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The Determinants of the Convertible Bonds Call Policy of Western European Companies  
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### Abstract:

This paper analyzes the determinants of the convertible bonds call delay of the Western European firms. This delay is analyzed comparatively to the optimal call policy suggested by Ingersoll (1977a) who argues that in a perfect market, managers should call the convertible bonds immediately when the conversion value reaches the call price. Like the previous studies in the US market, we find that the Western European companies delay the call of their convertible bonds for several weeks. This delay is explained by considering the main theoretical rationales for the convertible bonds call delays (the notice period, the call protection provisions, the cash flow advantage hypothesis, the financial distress and the signaling theory). The results are consistent with the cash flow advantage rationale but less evidence is found for the other theories.

**Keywords:** callable convertible bonds, call delay, soft call, hard call

**JEL classification:** G32

## 1 Introduction

Convertible bonds with call provision (callable CB henceforth) are a kind of convertible which grant the issuer the right to call back the bonds before their maturity. Among specific provisions in the CB contract, one providing the early redemption on the initiative of the issuer is widely used. For example, 692 out of 705 CB in Korkeamaki and Moore's (2004) sample are callable. When the issuers call the bonds, they redeem bondholders either by cash redemption or exchange the bonds for a specified number of company shares depending on whether the bonds are out-of-the-money (OTM) or in-the-money (ITM). ITM CB calls have significant impact on the firm value, in particular on the shareholders' wealth. Ingersoll (1977a) and Brennan and Schwartz (1977) argue that in a perfect market, managers should call the CB immediately when the conversion value reaches

the call price. By doing so, they preserve the market value of equity and limit the wealth transfer from existing shareholders to the new shareholders. Nevertheless, empirical evidence shows that firms' call policies do not meet this hypothesis by calling their CB only when they are deeply in-the-money. Explanations of this call delay can be grouped into three categories: the financial distress and transaction costs hypotheses (Ingersoll, 1977b, Emery and Finerty, 1989, Jaffee and Shleifer, 1990), the cash flow advantage rationale (Constantinides and Grundy, 1986, Asquith and Mullins, 1991) and signaling explanation (Harris and Raviv, 1985, Grundy and Verwijmeren, 2016).

The first contribution of this paper is to introduce ambiguity ("Knightian uncertainty", following Knight, 1921) and ambiguity aversion as one of the main drivers of the call delay. Because of ambiguity aversion, investors will have an asymmetric reaction to good and bad events; they will underestimate the possibility of a good event and overestimate the possibility of a bad event (Williams, 2015). In the context of CB calls, in period of economic or financial turbulence, ambiguity aversion could lead to overestimating the possibility for the bond to be out-of-the-money at the end of the notice period (explaining why companies wait for a higher call premium (than that given by the traditional probabilistic model) before calling the bond.

The second contribution of this paper is to test testing the various rationales for the call delay using a sample of CB called by Western European companies. Although theoretical literature is quite extensive, empirical papers on the subject are scarce and mainly focused on the US market. Moreover, the various rationales presented above are not empirically investigated and compared on the same sample apart from King and Mauer (2014). This paper tries to fill this gap by comparing empirically the major rationales on the same sample. We think that an examination of the CB call policy in a market other than the United States is important to better understand and explain the observed call delay. A few papers in CB literature discuss the European market (see for example Bancel and Mitto, 2004 for the issuers' motivation, Korekeamaki, 2005 for the CB design toward the local legal standards; Dutordoir *et al.*, 2014 for the link between governance quality and CB financing, Adoukonou *et al.*, 2018 for the sequential financing hypothesis). As pointed out by Bancel and Mitto (2004), the European CB market has been evolving rapidly since the mid-1990s and differs from the US market in several ways. For example, in the European market, CB are designed to be more debt-like (see for example Dutordoir and Van de Gucht, 2009). In line with this, the Bancel and Mitto (2004) survey analysis shows that about 70 % of respondents consider straight debt as an alternative to issuing convertible debt. It would be interesting to test

whether the call policy of European companies fits the debt-like design of their CB. The prediction towards this would be an optimal call policy since the debt-like CB issuers' objective is to use the call provision to buy back their bonds for cash. The call delay for these firms would be lower than that observed in the US market and the financial distress hypothesis would not be an important issue explaining this delay. Furthermore, we know that firms' practices can differ over time and across countries despite worldwide implication of the financial theories. It is therefore interesting to investigate: (1) whether the call policy of callable CB issuers in the Western European market can be explained by the various rationales given above and (2) what determines this policy and whether it differs from that of other markets.

Our study covers two categories of CB: the bonds called in-the-money before their maturity and those that are in-the-money but are not yet called by Western European firms between January 1992 and May 2018. We find that the widely-observed CB call delay also applies to the Western European market. More precisely, we find a median call delay of 89 days for the called CB sample. For these firms, the decision to call the bonds occurs only when the call premium (defined by the conversion value divided by the redemption price at the call date minus one) is around 43 %. Overall, our study provides empirical evidence for the cash flow advantage and the financial distress costs rationales for the CB call delay.

This study is structured as follows: section 2 presents the literature review on the call policy; in section 3 we deal with the investigation and the determinant of the CB call policy of Western European issuers, before concluding in Section 4.

## 2 Explanations of the call delay

In a perfect market, Ingersoll (1977a) as well as Brennan and Schwartz (1977) model that the firms should call their CB as soon as the conversion value reaches the call price. However, empirical studies on the CB call policy provide evidence that the companies delay the call of their bonds too long. For example, Ingersoll (1977b) finds that 170 out of 179 CB called between 1968 and 1975 were made when the conversion value significantly exceeded the call price. In this section, we discuss factors presented in the literature that could explain such deviation from the basic theory.

## 2.1 The financial distress and transaction costs hypothesis

When the CB are called, managers give the bondholders a number of days notice to say whether they want to exchange their bonds for the company's stocks or receive a cash redemption instead. This period between the call date and the effective conversion date is called the "notice period" and is usually between 30 days and 60 days<sup>1</sup>. There is a possibility that the CB called when the bonds are in-the-money become out-of-the-money at the end of the notice period. If this occurs, the conversion fails and the firms must operate a cash redemption which generates additional transaction costs and can push financially constrained firms into financial distress (Ingersoll, 1977b; Emery and Finerty, 1989; Jaffee and Shleifer, 1990). To avoid this situation, issuers delay the CB until they are sufficiently in-the-money. In line with this hypothesis, Altintig and Butler (2005) find that when the effects of the notice period are taken into account, the CB are not called late. Ekkaryokkaya and Gemmill (2010) also find that the interaction of the probability of a conversion failure with financial distress measures increase significantly with the observed call premium but they do not confirm that the notice period effect is the only reason for delaying the CB calls.

The delay crucially depends on the possibility of predicting whether the bond will be out-of-the-money at the end of the notice period. Traditionally this prediction is based on probabilistic models. Recently, Agliardi *et al.* (2015) introduce ambiguity into a model for convertible debt. From their theoretical model, we deduce that the call delay increases for firms with higher ambiguity aversion or in periods of higher ambiguity. Jeong *et al.* (2015) examined empirically the role of ambiguity in capital markets and found that ambiguity aversion is both economically and statistically significant. A recent study of Lee *et al.* (2019) confirmed that ambiguity is priced in the cross-section of expected stock returns. The possibility that ambiguity aversion could affect the call delay should therefore be seriously taken into consideration. Following Dicks and Fulghieri (2019) or Boyarchenko (2012), we expect that the call delay will increase in periods of financial turbulence.

## 2.2 The cash flow advantage hypothesis

Asquith and Mullins (1991) argue that if the dividend payment on the converted shares is greater than the after-tax interest payment (positive cash flow advantage as they call it), companies should not call to force conversion. Constantinides and Grundy (1986), taking the

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<sup>1</sup> In France, the notice period is typically 30 days for recent CB contracts (the OCEANE) which have become more common since the end of 1998. For older contracts (before 1998) the notice period is on average 3 months.

point of view of the CB holders, argue that when the bond's yield advantage is negative (coupon on the CB is lower than the dividend payment on converted share) CB holders will voluntarily convert their bonds.

Constantinides and Grundy (1986) show through a probit model that the probability of calling the CB within the six months of the first time that the forced conversion is feasible is greater when the yield advantage is high (positive yield advantage). Ekkaryokkaya and Gemmill (2010) provide evidence that the call premium is negatively related to the existence of a negative cash flow advantage (after-tax interest payments are greater than the dividend payment) when the issuers call the bonds. Using a linear regression model, Korkeamaki and Michael (2013) show that when the CB yield advantage is negative, firms delay the call decision which extends the life cycle of the bonds. More recently, the study of Grundy and Verwijmeren (2016) gives strong support for the cash flow advantage hypothesis. They formally demonstrate and check empirically that, in presence of dividend protection provision in the CB contract, the call delay disappears.

