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CONVERTIBLE BONDS: A LITERATURE REVIEW AND SOME MARKET EVIDENCE

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CONVERTIBLE BONDS: A LITERATURE REVIEW AND SOME MARKET EVIDENCE

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Abstract

The goal of this paper is to identify the determinants in the issuing decision of the convertibles and stock price fluctuation two days after an announcement. To do so, we review different papers to understand why we use convertibles and then apply the same methodology as Lewis (2003) used earlier. We apply this methodology to three different sectors, with larger samples than the ones used by Lewis. Furthermore, the selected period of our samples goes from 2001 to 2015 where in the previous study, the period was from 1979 to 1992. Our results show us that the economic environment has an important influence on the investor's behaviors and therefore, on the determinants of the convertible bonds.

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Convertible Bonds

I. Introduction

The first thing that comes to mind when we talk about convertible bonds is: what is their purpose? Why do we need them? Are they more attractive than other common bonds? Through this work, I will show the differences between common bonds and convertible bonds, what the specifics features of these bonds are, as well as what kind of decisions a company faces when it is trying to raise funds. What kind of companies use convertible bonds?

As we can see, a lot of questions can be asked and we will try to answer them on the base of financial theories. In order to make a in-depth analysis, we will focus on three types of variables that will appear in every chapter of this paper. Those three types of variables are the "investment opportunities", the "financing constraints" (equity related costs and internal funds available) and the "debt capacity" (debt related costs).

- We will go through the pecking order theory which is currently the most accepted theory that can explain the financing decisions of a company.
- Afterwards, we will identify all the determinants and issues solve by the convertibles. We will try to understand why companies would use convertible bonds to finance their investments.
- Then, we will analyze which type of variables are significant in the decision process for issuing convertibles and in the two days return after the issuance.
- Finally, we will try to reproduce the model analyzed in the empirical literature review to identify which type of variables are significant today in the issuing decision process and two days return

II. Theoretical content

2.1 Capital structure of Finance

Before trying to explain the pecking order theory, it could be interesting to explain the capital structure of finance discovered by Modigliani & Miller (1958). The underlying idea of M&M is saying that there is no differences between financing its operation with debt or equity. The WACC remains the same because the cost of debt and equity does not change. As a consequence, the price of the stock is not correlated with the financial structure of a company. The value of two firms, one with leveraged and the other without it, should be the same if they had the same expected cash flow.

With the introduction of taxes and bankruptcy costs, M&M proved that the theory was no longer valid. Now that interests paid on debt are deductible, the capital structure theory has an influence on the firm`s value. By financing a company with debts (issuing bonds), we can reduce the company's tax liability. The firm with the higher proportion of debt is worth more due to the interest tax shield. If the company has a high level of debts, its WACC will be smaller than the one for an unlevered company. With this new theory, there is a relation between the financial structure of a company and the price of the stock.

There is a drawback that must be taken into account in the M&M theory, if we assume that the introduction of tax deductibility reduces the average cost of financing. Indeed, every company should maximize its debt and have 100% of debt financing. There is a negative effect by having too much debt, that is an apparition of costs of bankruptcy, that raises more and more as we increase the ratio of the debts. We demonstrated that by showing that increasing the debt is riskier for the debtholder and stakeholder as well. Consequently, the required rate of return starts to increase when a company has a high ratio of debt. Through those observations, Myers (1984) introduced a new concept in which he suggested a new theory called "the trade-off theory".

2.2 The static trade-off theory

In this theory, a firm has to choose a target debt to value ratio and has to move slowly toward this ratio. The target ratio will be set by off-setting the debt tax shields and the cost of bankruptcy. Based on this theory, all companies from the same industrial sector should have the same optimum ratio. Actually, we notice that firms in the same sector have sometimes important differences between their debt to value ratio. In his theory, Myers (1984) says that there is a cost of adjustment that could explain why there are still differences between firms within the same sector. They cannot immediately adjust when information or events occur. Therefore when the cost of adjustment estimated is too high, the firm will not try to reach the optimum and will remain at the same debt ratio. Related to those information, he identified two different statements that influenced the cost of bankruptcy or financial distress cost :

1) Firms with higher risk tend to borrow less. Therefore, in this case, the word "risk" would mean a high variance rate for the market value of firm's assets. The riskier a company is, the higher will be the variance rate and the more difficult it will be for the firm to borrow a high amount of debt. The cost of debt will be very high and the optimum debt ratio will be low, then the interest tax shield will be fast offset by the financial distress costs for risky companies.

