delta - VCAC$		$\Delta + VCAC$	
Statistic	Tolerance	VIF	Tolerance	VIF	Tolerance	VIF	Tolerance	VIF
$\Delta + Div$	0.990	1.010	0.963	1.038	0.959	1.043	0.981	1.020
$\Delta - Div$	0.890	1.124	0.781	1.281	0.885	1.130	0.783	1.277
$Size$	0.919	1.088	0.930	1.076	0.935	1.070	0.708	1.412
Div_{pre}	0.918	1.090	0.810	1.234	0.943	1.061	0.857	1.167
$Spread$	0.969	1.032	0.960	1.042	0.993	1.007	0.737	1.356
$Risk$	0.624	1.603	0.625	1.599	0.617	1.621	0.568	1.762
$\Delta\ TVol$	0.992	1.008	0.975	1.026	0.988	1.012	0.978	1.023
$VCAC$	0.621	1.609	0.674	1.484	0.597	1.674	0.610	1.640
Number of VIF ≥ 10	0		0		0		0	
Average of VIF	1.196		1.222		1.202		1.332	
Multicollinearity	No		No		No		No	

3. Results

Table 4 reports the results of the pooled OLS regressions of cumulative abnormal returns on the change of dividend and with control variables over the period 2004-2012 (*given by Equation (4)*) for the two subsamples partitioned by $\Delta^{+} VCAC$ (increase in ambiguity) and $\Delta^{-} VCAC$ (decrease in ambiguity) over the event windows [-15; +15] and [-1; +1]. It should be noted that stable dividends were randomly and equally allocated into the two independent variables $\Delta^{+} Div$ and $\Delta^{-} Div$.

Table 4. Investor reactions to dividend changes following changes in uncertainty

	$\Delta^{-} VCAC$				$\Delta^{+} VCAC$			
	[-15; +15]	Pr > |t|	[-1; +1]	Pr > |t|	[-15; +15]	Pr > |t|	[-1; +1]	Pr > |t|
	(N=519 || R^2=11.2%)		(N=505 || R^2=10.5%)		(N=322 || R^2=9.9%)		(N=336 || R^2=10.1%)	
$\Delta^{+} Div$	-0.0817	**	0.3412	***	0.3638	***	0.0253	**
$\Delta^{-} Div$	-0.1207	**	-0.0824	***	0.4467	***	0.2423	**
Size	-0.0107	*	-0.0017	*	0.0021	*	-0.0032	*
DIV_{pre}	-0.0004	*	-0.0021	*	0.0100	*	0.0033	*
Spread	0.0044	*	-0.0187	*	-0.0044	*	-0.3539	***
Risk	0.2374	**	0.5429	***	-0.1006	**	0.2713	**
Δ *TVol*	-0.0045	**	0.0014	*	-0.0037	*	0.0002	*
VCAC	0.0010	*	0.0011	*	-0.0011		-0.0012	*
Asymmetry between $\Delta^{+} Div$ and $\Delta^{-} Div$								
	0.0390		0.4235		0.0829		0.2171	

*** , ** and * means significant respectively at the 1% level, 5% level and 10% level.

The two first columns estimate the investors' reactions to dividend announcements following decreases in the uncertainty ($\Delta^{-} VCAC$). Results show that the $\Delta^{+} Div$ and $\Delta^{-} Div$ coefficients are both different from zero, whatever the event window considered. We also noticed that the difference in the coefficient of these factors is much lower in the event window [-15; +15] (0.0390) than in the event window [-1; +1] (0.4235). So, because the distributions for $\Delta^{+} Div$ and $\Delta^{-} Div$ are statistically similar across $\Delta^{+} VCAC$ and $\Delta^{-} VCAC$ and across the two event windows, we can consider that this difference is mainly due to a positive stronger reaction to an increase in dividend over the shorter event window. Whereas the $\Delta^{+} Div$ coefficient is, as expected, largely positive (0.3412) over the event window [-1; +1], it becomes weakly negative (-0.0817) over the event window [-15; +15]. This could highlight the absence of continuity in the reaction to the dividend announcements. It is possible that the market overreacts to the announcement date and corrects afterwards. Finally, we noticed that the $\Delta^{-}Div$ coefficient appears negative over the two event windows (-0.1207 and -0.0824). This means that, in a less ambiguous environment, investors would not sanction a company having announced a decrease in dividends.