### 2.3 The signaling hypothesis

Harris and Raviv (1985) argue that companies whose managers have favorable private information have no incentive to force conversion of the bonds. Hence, the decision to delay the call signals the manager's confidence that future high dividends will generate voluntary conversion. Conversely, managers who have unfavorable private information will force their CB and this decision is perceived by the market as the likelihood of the issuers' price decline in the future which sends a negative signal. Grundy and Verwijmeren (2016) state that call delay can lead to a separating equilibrium: high-quality firms can wait for voluntary conversion (after the tax coupon is lower than the future dividend), low-quality firms are unable to copy since it is costly to continue paying relatively high coupons rather than low dividends.

This hypothesis explains a decline in issuers' stock price at the CB call announcements. In line with this, Ofer and Natarajan (1987) record significant negative announcement returns around the CB calls. They also find a strong decline in operating performance for companies which called their bonds for the years following the calls. Garcia-Feijo *et al.* (2010) also find a significant negative wealth effect at the call announcement but only for the firms which experienced an increase in equity beta around the call. They

conclude that the call decision conveys information about the systematic risk of the calling firms. Their results are consistent with the Mayers' (1998) sequential investment theory stating that firms plan the issuance and the call of their CB to finance staged investments. Inconsistent with the signaling hypothesis, Ederington and Goh (2001) show that negative abnormal returns at the CB call announcement are the result of the increased supply of stocks on the market and are therefore reversal. This finding is confirmed by the study of Ekkaryokkaya and Gemmill (2010) which finds that the negative call announcement returns of CB are only temporal and cannot be explained by the signaling hypothesis. The results of the event study only suggest a temporal negative effect on the announcement returns due to the increasing sale activity on the issuers' stocks. This can be explained by the fact that the CB holders in anticipation of the conversion sell the stock they hold. The increased supply of stock in the market creates downward pressure on the issuers' shares. In the French market, the result of Maati-Sauvez (2013) also rejects the signaling hypothesis.

### 3 Empirical analyses

In this section, we investigate the CB call policy of Western European firms and try to explain what determines this call policy. We introduce firstly our data and thereafter the methodology adopted to test the rationales for the CB call delay.

#### 3.1 Sample selection and data description

Using the Bloomberg database we identify the CB issued between January 1992 and May 2018 on the Western European market, which leads to 1181 operations. We select the CB of non-financial companies that are in-the-money during the same period. The main terms of the issuance must be available on the database. We obtain a final sample of 159 CB divided into two subsamples: 122 CB called in-the-money by 100 firms (1) and 37 CB in-the-money but not yet called by 36 firms (2) on 14 Western European countries between January 1992 and May 2018. Tables 1 and 2 show the number of CB per country for the called and not called subsamples. Around 34 % of the calls are made by the French companies, followed by the Dutch firms (20 %) and the UK firms (10 %). The trend is similar for the CB not called except for the UK bonds that are marginal in this subsample (Table 2). Table 3 exhibits the industry's affiliation of the firms according to the S&P GICS classification. We can see that most of the firms operate in Materials and in Capital goods industries.

Table 1: CB calls by the Western European companies

This table presents the CB called in-the-money by 100 non-financial companies on the Western European market between January 1992 and May 2018 per country and per year.

Country	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	Total
Austria	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-	-	-	-	1	-	3
Belgium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	1	1	-	4
Finland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1
France	-	1	3	-	6	4	3	2	2	-	1	-	2	4	3	2	1	-	-	-	-	3	2	-	2	1	-	42
Germany	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2	-	-	-	1	-	1	-	1	1	2	2	11
Holland	-	-	-	-	-	-	-	1	2	2	1	-	-	-	-	4	4	1	1	3	1	-	2	-	-	3	-	25
Ireland	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Italy	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
Luxembourg	-	-	-	-	-	-	-	-	-	-	1	-	2	-	-	1	1	-	-	-	-	-	1	-	-	1	-	9
Norway	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	1	-	4
Spain	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	-	-	1	-	1	6
Switzerland	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
UK	1	-	1	-	1	-	2	1	2	2	-	-	-	-	-	-	2	-	-	-	-	-	-	-	1	-	-	13
Total	1	2	4	0	7	6	6	4	7	4	3	1	4	4	6	11	8	1	2	4	1	6	7	4	5	10	4	122

Table 2: Not called In-The-Money CB by the Western European companies

This table presents the in-the-money CB not yet called by 36 non-financial companies on the Western European market at the end of May 2018 per country.

Country	Number	%
Belgium	2	5.41
France	11	29.73
Germany	5	13.52
Holland	4	10.81
Ireland	1	2.7
Italy	4	10.81
Luxembourg	2	5.41
Norway	1	2.7
Spain	2	5.41
Sweden	1	2.7
Switzerland	3	8.11
UK	1	2.70
Total	37	100

Table 3: Firms industries based on the S&amp;P GICS classification

This table presents the classification of the CB according to their firms' industry affiliation using the 4 digits S&P GICS classification.

Industry	Number	%
Automobiles & Components	5	3.14
Capital Goods	17	10.69
Commercial & Professional Services	2	1.26
Consumer Durables & Apparel	4	2.52
Consumer Services	6	3.77
Energy	4	2.52
Food & Staples Retailing	7	4.40
Food, Beverage & Tobacco	7	4.40
Health Care Equipment & Services	11	6.92
Materials	18	11.32
Media	10	6.29
Pharmaceuticals, Biotechnology & Life Sciences	8	5.03
Retailing	2	1.26
Semiconductors & Semiconductor Equipment	13	8.18
Software & Services	12	7.55
Technology Hardware & Equipment	9	5.66
Telecommunication Services	8	5.03
Transportation	10	6.29
Utilities	6	3.77
Total	159	100

### 3.2 Methodology

In this study, we focus on the call policy of the firms whose bonds are in-the-money. For the called bonds subsample, we determine the premium at the call date and compute the number of days by which the call decision is delayed. For the not called bonds subsample, the premium and the delay are computed considering that the call occurred at the end of May 2018. We refer to the percentage over which the conversion value exceeds the conversion price at the call date using the term "Call Premium". According to Ingersoll (1977a), the firms should call their CB as soon as the conversion value exceeds the call price. If the call decision does not occur at this point, a delay exists and corresponds to the number of days from this point to the effective call date (Call Delay).

We determine for each CB in our sample, the theoretical optimal call date considering the hard and soft call protections. The hard call provision in the CB agreement prevents the

firm during a given period from calling the CB even if the conversion value exceeds the call price. A soft call provision prevents the firm from calling the bonds unless the stock price exceeds the call price by a given percentage and for a specific number of days. The length of the hard protection is not available for the whole sample in the Bloomberg database. We therefore collect this information manually by consulting the issuance prospectus. For bonds for which we are unable to collect this information because the prospectus is unavailable, we consider the CB being callable two years after the issuance date, which is the most observed hard call protection length in our sample. For the CB with both soft and hard call protection, the theoretical optimal call date is the first date after the expiration of the hard call protection at which the history of stock prices satisfies the soft call conditions. We obtain the “Adjusted Call Delay” by computing the number of days between the effective called date and the theoretical optimal call date. We adjust the call premium to take into account the soft and hard call provisions. The call premium and the adjusted call premium are computed as follows:

$$\text{Call Premium} = \frac{S}{X} - 1$$

$$\text{Adjusted Call Premium} = \left( \frac{S}{X \cdot s_T} \right) - 1$$

where  $S$  is the conversion value at the call date,  $X$  the call price and  $s_T$  the soft call trigger percentage.

We attempt to explain the CB call delay using different approaches. We follow the three main rationales for the CB call delay based namely on the financial distress, the cash flow advantage and the signaling rationale.

We test firstly whether the observed call delay is due to the presence of the notice period. In univariate analysis, we compare the observed CB call delay with the optimal call delay computed using Butler’s (2002) model. This methodology is also used by Ekkaryokkaya and Gemmill (2010). In this univariate analysis, attention is also paid to the possible difference of the call delay between dividend protected and non-dividend protected CB calls which may be evidence for the cash flow advantage hypothesis.

We then run a multivariate analysis using the Tobit regression to explain the call delay and the call premium. In this analysis, we check whether the financial distress and/or the cash flow consideration leads the firm to delay the CB call decision.

Finally, we test the signaling rationale by performing an event study around the CB call announcement and by investigating the operating performance of these calling firms for the years following the forced conversion.

### 3.3 Univariate analysis

For the 159 CB in our sample, we compute the adjusted call delay which is the number of days from the adjusted optimal call date to the effective call date or the end of May 2018 according to the subsample (called or non-called CBs). The adjusted optimal call date is that at which the issuer stock prices satisfy for the first time the conditions under which the firms can force the conversion. These conditions include the soft and the hard call protections. Table 4 shows the characteristics of the CB in our sample. The detail of the calculation of the variables is indicated in Annex 1.