2) "The expected cost of financial distress does not only depend on the probability of trouble, but on the value lost if a trouble comes. Specialized intangible assets or growth opportunities are more likely to lose value in financial distress."(Myers 1984).

This trade-off theory is a competitor with the pecking order theory (Donaldson,1961), the last suggests that there is an order that must be followed when a decision is taken to raise funds. On the other hand, the trade-off theory suggests that the decision of using debt or equity for financing projects depends on the balance between tax shield earnings and financial distress costs[1].

[1] https://en.wikipedia.org/wiki/Trade-off_theory_of_capital_structure

Myers identified one of the major drawbacks of the trade-off theory which is related to the timing of issuing equity. There is a general idea that we should issue equity when the price of shares is high (overvalued), it would be more interesting to do it this way instead of issuing debts. We could earn more for a smaller price with equity rather than debt. On the other hand, if the stock price is low (undervalued), managers will issue debt to maximize the value of the issuing.
The problem is that when the value of the shares rises, the debt to value ratio plummets, and as a consequence, managers should issue debt instead of equity. From a financial point of view, managers are moving away from the ideal equilibrium point between debt and equity. The static trade-off theory is not followed in this case.

The static trade-off theory is interesting but does not match with the reality all the time. Indeed, we can see across the market companies within the same sector having wide differences between their debt to value ratios and level of debt. Sometimes, they are far away from the equilibrium debt to value point. Myers says that the trade-off theory does not take into account some information and adjustment costs. It will not be easy to adapt this model to these constraints. This is where the pecking order theory makes an entrance.

2.3 The pecking order theory

This theory was first suggested by Donaldson (1961) and Myers (1977) who were looking for a theory to contrast the trade-off theory (Kraus & all, 1973). Now let us try to come up with a homemade definition of the pecking order theory: “When a firm is following a pecking order theory, it prefers internal financing to external financing, and if external financing is needed, it will prefer debt over equity.”

Myers (1984) identified two main characteristics that we should mention before going further, the first one is:” *A company adjusts the target dividend payout ratio based on their investment opportunities*.” The second one is: “*There is always uncertainty about fluctuation of the profitability and the growth opportunities, therefore, sometimes the internal produced cash may not be sufficient. That is, the firm may need to review their payout ratio or be ready to use external financing resources*.”

In this second case, when the company will need external financing resources, it will first try to issue classic debt and then it will issue the safest security as possible. If this type of security cannot be issued, the company will start to issue hybrid securities such as convertible bonds and finally equity if nothing else mentioned before has been possible. This kind of decision might be taken in case of lack of cash to pay out the dividends. Instead of reducing the dividend payout ratio, which is often considered as a reduction of growth of the firm and of the firm's value, the company will try to sustain the dividend payout firstly by issuing debt, and then, if necessary, by issuing equity.

There is a real limitation in this model we should talk about. Indeed, when a firm issues equity, if we follow the strict definition of the pecking order theory, it means that there are no possibilities to use internal financing or debt. Equity should never be used if we have the capacity to issue debt.

In fact, we see a lot of companies issuing equity before debt, even if they have the possibility to issue it. This means that the strict interpretation of the pecking order is refutable and not always right in reality. This leads us to a new concept found by Murray (2005) which introduced the term "debt capacity". This notion limits the use of the debt in firms. Even if they can raise more debt, the debt capacity limits the amount of it to avoid financial distress cost which happens when a company has a huge debt to value ratio or to avoid that the cost of capital increases too much.

Myers shows a real preference for the pecking order theory based on different observations. The theory shows that firms prefer not to issue equity over debt because they want to avoid "*falling into the dilemma of either passing by positive-NPV projects or issuing stock at a price they think too low*" (Myers, 1984). Based on the pecking order theory, firms should try to issue debt to finance normal investments, they are then restraining themselves in order to maintain the debt as safe as possible. By doing this, companies are limiting the risk of their debt at the default risk free level. Therefore, firms avoid financial distress costs and have more flexibility to raise debt if an unforeseen event occurs. In the case of the static trade off-theory, firms do not have a sufficient leeway to react as fast as a firm that follows the pecking order theory. Furthermore, the average debt to value ratio in an industrial sector should not be considered as a target.