The last two columns in Table 4 show investors' responses to changes in dividends following an increase in the ambiguity ($\Delta^{+}VCAC$). As in the partition $\Delta^{-}VCAC$, the $\Delta^{+}Div$ and $\Delta^{-}Div$ coefficients are also significant over the two event windows. Results indicate that investors' reactions are not symmetric over the two partitions. For example, over the event window [-15; +15], the difference in the reactions is twice as high in the $\Delta^{+}VCAC$ partition (0.0829) as in $\Delta^{-}VCAC$ (0.0390). These results would tend to indicate that over a long event window [-15; +15], a rise in the ambiguity implies an increased difference between the responses to a positive and negative variation in dividends. These findings are consistent with ambiguity theory. Like Williams (2015), they enable us to illustrate the consequences of an increase in uncertainty, which make investors act differently when facing bad or good news (increases or decreases in dividends).

Over the event window [-1; +1], the situation is reversed. We noticed that the difference between the $\Delta^{+}Div$ and $\Delta^{-}Div$ coefficients decreases from 0.4235 to 0.2171 when ambiguity rises. Essentially, this drop is a consequence of a high decrease in the $\Delta^{+}Div$ coefficient from 0.3412 in the $\Delta^{-}VCAC$ to 0.0253 in the $\Delta^{+}VCAC$. That means that in the days close to the announcement date, investors react less strongly to an increase in dividends following a rise in ambiguity. By contrast, the $\Delta^{-}Div$ coefficient in the $\Delta^{+}VCAC$ partition (0.2423) suggests a stronger reaction to negative changes in dividends following an increase in ambiguity. In an ambiguous environment, abnormal returns calculated over the event window [-1; +1] would increase weakly (decrease strongly) with a positive (negative) variation in dividends. When comparing the two event windows, it appears that over a short event window [-1; +1], investors respond less strongly to dividend announcements following a rise in ambiguity.

As a robustness check, we explicitly introduce stable dividends in the analysis (see table A1 in the appendix). We observe that there is a negative but not statistically significant reaction of stock prices to stable dividend announcements. More importantly, the introduction of stable dividends does not significantly affect the results on the impact of dividends increases or decreases on cumulated abnormal returns.

We attempted to estimate also whether the major changes in the $VCAC$ influence investor responses. Table 5 shows the results of pooled OLS regressions from the model given by Equation (4) estimated within the extreme $\Delta VCAC$ quintiles. We assumed that the 1st and the 5th quintiles are more likely associated with a significant change in uncertainty than the central quintiles. The implementation of the T-test and the Z-test indicates that the distributions for the $\Delta^{+} Div$ and $\Delta^{-} Div$ are not statistically different across the 1st and the 5th quintiles over the two event windows. On the event window [-15; +15] ([-1; +1]), the mean of change in the $VCAC$ is -6.8 (-3.34) percent for the 1st quintile and 6.28 (2.93) percent for the 5th quintile.

Table 5. Investor responses to dividend changes following major changes in uncertainty

	[-15; +15]				[-1; +1]			
	1st quintile		5th quintile		1st quintile		5th quintile	
	(N=168 || R^2=10.3%)		(N=168 || R^2=9.6%)		(N=168 || R^2=11.7%)		(N=168 || R^2=9.8%)	
$\Delta^{+} Div$	-0.032	**	0.609	**	0.864	***	0.017	*
$\Delta^{-} Div$	-0.051	*	0.547	**	-0.038	*	-0.181	*
Size	-0.016		0.004		-0.001		-0.002	
DIV_{pre}	-0.006	*	0.016		-0.006		0.007	*
Spread	-0.005		-0.002		-0.022	*	-0.592	**
Risk	0.706	**	1.126	**	-0.360	**	-0.004	
Δ *TVol*	-0.014	*	-0.006		0.003		0.008	*
VCAC	0.002	*	0.000		0.000		-0.001	
Mean $\Delta VCAC$	-6.80		6.28		-3.34		2.93	
Asymmetry between $\Delta^{+} Div$ **and** $\Delta^{-} Div$								
	0.020		0.062		0.902		0.198	

*** , ** and * means significant respectively at the 1% level, 5% level and 10% level.

The results in Table 5 show that over the event window [-15; +15], the difference between the $\Delta^{+} Div$ and $\Delta^{-} Div$ coefficients is three times lower in the 1st quantile (0.020) than in the 5th one (0.062). This asymmetry in investor responses is therefore higher by using the 5th quintiles than across the $\Delta^{-} VCAC$. These findings are consistent with the fact that significant changes in uncertainty imply a more differentiated response to a rise or a drop in dividends. By contrast, over the event window [-1; +1], the difference is higher in the 1st quintile than in the 5th quintile. At first glance, these results could tend to indicate that investor responses around the announcement date [-1; +1] tend to be less differentiated following an increase in ambiguity. But, in fact, we can see that, in coherence with ambiguity theory, reaction to good news is much weaker when ambiguity rises than when ambiguity falls. And conversely, the reaction of the market is stronger for bad news.