Table 4 shows that there is considerable heterogeneity relative to the amount issued for the called subsample (from €4.5 million to €2.6 billion). The call decision occurs on average after 3.98 years with a median of 3.36 years. For the non-called subsample, the numbers of years since the issuance is around 3.6. More than half of the CB called (72 %) include a soft call provision and the trigger ranges from 115 % to 150 %. This percentage is lower for the not called CB subsample (49 %). 36 issues which account for about 30 % of the total sample of the CB calls are dividend protected. This percentage is low compared with that of the not called subsample (64 %) and the Grundy and Verwijmeren's (2016) 2000-2008 sample in which dividend protected CB account for 60 % of the total.

Table 5 gives an overview of the CB call policy of Western European companies. In this table, we report the mean and median values of the call premium and the call delay relative to Ingersoll's (1977a) optimum point. We also determine the adjusted call premium and call delay according to the procedure described previously.

For the called CB subsample, the call premium is 97 % (with a median of 43 %). As expected, the premium is lower for the non-called subsample (57 % with a median of 31 %). The effective call delays for the non-called firms will necessarily be longer than those we observe here. The corresponding delay for the called CB is around 200 days (with a median of 89 days). Surprisingly, the unachieved delay observed for the non-called CB is longer than for the called CB (281 days with a median value of 244 days). This result can hardly be explained by the design of the bonds. For example, as mentioned on the Table 4, 72 % of the CB in the

called subsample present a soft call protection clause against 40 % for the non-called subsample. Similarly, only 30 % of the called CB are dividend protected against 65 % for the not called CB. Hence, the - unachieved - longer delay observed for the not called CB cannot be a consequence of the design of the bonds. We think this result is due to the nature of the two subsamples. In the called CB group, some firms achieve an “optimal call policy” by calling their CB as soon as possible leading to 0 call delay<sup>2</sup>. This fact is not observable for the second group. Concerning the adjusted call premium and delay, we find that the firms delay the call of their CB for about 89 days with a median of 46 days (155 for the not called CB) relative to the first time that the bond effectively becomes callable. In comparison with this, King and Mauer (2014) find an adjusted delay of 65 days with a median of only one day. The adjusted call premium is 76 % and the median is 19 % (15 % for the not called CB) which is approximately the same that reported by King and Mauer (2014) in the US market and Maati-Sauvez (2003) in the French market over the period 1982-1997. However, this call premium is lower than the 35 % reported by Altintig and Butler (2005) in the US market. Overall, in comparison with the results in the US market, the call policy of Western European companies does not differ significantly despite the institutional and bond design differences.

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<sup>2</sup> 10 companies achieve this optimal call policy in the called subsample. Many others call their CB near the optimal date

Table 4: Characteristics of the CB

This table shows some characteristics for the 122 CB called (1) and for 37 not called CB in-the-money (2) at the end of May 2018 on the Western European market. CB amount is the proceeds of the CB offer in EUR million. Years To Issue is the number of years between the issuance date and the effective date of the call for the group (1) and the end of May 2018 for the group (2). Soft call protection equals 1 if the CB has a soft call protection provision and 0 otherwise. Soft Call Trigger is the predetermined percentage of the conversion value over the conversion price above which the CB becomes callable by the issuer. Dividend Protection equals 1 if the CB has a dividend protection and 0 otherwise.

Characteristics		Mean	Median	Min	Max	Standard deviation
CB Amount	(1)	325.42	246.6	4.57	2657.30	368.21
	(2)	174.48	80.11	1.54	862.5	248.88
Coupon	(1)	3.72	3.25	0	9	2.24
	(2)	3.19	3.00	0	10	2.66
Maturity	(1)	7.61	6.32	2.35	32.65	4.87
	(2)	5.56	5.00	3.00	10	1.22
Years To Issue	(1)	3.98	3.36	0.25	14.55	2.28
	(2)	3.60	3.72	1.16	5.46	1.11
Soft Call Trigger	(1)	130.57	130	115	150	8.79
	(2)	137	130	120	150	7.75
Soft Call Protection	(1)	with: 68 (72.13%)			without: 34 (27.87%)	
	(2)	with: 15 (40.54%)			without: 22 (59.46%)	
Hard Call Protection	(1)	with: 105 (86.07%)			without: 17 (13.93%)	
	(2)	with: 32 (86.49%)			without: 05 (13.51%)	
Dividend Protection	(1)	with: 36 (29.51%)			without: 86 (70.49%)	
	(2)	with: 24 (64.86%)			without: 13 (35.14%)	

Table 5: CB call policy of the Western European firms

This table shows the means and the medians of the call premiums and the call delays for the 122 CB called (1) and for 37 not called CB in-the-money (2) at the end of May 2018 on the Western European market. Adjusted call premium and call delay are computed considering the hard call and the soft call provisions.

		Call Policies		Adjusted Call Policies	
		Mean	Median	Mean	Median
Premium	(1)	0.97	0.43	0.76	0.19
	(2)	0.57	0.31	0.41	0.15
Delay	(1)	200.73	89	89	46
	(2)	281.43	244	181.59	155

For the not called but in-the-money CB (2), calculations are made at the end of May 2018

### 3.3.1 Test of Butler's model

We use the model of Butler (2002) to test whether the firms in our sample delay the call of their CB due to the presence of the notice period. We compare the delay observed at the call announcement or at the end of May 2018 to that we should observe if the CB were called at Butler's (2002) optimum point. If the firm gives the bondholders a notice period, the optimum point to call the bonds is henceforth above that of Ingersoll (1977a), since a certain "safety" premium becomes necessary to ensure the conversion at the end of the notice period. Butler's (2002) model provides an approximation for this optimum point at which the CB should be called in the presence of a non-zero notice period. The model is based on the Black & Scholes option pricing model. It gives for a non-zero call notice period the "S/X level" at which it is optimal to call the CB. This S/X level satisfies the following equation:

$$N[d_1(t, r_t)] - \left(\frac{n}{n+m}\right)^2 N[d_1(T, r_T)] = 1 - \left(\frac{n}{n+m}\right)$$

with

$$d_1 = \frac{\ln(S/X) + (r_t + \delta^2/2)\tau}{\delta\sqrt{\tau}}$$

$S$  is the stock price,  $X$  the call price,  $r$  the risk-free rate,  $\tau$  is either  $t$  (the notice period) or  $T$  (the time to maturity),  $\delta$  is the annualized underlying stock price returns volatility,  $N(\cdot)$  the cumulative standard normal distribution,  $n$  the existing number of shares and  $m$  the number of shares into which the CB are exchanged.

Because the effective call notice periods are not available in the Bloomberg database, we check this information manually on the CB offers prospectus when available. For all prospectuses we consult, a delay range is mentioned instead of a specific numbers of days. For example, for the OCEANE French CB, it is mentioned that the issuer will redeem the bonds after giving the bondholders at least 30 days' notice. For the UK CB, the issuers give not less than either 30 or 45 but in all cases no more than 60 days' notice to bondholders to exercise their option to convert or not. In practice, the researchers report typically a 30 day notice period (see for example King and Mauer, 2014; Altintig and Butler, 2005; Ekkaryokkaya and Gemmill, 2010). We determine Butler's (2002) optimum S/X level using successively 30, 45 and 60 days' notice. However, for expositional purpose we report only the result for the 30 and 45 days' notice.

Table 6 shows the optimum S/X level at which the firms should call their CB if the notice period was 30 or 45 days. For each company in our sample, we compute the call delay if firms had to force the conversion at Butler's (2002) optimum point. We also compute at Butler's (2002) optimum point the probability that the CB will not be converted after the expiration of the notice period (henceforth the failure probability). The conversion probability is given by the  $N(d_2)$  of the Black & Scholes option pricing model. Hence, the non-conversion probability is equal to 1 minus the conversion probability  $[1 - N(d_2)]$  which is also equal to  $N(-d_2)$ . As shown in Table 6, the median Butler's (2002) call premium is 31 % for the 30 days' notice period and 35 % for the 45 days' notice period (respectively 3 % and 4 % for the not called CB). The corresponding adjusted call premiums are respectively 4 % and 5 % (respectively 2 % and 3 % for the not called CB). The adjusted median call delays for these different levels are respectively 1 and 3 days which are lower than the observed median call delay of 46 days. For the 60 days' notice period the median call premium is 7 %. The last columns of table 6 show the z-statistics of the Wilcoxon signed-rank test. We can see that the observed call policy is very different from that proposed by the Butler model. For example, for 30 days' notice the median adjusted call premium necessary to ensure the conversion at the end of the notice period is scarcely 4 %: while the observed call premium in our sample is 19 % (called subsample).