The next important concept we have to mention here is the consequence of adverse selection problems (Brennan and Schwartz, 1988) that generally occurs with an equity issuance. When a firm decides to issue equity, and we know that equity issuance is usually realized when the market overvalues the firm, the consensus on the firm's value after the announcement is lower than before. By first trying to finance investments with internal cash, which is not really information-sensitive, as suggested by the pecking order, we can solve different adverse selection problems. If internal cash flows are not available, the firm will finance its investments by issuing debt which is more information-sensitive than internal financing, but less than equity. As a last resort before issuing equity, hybrid-securities will be used if no other less information-sensitive financing tool is available. We understand here that the pecking order theory is offering a solution to the adverse selection problem that can occur with different types of financing, by first promoting the financing that is less information-sensitive and demanding (Autore & Kovacs, 2004).

We can conclude here that the pecking order is a useful strategy to control the costs of debt in a firm (debt capacity), to limit the dilution among shareholders, to avoid issuing shares at discounts (financial constraints), to give some leeway to react to any investment opportunity and to reduce adverse selection costs (financial constraints).

III. Why do we use convertibles?

3.1 What kind of problems do convertibles solve?

Until now, We do not really know why convertibles notes are used for. What we know is that convertibles allow a firm to finance itself in a cheaper way. By issuing convertibles, firms will have to pay a lower coupon than in the case of straight debt and it will be cheaper than an equity issuance because the conversion price is often highly above the stock price at the issuance date (Dutordoir & al, 2014).

Convertibles are well-known for the following reasons:

Firstly, convertibles are seen as a great financing tool to avoid the risk-shifting problems (cfr 3.2.3) by giving the opportunity to the convertibles holders to take advantage of the potential risky strategy of the shareholders (Green,1984).

Secondly, convertibles are also useful to reduce the overinvestment problems (cfr.3.2.6) by implementing a sequential financing model. This model suggests that convertibles are more adequate than long term straight debt for financing project opportunities because they can avoid the overinvestment problems by redeeming the bonds and giving the cash back to the bondholders if the projects turn out to be not profitable (Mayers,1998). If the project seems profitable, the sequential financing will allow the bondholders to convert their debt into equity.

Thirdly, convertible bonds solve the underinvestment problem spotted by Myers (1977). They allow the firm to finance itself even if it is facing a debt-overhang problem by transferring wealth from convertible debtholders to shareholders (cfr 3.2.4). Convertibles can be seen as a very useful tool to reduce agency costs of debt (Lyandres and al, 2014).

Another problem solved by convertible bonds are the adverse selection costs problems (cfr.3.2.5). If the market and managers do not agree on the risks of the firm, they will not agree on what interest rate they have to set. By issuing convertibles, the credit features will be undervalued where the option will be overvalued and the security should be fairly priced (Brennan and Schwartz, 1988).

Finally, convertibles are also a great tool to reduce asymmetric-information costs (cfr 3.2.1) that appears when managers and shareholders do not have the same information. By being a hybrid instrument, convertibles can reduce the negative signal effect that appear in the case of an equity issuance (Stein, 1992).

Ultimately, convertibles can be used to reduce the negative price effect of an announcement and increase the selling prices of the bonds if they are followed by a stock repurchase (cfr 4.6). It allows the firm to have a lower offering discount (de Jong & al, 2011).

3.2 Determinants of convertible bonds and characteristics

3.2.1 The asymmetric-information problem

Stein (1992) found out that firms with asymmetric information problems are willing to issue convertibles rather than straight debt. Issuing straight debt, while the company has already a high amount of debt and of interest to pay, would not make sense. An equity issue could be the only other option available to raise funds. The problem here is that with asymmetric-information problems, an equity issue would be very costly. This is explained by the fact that investors do not have the same information than managers. If the managers decide to issue equity, investors will think that shares are overpriced and therefore, they will ask a bigger amount of shares for a given price.

The new theory presented by Edmans (2014) suggested that because shareholders have private information, using it to trade makes the stock price reflecting more the value of the firm. If the managers do not want to act in the same way as the shareholders, the latter will use the threat of "Exit" to reduce this asymmetric information and force managers to follow the shareholders wishes.