Finally, in order to check the robustness of our results, rather than divide the sample into two parts (increase and decrease in uncertainty), we constructed an interaction term between the variation in dividends and the sign of the VCAC variation ($\Delta VCAC$ is an indicator variable coded as 1 for an increase in VCAC and 0 otherwise). Consequently, *Equation (4)* is modified and becomes:

$$CAR_{it} = \beta_0 + \beta_1 \Delta VCAC + \beta_2 \Delta^{+} Div_{it} + \beta_3 \Delta^{-} Div_{it} + \beta_4 \Delta VCAC * \Delta^{+} Div_{it} + \beta_5 \Delta VCAC * \Delta^{-} Div_{it} + \beta_7 D_{pre} + \beta_8 \, Spread + \beta_9 \, Risk + \beta_{10} \Delta TVol + \varepsilon_{it} \quad (5)$$

To test for the asymmetric reaction of changes in the VCAC index, we examined whether $\beta_5 > 0$ and $\beta_4 \leq 0$, as well as whether the total coefficient was different $(\beta_3 + \beta_5) > (\beta_2 + \beta_4)$.

Table 6 reports the coefficients betas of *Equation (5)*. Whatever the window, we find in coherence with the ambiguity hypothesis that the coefficient β_5 is positive and significant while β_4 is negative or positive but non-significant.

Table 6. Investor responses to dividend changes following major changes in uncertainty

	[-1;+1]		[-15;+15]	
	Value	Pr > |t|	Value	Pr > |t|
Δ *VCAC*	-0.0010		-0.0028	***
$\Delta + Div$	0.2656		-0.0614	
$\Delta - Div$	-0.0961		-0.1217	
Δ *VCAC x* $\Delta + Div$	-0.2347		0.3857	
Δ *VCAC x* $\Delta - Div$	0.3698	*	0.5648	*
Size	-0.0019	*	-0.0061	***
Div_{pre}	-0.0006		0.0040	
Spread	-0.0192	*	0.0038	
Risk	0.4373		0.1375	
TΔ*Vol*	0.0012		-0.0035	*
VCAC	-0.0004		0.0002	

*** , ** and * means significant respectively at the 1% level, 5% level and 10% level.

The results also indicate that $(\beta_3 + \beta_5) = 0.2737 > (\beta_2 + \beta_4) = 0.0309$ for the [-1; +1] window and $(\beta_3 + \beta_5) = 0.4431 > (\beta_2 + \beta_4) = 0.3243$ for the [-15; +15] window. The asymmetric response diminishes with the length of the window, meaning that investors need more time to assess the meaning of new information when ambiguity increases.

4. Conclusion

The role of macro-level uncertainty on market reactions to firm events is a promising topic. Dividend announcements in particular provide the potential for insight. We investigate, in this paper, the impact of shocks to the economic and financial environment on French company dividend announcements. To examine the role of changes in ambiguity level around the announcement dates we use the variation of implied volatility (*VCAC* index) as an empirical proxy for ambiguity. Based on the global sample and applying interaction methodology, we found results that support ambiguity theory, which claims that an increase in VCAC leads investors to place more weight on bad dividend news than on good dividend news. Given a larger observation window [-15; +15], when ambiguity increases investors respond asymmetrically to dividend news (more on bad news than on good news). These results are more sensitive when a larger observation window is considered than a smaller one. We actually obtained a higher asymmetric impact between good and bad dividend news for the [-15; +15] window but not for the smaller one [-1; +1]. Nevertheless, in this latter case, we noted consistently with the ambiguity explanation that the reaction to good (bad) news decreases (increases) dramatically when ambiguity increases compared to when ambiguity decreases. However, these results are more complex when the sample is split following the *VCAC* sign.