Furthermore, we find at Ingersoll's (1977a) optimum point (when  $S=X$ ) that the probability that the CB will not be converted at the end of the call notice period is around 51 %. This probability is very high and can explain why the great majority of the firms in our sample do not call their CB at the ( $S=X$ ) point. As shown in the Table 6, the failure probability after the expiration of the notice period computed at Butler's (2002) optimum point (0 %) is lower than those of Ingersoll's (1977a) optimum (51 %). For the majority of companies in our sample, the probability of non-conversion computed at the Butler optimum point is almost null. It was therefore not necessary for these firms to delay the call any longer. These results should be viewed with caution however. The reason is that the zero-failure conversion probability observed at the Butler optimum point is due to the presence of the soft call provision. For example, 72 % of the CB in the first subsample (1) include a soft call provision. This clause makes the call possible only if the stock prices rise enough (115-150 percent above the call price in this subsample). To better understand why the firms do not call their bonds at the Butler optimum point, it is necessary to compute the failure probabilities by isolating the bonds with soft protection from those without this clause. Table 7 show the

results of this operation. We find that the median non-conversion probability for the convertible without the soft call provision is about 27 % given 30 days' notice (Table 7). The probability drops to 0 % from the Butler optimum point to the call date. The same result holds for the not called subsample (2). The non-conversion probability drops from 38 % at the Butler optimum point to 0 % at the call date. The latter result may indicate that these firms wait too long before calling their bonds to further reduce the non-conversion probability and ensure that the conversion will succeed. This behavior can be interpreted by a dread of cash redemption, especially for financially constrained companies. We further investigate this possibility below.

Overall, these results do not allow us to state that the observed call delay is due to the existence of the notice period. We find that the issuers of the CB without the soft call provision delay the call of their convertible bonds until the conversion success probability at the end of the notice period rises to around 100 %. For the issuers of the CB with the soft call provision however, the delay observed is not justified since the probability that the conversion will fail at the end of the notice period was practically nil at the Butler optimum point (see Table 7). This probability is however slightly greater for the not called CB. Additional tests are therefore necessary to conclude.

Table 6: Observed call policy vs. Optimal call policy from the Butler (2002) model

This table shows the call premiums, the call delays and the non-conversion probabilities at the call dates and at Butler optimum point delays for the 122 CB called (1) and for 37 not called CB in-the-money (2) at the end of May 2018 on the Western European market. The columns 4 to 7 show the premium and the number of days by which the CB call should be delayed if the calling firms had called their bonds at the Butler's (2002) optimum point for respectively a 30 days and 45 days' notice periods. The Wilcoxon signed-rank test is used to assess eventual difference between the observed call policy and those of the different Butler's (2002) models. The two last columns report the z statistic of the Wilcoxon signed-rank test. \*\*\* denote the significance at 1% level.

		Observed Call policy (a)		Butler Model 30 days (b)		Butler Model 45 days (c)		Wilcoxon Test	
		Mean	Median	Mean	Median	Mean	Median	(a) vs. (b)	(a) vs. (c)
Premium	(1)	0.97	0.43	0.27	0.31	0.35	0.35	<b>5.45***</b>	<b>3.65***</b>
	(2)	0.57	0.31	0.11	0.03	0.12	0.04	<b>3.21***</b>	<b>3.04***</b>
Adjusted Premium	(1)	0.76	0.19	0.08	0.04	0.11	0.05	<b>8.38***</b>	<b>7.99***</b>
	(2)	0.41	0.15	0.05	0.02	0.06	0.03	<b>3.21***</b>	<b>3.07***</b>
Adjusted Delay	(1)	89	46	20.29	1	24.21	3	<b>6.04***</b>	<b>5.48***</b>
	(2)	181.59	155	0.10	0	0.42	0	<b>3.76***</b>	<b>3.77***</b>
Failure probability	(1)	0.05	0.00	0.09	0.00	0.05	0.00	<b>-3.16***</b>	-1.57
	(2)	0.10	0.00	0.30	0.36	0.28	0.33	<b>-3.74***</b>	<b>-3.63***</b>

For the not called but in-the-money CB (2), calculations are made at the end of May 2018

Table 7: Premium and failure probability (CB without soft call vs. CB with soft call clause)

This table shows the mean (median) adjusted call premiums and the non-conversion probabilities (failure probability) at the call dates and at the Butler optimum point for the 122 CB called (1) and for 37 not called CB in-the-money (2) at the end of May 2018 on the Western European market. The columns 3 to 4 are relative to the Butler's (2002) optimum point for respectively a 30 days and 45 days' notice periods. The Wilcoxon signed-rank test is used to assess eventual difference between the observed call policy and those of the different Butler's (2002) models. The Mann-Whitney test serves to test the statistical difference between the call policies relative to the CB with soft call

		Observed Call policy (a)		Butler Model 30 days (b)		Butler Model 45 days (c)		Wilcoxon z-values	
		No Soft	Soft	No Soft	Soft	No Soft	Soft	(a) vs. (b)	(a) vs. (c)
Adjusted Premium	(1)	1.37 (0.40)	0.45 (0.18)	0.16 (0.06)	0.05 (0.03)	0.21 (0.08)	0.06 (0.04)	<b>8.38***</b>	<b>7.99***</b>
		<b>2.77***</b>		<b>5.41***</b>		<b>5.43***</b>			
Mann-Whitney z-values (No Soft vs. Soft)	(2)	0.48 (0.20)	0.30 (0.07)	0.00 (0.03)	0.03 (0.03)	0.07 (0.03)	0.03 (0.03)	<b>3.21***</b>	<b>3.07***</b>
		1.48		0.18		0.27			
Failure probability	(1)	0.07 (0.00)	0.04 (0.00)	0.26 (0.27)	0.00 (0.00)	0.14 (0.14)	0.00 (0.00)	-	-1.57
		0.72		<b>9.00***</b>		<b>8.68***</b>		<b>3.16***</b>	
Mann-Whitney z-values (No Soft vs. Soft)	(2)	0.17 (0.00)	0.02 (0.00)	0.37 (0.38)	0.02 (0.00)	0.34 (0.36)	0.02 (0.00)	-	-
		0.99		-1.16		-1.17		<b>3.74***</b>	<b>3.63***</b>

provision and those without this clause. \*\*\* denote the significance at 1% level.

For the not called but in-the-money CB (2), calculations are made at the end of May 2018

### 3.3.2 Test of the cash flow advantage hypothesis

The cash flow hypothesis explains the call delay by the existence of a cash flow advantage for the firm. This is the case when the current (after-tax) interest expenses on CB are lower than the dividend payment (see Grundy and Verwijmeren, 2016; Asquith and Mullins 1991; Constantinides and Grundy, 1986). We determine at the Ingersoll (1977a) adjusted<sup>3</sup> optimum point whether the current after-tax interest expenses on CB are lower than the last announced dividend payment. The corporate effective tax rates are collected from the Bloomberg database. To test the cash flow advantage hypothesis, we make three comparisons. Firstly, we compare the adjusted call delay of the CB that present a cash flow advantage with those without this advantage. Secondly, we make the same comparison between the dividend protected and non-dividend protected CB. For the dividend protected CB, the conversion price is adjusted to take into account a possible distribution of dividends. Consequently, the decision to convert or call the CB cannot be driven by the cash flow advantage consideration. We then expect that the call premium and delay for the dividend protected CB should be less than those of non-dividend protected CB. Thirdly, we consider only the CB that present a cash advantage and make a comparison according to the presence of the dividend protection clause. In a situation where there is a cash flow advantage, we expect that the delay for the non-dividend protected CB will be larger than for the dividend protected CB.

We find that the adjusted call delay for CB with a cash flow advantage (Table 8, Panel A) is larger than the delay observed for the CB without this advantage. The opposite is true for the not called subsample but these differences are not statistically significant. Table 8 (Panel B) shows that the adjusted call delay for the dividend protected CB (median 35 days) is significantly (at 5 %) lower than that of the non-dividend protected CB (median 52 days). This delay for the dividend protected CB (mean 71 days) is higher than the mean 47.3 days (with a zero-median value) reported by Grundy and Verwijmeren (2016) in the US market. For the not called CB, the difference is not statistically significant. We also find that, when there is a cash flow advantage for the firms (Panel C), the adjusted call delay for the non-dividend protected CB is greater (with a probability of 73 %) than that of the dividend protected CB. Despite this high probability, the difference is not statistically significant. We

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<sup>3</sup> We adjust this optimum point for the CB that include the soft call protection since for these bonds, the call is not possible at the  $S=X$  level.

think that the lack of significance relative to these tests is probably due to the very low size of the different subsamples.

Overall, the univariate analysis does not allow us to investigate in detail the other rationales for the call delay. We therefore perform a multivariate analysis to test whether the apparent suboptimal call policy we observe is due to the cash flow advantage or the financial distress rationale. The signaling hypothesis is tested using the event study around the call announcement.

Table 8: CB call policy according to the cash flow advantage and the dividend protection clause

This table shows the means and the medians of the adjusted call delay for the 122 CB called (1) and for 37 not called CB in-the-money (2) at the end of May 2018 on the Western European market. Adjusted premium is computed considering the hard call and the soft call provisions. The Mann-Whitney test is used to assess eventual difference between the two groups. The last column reports the z statistic of the Mann-Whitney test. \*\* denote the significance at 5% level.

		Global (a) + (b)		Group (a)		Group (b)		Mann-Whitney z-stat	Probability (a)>(b)
		Mean	Median	Mean	Median	Mean	Median		
<b>Panel A: CB with cash flow advantage (a) versus CB without cash flow advantage (b)</b>									
Adjusted delay	(1)	89	46	93.54	49	88.456	45.5	0.27	52%
Observations			122		12		110		
	(2)	181.59	155	109.25	99	191.57	155	1.39	72%
			37		4		33		
<b>Panel B: Non-dividend protected CB (a) versus Dividend protected CB (b)</b>									
Adjusted delay	(1)	89	46	98.19	52.5	71.14	35	<b>1.99**</b>	<b>62%</b>
Observations			122		86		36		
	(2)	181.59	55	144.31	116	201.79	185	-1.35	<b>36%</b>
			37		13		24		
<b>Panel C: Non-dividend protected CB with CF adv. (a) versus Dividend protected CB with CF adv. (b)</b>									
Adjusted delay	(1)	93.54	49	128.57	55	32.25	36.5	1.23	73%
Observations			12		10		2		
	(2)	198	181	-	-	198	181	-	-
			4		0		4		

For the not called but in-the-money CB (2), calculations are made at the end of May 2018

### 3.4 Multivariate analysis

In this section we investigate the impact of the financial distress and the cash flow consideration on the firms' call policy. The methodology adopted consist in linking various proxies for the financial distress and the cash flow advantage to the delay or the call premium.

Following the Grundy and Verwijmeren (2016) methodology, the dependent variables are the log-transformation of the adjusted call premium ( $\log(1 + \text{Adjusted Call Premium})$ ) and call delay ( $\log(1 + \text{Adjusted Call Delay})$ ). Considering the fact that these variables are left-censored, we used a Tobit model as in Grundy and Verwijmeren (2016).

The choice between the call delay and the call premium as dependent variable can be discussed. There is a positive correlation between these two variables, but this correlation is very weak as indicated by the Pearson correlation coefficient of 0.06 (see Appendix 2). Introduction of both variables in the empirical analysis is then relevant for a better understanding of call policy. We think that the call delay may be better for testing the cash flow advantage rationale because the profit derived from this situation is linked to the length of the delay. However, as this delay necessarily induces an increase in the call premium, the firms probably compare the cash flow advantages with the disadvantages of wealth transfer when they delay the call. If true, the call premium is more relevant to test both the cash flow advantage and the financial distress rationales. The independent variables are various measures of financial distress, financial constraint and cash flow advantage presented below.

### 3.4.1 Hypotheses and variables

Following the financial distress and transaction costs hypothesis, companies that are financially constrained or facing a high cost of financial distress should have larger call premium and delay.

We use the KZ index (Kaplan and Zingales, 1997) as a proxy for the financial constraint because, as mentioned by Farre-Mensa and Ljungqvist (2016), it is the most popular measure of financial constraint. We use the coefficient estimates of Lamont *et al.* (2001) to create our KZ index. Appendix 1 provides details on the calculation of the KZ index scores. Since high levels of the KZ scores are associated with financial constraint, we predict a positive relationship between this score and the delay or the call premium. We also use the dividend payment dummy variable as an indicator of firms facing financial constraint. We predict that firms facing high financial constraint near the optimal call date are less likely to pay dividends the year preceding the call. For these firms, the delay and the call premium are expected to be larger.

We measure the financial distress by the Altman (1968) Z score. This score can be viewed as an accounting-based measure of the distance to default and is widely used as an

indicator for firms facing financial distress. The Z score is the combination of five ratios weighted by different coefficients. A low Z score indicates that the firm is likely to default and therefore incurs high financial distress costs. We then predict a negative relationship between the Z score and the delay or the call premium. For firms incurring high costs of financial distress, we predict that the issue size and the percentage of the shares into which the bonds will be converted are important determinants for the observed call policy. These last two variables are not the direct proxies for the financial distress but in case of conversion failure, the amount necessary to redeem the bondholders would be greater for these issuers. In this context, we expect a positive relationship between the issue size and the part of the shares accruing to the bondholders when the conversion occurred. Similarly, if the delay is due to financial distress, the safety premium computed at the date when the conversion could first be forced will mitigate the delay and the call premium. The firms for which this safety premium is important have a good margin ensuring conversion and do not have to delay the call for a long time. Following Grundy and Verwijmeren (2015), we predict a negative relationship between the safety premium and the call delay.

We further test the cash flow advantage rationale by analyzing the impact of the dividend protection clause and the opportunity for the firm to profit from the existence of the cash flow advantage on the call premium. The dividend protection dummy variable takes the value of 1 if the CB is dividend protected and 0 otherwise. This variable is expected to have a negative impact on the delay or the call premium. We add a dummy variable for non-dividend protected CB with cash flow advantage (NON\_DIV\_CF). As indicated in section 3.3.2, this cash flow benefit is assessed at the Ingersoll (1977a) adjusted optimum point. The adjustment concerns the CB with soft call provision and gives the date at which the stock price reaches the call price multiplied by the soft trigger percentage. We predict that the NON\_DP\_CF variable has a positive impact on the delay or the call premium.

Previous studies (Miao *et al.*, 2012; Williams, 2015) suggest that the change in the implied volatility for options would be an accurate empirical proxy of the time-variation in ambiguity. To measure the degree of ambiguity on the European capital markets, we used VSTOXX, the weighted average implied volatility for the European markets, based on EURO STOXX 50 options prices. We predict that in period of high expected uncertainty (high VSTOXX), firms will delay the call of their CB. The investor sentiment at the date when the conversion could first be forced will be positively related to the delay or the call premium.

The stock price volatility and the firm's size are added to the regression models as control variables.

Appendix 1 provides information on the calculation of the variables in our models. The variables are measured at the last fiscal year before the CB calls unless otherwise stated.

### 3.4.2 Results

Table 9 reports the descriptive statistics for the multivariate analysis variables. The majority of the firms in our sample pay dividends the year preceding the date at which their CB can be forced the first time. On average the CB conversion value exceeds the conversion price by about 33 % on the date when the conversion could be forced the first time (see the SAFETY PREMIUM variable).

Appendix 2 shows that there is a strong correlation between the firm size and the issue size. Large companies need more financing than small companies (in absolute terms), so the CB amount issued is therefore larger for these firms. The correlation matrix also shows that the high safety premium at the Ingersoll (1977) optimum point is translating into a high adjusted call premium when the call occurs. To deal with potential multicollinearity problems, we do not include two highly correlated variables in the same model. For each specification we report the variance inflation factor (VIF), which is less than 1.5 in the models.

Tables 10 and 11 report the results of the impact of the financial distress, financial constraint and the cash flow considerations on the CB premium and delay<sup>4</sup>. As indicated by the pseudo R-squared, the models with the call premium as dependent variable (Table 10) are better than those with the call delay as dependent variable (Table 11).

In Table 10, the Altman Z-score coefficient is statistically significant at the 10 % level but only on model 2. The issue size impacts the call premium positively (statistically significant at the 1 % level). In the models with the call delay as dependent variable, the percentage of the shares to the bondholders at the conversion (the potential dilution) is positively related to the call delay. This result is statistically significant at the 1 % level and supports the financial distress rationale as the cash necessary to redeem bondholders increases with the potential dilution. This result is similar to that of Bajo and Barbi (2012) who find a

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<sup>4</sup> In the models, we merged the two subsamples (called and not yet called CB). The premium and delay are computed for the not called subsample at the end of the May 2018.

positive relationship between the dilution and the net time value advantage<sup>5</sup>. Another argument for this result is that firms postpone the call when the dilution level is high. The Altman Z-score presents a significant coefficient in model 1 with the expected sign. As predicted, the high safety premium at the optimal call date reduces the delay since a sufficient margin at this date ensures the conversion and the company does not have to delay the call any longer. Concerning the financial constraint proxies, the KZ score is not significant in the models (neither in table 10 nor in table 11). We find a negative relationship between the dividend payment dummy variable and the call delay regardless of the dependent variable used. Taken together with the univariate outcomes, these results are consistent with the financial distress rationale indicating that the firms delay the call of their bonds to ensure that the conversion will take place when the call occurred so they are not obliged to pay back the bonds in cash.