Our results suggest a recommendation for the communication policy of companies concerning their dividend announcements when the ambiguity in the market rises. Considering the stronger negative reaction of investors to declarations which predicts a decrease in dividends, companies should seek to delay such a decision by implementing it when uncertainty declines. Indeed, the response of investors appears weaker in this context. Furthermore, companies that reflect upon the balance between self-financing amounts and dividend payments should favor the constitution of internal financing when the ambiguity decreases. Thus, when uncertainty rises, the decline in the dividend payment in order to give preference to self-financing would have a stronger negative impact on the market, increasing the vulnerability of the company in the face of private equity investments and takeovers. Conversely, the positive reaction of investors to announcements of an increase in dividends strengthens the company's position in such situations.

Choosing to repurchase stocks or to have no payout policy at all rather than to pay dividends could also be explained by the increase in uncertainty in the economy (Schatt and Wichman, 2008; Berna and Guluzar, 2010; Fatemi and Bildik, 2012). Indeed, as in an uncertain environment the dividend increase is not so strongly perceived as good news and its decrease is more strongly sanctioned by the market, companies are entitled to wonder about the usefulness of the dividend policy as a signaling tool. Some prefer to opt for more flexible distribution policies such as stock repurchases or for no distribution at all (the shareholder's remuneration is then made by capital gains). For similar reasons (avoiding dividend variations), the presence of uncertainty could also justify the dividend-smoothing strategies largely described in the empirical literature (Lintner, 1956; Bliss *et al.*, 2015).

Companies could try to take into account the asymmetric response of investors to good and bad news in their financial communication. By releasing more information in periods of uncertainty, companies can reduce the ambiguity aversion phenomenon. For instance, they could have more meetings with investors to demonstrate the robustness of their business model to the environment's uncertainty or explain the steps by which they can cope with uncertainty (by developing flexibility, for instance). As in periods of uncertainty investors concentrate their attention on the worst-case scenarios, companies should focus on these scenarios to demonstrate that they are not so detrimental to the financial health of the companies. In short, companies have to answer the question of how the sources of value creation are affected by crises and the increase in the uncertainty level.

At a structural level, by developing their commitment to social responsibility, companies develop "reputational capital safeguards" (Fombrun *et al.*, 2000) to obtain greater stakeholder support, which could help them to survive in a period of crisis (Freeman, 1984; Cornell and Shapiro, 1987; Mishra and Modi, 2013). This strategy is a way to create a hedge against uncertainty in the relationship with the stakeholders. In this perspective, corporate social responsibility reduces the risk perceived by investors and more generally by stakeholders (Lahrech, 2011). Stepping up corporate social responsibility should lead companies to be more transparent and to disclose more reliable information to stakeholders. Several empirical studies illustrate the positive impact of adopting corporate social responsibility on the quality of information disclosure (Choi and Pae, 2011; Andersen *et al.*, 2012; Gao and Zhang, 2015; Martínez-Ferrero *et al.*, 2015).

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APPENDIX

Table 7. Investor reactions to dividend changes (increase, decrease or stable) following changes in uncertainty

	$\Delta^- VCAC$				$\Delta^+ VCAC$			
	[-15; +15]	Pr > |t|	[-1; +1]	Pr > |t|	[-15; +15]	Pr > |t|	[-1; +1]	Pr > |t|
	(N=519 || R^2=10.7%)		(N=505 || R^2=11.4%)		(N=322 || R^2=9.5%)		(N=336 || R^2=10.9%)	
$\Delta^+ Div$	-0.0855	**	0.2582	***	0.2852	***	0.0232	*
$\Delta^- Div$	-0.1109	**	-0.0630	**	0.5662	***	0.2563	**
Stable DIV	-0.0032		-0.0052		-0.0111		-0.0026	
Size	-0.0107	*	-0.0017	*	0.0014		-0.0032	*
DIV_{pre}	-0.0004	*	-0.0020	*	0.0122	*	0.0033	*
Spread	0.0044	*	-0.0184	*	0.0004	*	-0.3569	***
Risk	0.2703	**	0.5795	***	0.2663	**	0.2970	**
Δ *TVol*	-0.0045	**	0.0013	*	-0.0028	*	0.0003	*
VCAC	0.0016	*	0.0007		-0.0008		-0.0011	*
Asymmetry between $\Delta^+ Div$ and $\Delta^- Div$								
	0.0254		0.3212		0.2809		0.2331	

*** , ** and * means significant respectively at the 1% level, 5% level and 10% level.