The dividend protected and the non-dividend protected CB with the cash flow advantage dummies present a statistically significant coefficient with the expected signs in the models with the call premium as dependent variable. The results are similar in Table 11 but are non-significant. We find a positive relationship between the opportunity for the firm to benefit from the existence of the cash flow advantage and the call premium. This result shows that the call premium is greater for the non-dividend protected CB with negative yield advantage (after-tax interest rate lower than the dividend payment). We also find that the call premium is lower for the dividend protected CB compared with the non-dividend protected CB. The dividend protected dummy variable presents a negative coefficient which is statistically significant at the 5% level in the models.

The VSTOXX variable presents a statistically significant positive coefficient in the two models regardless of the dependent variable used. This result indicates that the investors sentiment (aversion to ambiguity) is a determinant of the firms' call policy. The expected level of uncertainty affects both the delay and the call premium positively.

Regarding the control variables, the results are as follows. The stock price volatility presents a statistically significant coefficient in the models with the call premium as dependent variable (Table 10). Considering that the firms delay the call of their CB, the more volatile the stock price the greater the call premium. The opposite result is obtained with the

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<sup>5</sup> Bajo and Barbi (2012) proposes as alternative for the call premium, the "Net Time Value Advantage" which determines the loss derived from a suboptimal call policy. The NTVA is the result of the trade-off between the positive and negative effects of the call decision on the value of the firm.

call delay as dependent variable (Table 11). The issuer stock price volatility has a significant negative impact on the call delay. This result can be explained by the fact that the more volatile stocks need less time for the prices to reach a suitable level to ensure the conversion. The firm size has a significant positive impact on the call premium. As this variable is highly positively correlated with the issue size (Pearson correlation coefficient of 0.82), we can explain this result by the positive relationship between the call premium and the issue size which supports the financial distress costs hypothesis. Another argument relies on the information content hypothesis. The sign of the variable indicates that small companies call back their CB sooner than larger firms. This result is surprising since large firms suffer from less information asymmetry and should call their CB as soon as possible without fear of market misinterpretation. This result differs from that of Bajo and Barbi (2012) and is inconsistent with the signaling hypothesis.

On the whole, the results in Table 10 present strong support for the cash flow advantage rationale and weak support for the other rationales.

Table 9: Descriptive Statistics

This table presents the descriptive statistics for the variables used in the Tobit regressions for the 122 CB called (1) and 37 not called CB in-the-money (2) at the end of May 2018 on the Western European market. More details on these variables are provided in the Annex 1.

Characteristics	Mean	Median	Min	Max	Std dev.
ALTMAN Z SCORE	3.87	2.98	-2.22	17.93	3.46
SH_BONDHOLDERS	0.12	0.08	0.01	0.86	0.14
ISSUE SIZE	4.96	5.21	0.61	7.88	1.56
SAFETY PREMIUM	0.64	0.33	0.00	10.53	1.20
DIV_PAYMENT	0.50	1	0	1	0.50
KZ SCORE	1.18	1.30	-8.87	3.64	1.14
DIV_PROTECTION	0.38	0	0	1	0.49
NON_DP_CF	0.06	0	0	1	0.24
VSTOXX	23.71	20.75	14.56	48.39	7.32
STOCK VOL.	0.35	0.32	0.06	1.15	0.16
FIRM SIZE	7.94	8.26	2.93	11.38	2.09

Table 10: Determinants of the CB Call Premium.

This table reports various Tobit regressions models for the determinant of the CB call premium. The dependent variable is  $\log(1 + \text{Adjusted Call Premium})$ . Independent variables are measures for financial distress costs, financial constraint and the cash advantage presented in the Annex 1. The t values in parentheses are heteroskedasticity-consistent. VIF is the variance inflation factor. \*, \*\* and \*\*\* denote respectively the significance at 10%, 5% and 1% levels.

Variables	Expected signs	Model 1	Model 2
ALTMAN Z SCORE	-	-0.001 (-0.90)	<b>-0.002</b> * <b>(-1.76)</b>
SH_BONDHOLDERS	+	0.32 (1.09)	0.18 (0.62)
ISSUE SIZE	+	-	<b>0.06</b> *** <b>(2.79)</b>
DIV_PAYMENT	-	<b>-0.17</b> ** <b>(-2.35)</b>	<b>-0.15</b> ** <b>(-2.09)</b>
KZ SCORE	+	-0.03 (-1.17)	-0.03 (-1.01)
DIV_PROTECTION	-	<b>-0.17</b> ** <b>(-2.17)</b>	<b>-0.18</b> ** <b>(-2.19)</b>
NON_DP_CF	+	<b>0.35</b> *** <b>(2.75)</b>	<b>0.33</b> *** <b>(2.61)</b>
VSTOXX	+	<b>0.01</b> ** <b>(2.15)</b>	<b>0.01</b> ** <b>(2.37)</b>
STOCK VOL.	?	<b>0.47</b> ** <b>(2.01)</b>	<b>0.42</b> * <b>(1.79)</b>
FIRM SIZE	?	<b>0.05</b> *** <b>(3.10)</b>	-
N		152	149
Pseudo R-square		21.77%	20.91%
Mean VIF		1.41	1.42

Table 11: Determinants of the CB Call Delay.

This table reports various Tobit regressions models for the determinant of the CB call delay. The dependent variable is  $\log(1 + \text{Adjusted Call Delay})$ . Independent variables are measures for financial distress costs, financial constraint and the cash advantage presented in the Annex 1. The standard errors in parentheses are heteroskedasticity-consistent. VIF is the variance inflation factor. \*, \*\* and \*\*\* denote respectively the significance at 10%, 5% and 1% levels.

Variables	Expected signs	Model 1	Model 2
ALTMAN Z SCORE	-	<b>-0.006 *</b> (-1.69)	-0.005 (-1.36)
SH_BONDHOLDERS	+	<b>3.97 ***</b> (4.74)	<b>4.03 ***</b> (4.88)
ISSUE SIZE	+	-	-0.04 (-0.68)
SAFETY PREMIUM	-	<b>-0.27 **</b> (-3.47)	<b>-0.27 ***</b> (-3.47)
DIV_PAYMENT	-	<b>-0.47 **</b> (-2.12)	<b>-0.47 **</b> (-2.23)
KZ SCORE	+	-0.09 (-1.03)	-0.09 (-1.06)
DIV_PROTECTION		-0.19 (-0.82)	-0.17 (-0.76)
NON_DP_CF	+	0.14 (0.38)	0.15 (0.42)
VSTOXX	+	<b>0.03 *</b> (1.78)	<b>0.03 *</b> (1.80)
STOCK VOL.	?	<b>-2.10 ***</b> (-3.12)	<b>-2.10 ***</b> (-3.16)
FIRM SIZE	?	-0.02 (-0.49)	-
N		152	149
Pseudo R-square		7.58%	7.62%
Mean VIF		1.42	1.42

### 3.5 Event study analysis

We test the information rationale for the CB calls by performing an event study around the announcement of the decision to call the bonds. We test firstly whether the CB calls announcement returns are negative in the Western European market as it is the case on the other markets (see for example Mikkelson, 1981; Campbell *et al.*, 1991; Ederington and Goh, 2001). Secondly, we investigate whether these announcement returns are induced by the signaling rationale.

#### 3.5.1 The announcement effect of the convertible bond calls

The methodology adopted to perform this event study is that described by Brown and Warner (1985). It is well known that the issuers stock prices increase rapidly near the call decision and drop subsequently. We therefore use the windows of [-503, -252] relative to the call date to perform the event study in order to isolate the estimation period from the rapid growth period. The parameters of the market model are estimated using an ordinary least squares regression. The market index is the DJ Stoxx 1800. Abnormal returns are determined by the following formula:

$$AR_{it} = Ro_{it} - Rm_{it}$$

Where  $AR_{it}$ ,  $Ro_{it}$  and  $Rm_{it}$  are respectively the abnormal, observed and normal returns of security  $i$  at time  $t$ .

We use the non-parametric signed-rank test of Wilcoxon to test the null hypothesis that the observed returns and the normal returns are equal.

Table 12 shows the results of the event study. Panel A shows the abnormal returns (AR) while Panel B presents the cumulative abnormal returns (CAR). At day -1, we record a significant negative AR of -0.27 % at the 5 % level. This result is consistent with the information content hypothesis. However, we find a significant positive AR at day -2. This result can be explained by the stock price run-up observed before the call (see Ekkaryokkaya and Gemmill, 2010). The results in Panel B are non-significant. These results indicate that the call of the CB convey relevant information to the market but the informational content is heterogeneous and supports only weakly the signaling theory rationale. In the next subsection, we make a further test of the signaling rationale using a multivariate analysis.

Table 12: Abnormal returns around the CB call announcement.

This table shows the means and the medians (in parentheses) of the abnormal returns around the CB calls announcement of the Western European firms. Panel A shows the abnormal returns from the day -4 to the day +4. Panel B shows the cumulative abnormal returns for various windows. Day 0 is the call announcement date. The Wilcoxon signed-rank test is used to test the null hypothesis that the observed returns equal the normal returns. \*\* and \*\*\* denote respectively the significance at 5% and 1% levels of the Wilcoxon sign rank test

Period	Abnormal Return	Wilcoxon Z stat
<i>Panel A: Abnormal returns</i>		
-4	0.15 (0.02)	0.17 (0.87)
-3	0.13 (0.15)	0.23 (0.82)
-2	<b>0.56 (0.31)</b>	<b>2.74 (0.00)***</b>
-1	<b>-0.27 (-0.15)</b>	<b>-2.24 (0.03)**</b>
0	-0.15 (-0.09)	-0.10 (0.92)
+1	0.10 (0.01)	1.04 (0.30)
+2	0.18 (0.23)	1.25 (0.21)
+3	0.02 (0.07)	0.92 (0.36)
+4	-0.26 (0.07)	-0.05 (0.96)
<i>Panel B: Cumulative Abnormal Returns</i>		
[-1 ; 0]	-0.42 (-0.19)	1.14 (0.25)
[0 ; 1]	-0.06 (0.34)	0.89 (0.37)
[-1 ; 1]	-0.34 (0.22)	-0.02 (0.98)
[-4 ; 0]	0.42 (0.01)	0.57 (0.57)
[0 ; 4]	-0.13 (0.34)	1.04 (0.30)
[-4 ; 4]	0.47 (0.21)	0.75 (0.45)

### 3.5.2 The determinants of the convertible bonds call announcement returns

We previously found that the market reaction around the CB calls are mixed. We use multiple linear regression models to further investigate the empirical consequences of the signaling hypothesis. The dependent variable is the CAR over day -1 from the call date. We retain as the independent variable, various proxies for the call policies. We predict according to the signaling hypothesis that the market reaction will be less negative when the call delay is long. The same prediction holds for the call premium since these variables move in the same direction. The signaling rationale is also tested using the cash advantage dummy. Following Grundy and Verwijmeren (2016), we predict that the call of the CB when there is a cash flow advantage for the firm not to call the bonds is perceived by the investors as a future decrease of the dividends. We then predict a negative relationship between the cash flow advantage dummy and the market reaction. We test whether the abnormal returns are caused by possible price pressure from the increase in the supply shares in the market. If this is the case, we would expect that the dilution caused by the conversion will have a negative impact on the stock price around the CB call. The reason is that the number of shares to sell in anticipation of the conversion will increase with the number of shares into which the CB will be converted. The firm size is added to our model as liquidity proxy. For large firms, shares are easily tradable at lower cost and in this case the downward pressure will be lower. We then predict a positive relationship between firm size and the market reaction around the CB calls. The stock price volatility is added to the regression model as control variable.

Table 13 reports the results of the models. The call of the bonds when there is a cash flow advantage for the firm is negatively perceived by the market. This result is consistent with Harris and Raviv's (1985) signaling rationale. The stock price volatility variable presents a negative statistically significant coefficient at the 5 % level which indicates that the market reaction is more negative for the high volatility stocks. Overall, the results of the event study and analysis of the determinant of the market reaction to the CB call announcement do not support the signaling hypothesis. We subsequently analyze the post-call performance of the firms to determine whether European companies delay the call of their CB to signal good prospects.

Table 13: Determinants of the market reaction to the CB call announcements.

This table reports multiple linear regression models for the determinants of the CB call abnormal returns. The dependent variable is the cumulative abnormal returns (CAR) from day -1 to the call announcement date day 0. Independent variables are the call premium (PREMIUM), the number of shares into which the CB will be converted divided by the number of shares after the conversion (DILUTION), the natural logarithm of the firms' total assets (FIRM SIZE) and the Tobin's q (TOBIN Q) measured at the fiscal year ending before the CB calls. In the pre-call model, the dependent variable is the AAR computed using the pre-call estimation period while in the post-call model the dependent variable is computed using the post-call estimation period. VIF is the variance inflation factor. \*, \*\* and \*\*\* denote the significance at respectively 10%, 5% and 1% levels.

Variables	Expected signs	Coefficients
Intercept		2.46 (1.21)
PREMIUM	+	0.07 (0.45)
DELAY	+	-0.001 (-1.62)
DILUTION		0.35 (0.12)
FIRM SIZE	+	-0.09 (-0.47)
CF ADVANTAGE	-	- 2.80 *** (-2.69)
STOCK VOL.		-4.55 * (-1.91)
Adjusted R-squared		9.35%
VIF		1.10

### 3.5.3 The post-call performance of the convertible bonds calling firms

Harris and Raviv's (1985) signaling hypothesis supports the fact that the calling firms' managers do not believe that the stock price will increase to ensure the conversion upon maturity of their CB. Since the stock prices increase with the positive information about the firm's prospects and the operating performance we can test the information content of the CB calls by tracking the post-call operating performance of the calling firms. Few empirical tests of this aspect of the signaling rationale have been performed. We may mention for example, Harris and Raviv (1985) and Ofer and Natarajan (1987) who find a strong decrease of some

operating performance indicators of the calling firms immediately after the calls and for the next five years.

Like Ofer and Natarajan (1987) we use the earnings before interest and taxes (EBIT) and add two other performance measures such as the operating margin ratio (OMR) and the price earnings ratio (PER). We scale the EBIT and the OMR by the total asset of year -1. Unlike Ofer and Natarajan (1987), we compare the calling firms post-call performance with that of control firms obtained from following matching procedure: (1) firms in DJ Stoxx 1800 market index except the calling firm, (2) firms operating in the same 4-digits industry (S&P GICS classification) and (3) firms with total assets within a range of 90-110 %. We find control firms for 103 observations with a maximum for paired firms of 28 and minimum of 1. Two companies have 1 matching firm and 4 companies have 2 matching firms. The procedure fails for 19 firms. Table 14 reports the operating performance of the calling firms and their counterparts the year of the call through the subsequent three years. Panel A shows the level of these performance measures and Panel B exhibits the change for these measures from the year of the call to the three next years. The changes are computed on the basis of the level of the year of the call. The Wilcoxon signed rank test is used to test whether the operating margin ratio, the price earnings ratio and the relative size of the earnings before interest and taxes of the calling firms are different from those of the non-calling firms.

In Table 14, shows that the operating margin of the calling firms decreases while that of their industry increases over the three years following the CB call. The difference in operating margin of the two groups is statistically significant. This result is consistent with the signaling hypothesis. However, there is no difference between the PER of the calling firms and their industry except at the year of the call. Concerning the EBIT, we also record a decrease for the calling firms over the years following the call, but this is also the case for their respective industries. Concerning the changes in performance measures, we do not find any difference between the calling firms and their industries except for the EBIT. More precisely, we find a positive variation of 6.43 % found at year + 3 for the calling firms against a negative variation of (-19.47 %) for the matching group. This result contradicts the signaling rationale for the CB call delay. Hence, we conclude that the post-call performance of the calling firms is not related to the private information held by managers as predicted by the signaling hypothesis of Harris and Raviv (1985).

Overall, we find very little support for the signaling hypothesis. First, we find significant positive abnormal returns at day -2 and at day -1 a rather negative abnormal excess

return (Table 12). Second, we find in our cross-section that the cash flow advantage for the firm is negatively perceived by the market (Table 13), which is in line with Harris and Raviv's (1985) signaling hypothesis. Third, of the three variables considered in the multivariate analysis, only one presents a trend in line with a decrease in operating performance after the call (Table 14).

Table 14: Post-call operating performance of the calling firms and their matching group.

This table shows the means and medians (in parentheses) of some post-call operating performance indicators for the CB calling firms and their control groups. Operating performance indicators are operating margin ratio (OM), price earnings ratio (PER) and earnings before interest and taxes (EBIT). Calling firms are companies that called their CB in-the-money before their maturity. Matching firms are control groups obtained by the following matching procedure: (1) firms in DJ Stoxx 1800 market index except the calling firm, (2) firms operating in the same 4-digits industry (S&P GICS classification) and (3) firms with total assets within a range of 90-110%. The Wilcoxon signed-rank test is used to assess eventual difference between the post-call performance of the calling firms and their control groups. \*, \*\* and \*\*\* denote the significance at respectively 10%, 5% and 1% levels.

Periods	OM			PER			EBIT		
	Calling Firms	Matching Firms	N	Calling Firms	Matching Firms	N	Calling Firms	Matching Firms	N
Panel A: Operating performance									
0	<b>0.38 (0.08) **</b>	0.64 (0.15)	103	<b>21.17 (16.54) ***</b>	25.57 (23.39)	103	<b>7.44 (6.65) **</b>	9.39 (8.60)	103
1	<b>0.36 (0.07) *</b>	0.87 (0.11)	103	24.30 (16.91)	22.46 (19.48)	98	7.08 (6.11)	8.71 (8.30)	99
2	<b>0.34 (0.08) **</b>	1.19 (0.15)	101	18.84 (15.07)	22.53 (19.74)	98	<b>6.37 (6.52) **</b>	8.81 (7.83)	97
3	<b>0.29 (0.07) ***</b>	2.22 (0.27)	101	24.04 (16.61)	19.90 (19.52)	100	<b>6.64 (6.73) *</b>	9.15 (8.34)	98
Panel B: Changes in operating performance									
1	-4.34 (-5.83)	-10.21 (-6.98)	103	-0.54 (-4.69)	-1.45 (-11.66)	98	2.39 (-6.27)	-5.05 (-2.05)	99
2	-11.13 (-13.51)	-9.10 (-7.92)	101	-3.04 (-5.97)	-9.90 (-9.32)	95	1.76 (-4.38)	-1.37 (1.15)	94
3	-12.27 (-17.51)	-12.28 (-20.14)	101	<b>6.43 (9.17) **</b>	-19.47 (-20.47)	98	-5.52 (-5.64)	2.76 (-1.52)	94

## 4 Conclusion

In this study we analyze the call policy of Western European companies from January 1992 to May 2018. We find that firms delay the CB call for 46 days and that the call occurs when the call premium is around 19 %. We also analyze the “unachieved” call policy of the firms with callable CB with conversion option in the money, but that have not been called. For these bonds, the delay is 155 days for a median premium of 15 %. Unlike previous researches in the same area, our research considers all the main theoretical rationales for the CB call delays (existence of the notice period and the call protection provisions, the cash flow advantage hypothesis, the financial distress and the signaling theories). Firstly, considering the call protection provision in determining the delay length we still conclude that CB are called late. Using Butler’s (2002) model, we find that the existence of the notice period does not explain the call delay perfectly. We find that the unusually long notice period of 45 days would only result in delay of 3 days and a call premium of 5 % while the firms in our sample call their CB after a delay of 46 days with a call premium of 19 %. This result confirms that of Ekkaryokkaya and Gemmill (2010) on the US market. Secondly, our results concerning the cash flow advantage rationale are consistent with the hypothesis that firms delay the call of their CB to take advantage of the negative yield advantage on the CB relative to the dividend payments. We find little support for this hypothesis in the univariate analysis and strong support in a cross-sectional regression. Thirdly, we also find evidence in line with the financial distress costs hypothesis. Indeed, at the call date the probability of non-conversion is null for an overwhelming majority of the firms in our sample. Overall, the distress cost variables present a significant coefficient in line with the financial distress hypothesis. Finally, for the information content hypothesis the results are mixed. In our regression models, the firms suffering from lack of information to the market (in other words the small companies) do not delay the call longer than the large companies; we observe the opposite in fact. We find a small stock price decline one day before the CB call announcement but this decline follows a positive market reaction recorded at day -2. In line with the information content hypothesis, we show that the call of the CB when there is a cash flow advantage for the firm is negatively perceived by the market. This result is not confirmed in the post-call operating performance analysis. Overall, we conclude that the observed CB call delay in the Western European markets can be explained only marginally by Harris and Raviv’s (1985) signaling hypothesis. An interesting result not covered by the existing literature is the finding relative to the investors sentiment as the determinant of the firms' call policy. We find that the level of perceived uncertainty on the markets measured by the 12 months implied volatility

based on EURO STOXX 50 index options has a positive impact on both the delay and the call premium.

This research contributes to the existing literature on the CB call policy by providing empirical evidence of the determinants of the CB call delay on the Western European market. We provide evidence that Western European firms delay the call of their CB due to the financial distress costs in the event that the bonds will be out-of-the-money at the end of the notice period and investors choose cash redemption rather than conversion. The reason is that at the Butler's (2002) optimum the probability of non-conversion is still high. For example, we find that the non-conversion probability at the end of the notice period for Butler's (2002) model is 27 % for the CB without soft call provision, which remains very high for financially constrained firms.

## Appendix 1: Details on the calculation of the variables

This table presents the variables used in various models and their calculations. All the variables are measured at the fiscal year ending immediately before the CB calls unless otherwise stated.

Variables	Calculations
STOCK VOL	Monthly Stock price returns' volatility over -312 to -60 relative to the date the CB could be first forced
VSTOXX	12 months implied volatility based on EURO STOXX 50 index options at the date when the conversion could first be forced. Historical data available on STOXX website.
FIRM SIZE	Log of Total Assets
ISSUE SIZE	Log of Amount issued
ALTMAN Z SCORE	$1.2 \times \frac{wc}{ta} + 1.4 \times \frac{re}{ta} + 3.3 \times \frac{ebit}{ta} + 0.5 \times \frac{mc}{tl} + \frac{s}{ta}$ <p>wc: working capital, re: retained earnings, ebit: earnings before interest and tax, mc: market capitalization, s: sales, ta: total assets, tl: total liabilities</p>
DIV_PAYMENT	Dummy variable taking the value of 1 if the firm pays dividend the year preceding the date when the conversion could first be forced
DIV_PROTECTION	Dummy variable taking the value of 1 if the CB is dividend protected and 0 otherwise
NON_DP_CF	Dummy variable taking the value of 1 for Non-Dividend protected CB with cash flow advantage
SAFETY PREMIUM	The conversion value divided by the call price, minus one (computed at the date when the conversion could first be forced)
SH_BONDHOLDERS	$\frac{n}{N+n}$ (n the number of shares into which the CB will be converted and N the outstanding number of shares)
KZ SCORE	$-1.001909 \times \frac{(ib + dp)}{\text{lagged ppent}} + 0.2826389 \times \frac{(at + mve - ceq - txdb)}{at}$ $+ 3.139193 \times \frac{(dltt + dlc)}{(dltt + dlc + seq)} - 39.3678 \times \frac{(dvc + dvp)}{\text{lagged ppent}} - 1.314759 \times \frac{che}{\text{lagged ppent}}$ <p>ib: income before extraordinary items, dp: depreciation and amortization, ppent: property, plant and equipment, at: total asset, mve: market value of equity, ceq: common equity, txdb: deferred taxes, dltt: long term debt, dlc: debt in current liabilities, seq: shareholders' equity, dvc: common dividend, dvp: preferred dividend, che: cash and short-term investment</p>
OM	Operating earnings / Total Assets
PER	Stock price / Earnings per share
EBIT	Earnings before interest and taxes/Total Assets

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## Appendix 2: Correlation matrix

	PREMIUM	DELAY	ALTMAN Z SCORE	SH_BOND. HOLDERS	ISSUE SIZE	SAFETY	DIV_ PAYMENT	KZ SCORE	DIV_ PROTECTION	NON_ DIV_CF	VSTOXX	STOCK VOL.	FIRMS SIZE
PREMIUM	1.0000												
DELAY	0.0580	1.0000											
ALTMAN Z SCORE	-0.0337	-0.0145	1.0000										
SH_BOND. HOLDERS	0.1112	0.2717*	0.2450*	1.0000									
ISSUE SIZE	0.0831	-0.1023	0.3300*	-0.0729	1.0000								
SAFETY	0.7036*	-0.1994*	-0.0403	0.0027	0.1025	1.0000							
DIV_ PAYMENT	-0.2644*	-0.1685*	-0.1480*	-0.2152*	0.0649	-0.1531*	1.0000						
KZ SCORE	0.0704	0.0049	-0.1074	0.0502	0.1022	0.0378	-0.3444*	1.0000					
DIV_ PROTECTION	-0.2252*	-0.1011	0.1303	0.0194	0.1603*	-0.1129	0.1734*	-0.1329*	1.0000				
NON_ DIV_CF	0.1770*	-0.0722	-0.0349	-0.1643*	0.1824*	-0.0657	0.2488*	-0.0688	-0.2818*	1.0000			
VSTOXX	0.3058*	0.0562	-0.0520	-0.1738*	0.0510	0.2407*	-0.1451*	0.1669*	-0.3839*	-0.0960	1.0000		
STOCK VOL.	0.1661*	-0.0289	0.0792	0.5033*	-0.1706*	0.0392	-0.1935*	0.1408*	-0.1464*	0.0458	-0.0156	1.0000	
FIRMS SIZE	0.0862	-0.1388*	-0.0643	-0.3712*	0.8195*	0.1344*	0.2075*	-0.0485	0.0622	0.2523*	0.1590*	-0.3383*	1.0000

PREMIUM and DELAY variables are the log transformation of the initial variables. The Pearson correlation coefficient between the initial variables is 0.27

\* denotes significance at least at 10%

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Highlights

- Convertible bonds issued in the Western European markets are called late
- The delay depends on the characteristics of the bond (call or dividend protection)
- And on the fear of having to make a cash payment at the end of the notice period
- This fear depends on the expected uncertainty during the notice period
- The firm prefers not to call when interest are lowers than dividends.

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