Firms with significant financial distress costs and asymmetric information problems tend to offer more convertibles than other companies. Indeed, a convertible issuance has a small equity component which is seen as a secondary equity offering, convertibles are less likely to be seen as a signal of company overvaluation. By doing that, they will minimize the total financing costs and asymmetric-information costs. Furthermore, the results of Lemmon & Zender (2012) confirm that in case of asymmetric-information problem, a firm will follow the pecking order preference in order to reduce the information costs. Therefore, convertibles are a less costly option to raise funds compared to equity.

The use of convertibles reduces the total financing costs and the adverse selection costs (Asymmetric-information costs).

3.2.2 Warrants associated with convertible bonds and overinvestment problems

The overinvestment problem consists of an opportunistic behaviour that can lead to a decrease of the total firm's value. Beside the goal of maximizing the share value, shareholders may see the firm as a source of profit and use it to increase their own capital (Cariola & La Rocca, 2005).

According to Green (1984) "*The firm overinvests in the risky project relative to the less risky project*". As long as a firm issues risky debt, there will be a risk incentive problem. Equity holders are residual claimers, that is, they will only get something if the payoff is in the upper tail. They will have a great incentive to go for a risky project if this project is increasing the payoff of the upper tail. To solve this problem, convertibles give the opportunity with the conversion option and warrants issued with debt, to change the shape of the residual claim by sharing the distribution of returns with the warrant holders (Jensen and Meckling, 1976), and therefore, level down the incentive to go risky. Furthermore, the debt component of the convertibles will promote control and discipline to the managers and shareholders, since they first need to payback all interest and loan capital (Cariola & La Rocca, 2005).

In this case, convertibles put some financial constraints on the managers to prevent them from investing into investment opportunities that are too risky and if they do so, they will have to share the proceeds of this investment.

3.2.3 Agency costs and risk-shifting problem

Jensen & Meckling (1976) found in their analysis that the managers incentive to use the resources of the company for their own benefits is more important for firms that finance themselves through equity.

One of the most well-known problems with debt financing is risk shifting (Green 1984). When a company is highly levered and finds an investment opportunity with very high payoffs but a very low probability of success, the owner-manager interest differs from the one of the creditors. The owner-manager will go for the project for sure, because even if it does not succeed, the loss will

be supported by, in a large part the creditors. In that case, the funds brought by the owner are not sufficient, and a large part of the financing of the project comes from the creditor`s pockets.

Convertible bonds give the opportunity to mitigate distortionary incentives, they are very good instruments to take advantages of the reallocation of the wealth from creditors to stock holders. By using those bonds, debt holders may choose to convert into equity if the transfer of wealth occurs and thus, take advantage of the risky strategy of the owner-manager. On the other hand, using equity finance gives managerial discretion to the managers where they can follow their own goals, for example excessive risk taking or excessive firm growth. Convertibles create few managerial discretion (Isagawa, 2000) compared to an equity issue.

Using convertibles protects the bondholder from the shifting of distribution of revenues and at the same time reduces the effect of agency costs from a manager's point of view (Jensen and Meckling, 1976). We can see convertibles as a tool that allows highly levered firms to take advantage of different investment opportunities by sharing revenues and risks.

3.2.4 Debt-overhang problem or underinvestment problem (risk avoidance)

The underinvestment problem, discovered by Myers (1977), is the consequence of the debt overhang problem that a company may have to face when it has too much leverage. When the firm has too much debt to handle, shareholders will not have any incentive to invest in projects where all the profits will directly go into the bondholder`s pocket. Another way for providing funds could be the issuance of new equity rather than debt but a new conflict of interest would rise between senior and new shareholders. Therefore, the latter will ask a high premium in order to protect themselves. The new funds will be raised by issuing equity at a lower price than the market one (Cariola & La Rocca, 2005).

According to Brito and John (2002), firms that are facing underinvestment problems are companies that have good economic prospects and future growth opportunities. They want to avoid the loss of control to the debt holders. Indeed, by setting a limit to the amount of debt, they

will be able in the future to take advantage of the growth opportunities that they would not have taken otherwise if they had already invested too much.

We understand here that underinvestment can be caused by two different types of behaviours. The first one is the excess leverage of the company whereas the second is the fear of not being able to take advantage of future growth opportunities.

Using convertibles in this case is really interesting because even if there is a debt feature that will reinforce underinvestment, such as in the case of straight debt, the conversion options will push shareholders to speed up their investment (Lyandres and al, 2014). The later has a stronger effect than the former thanks to the probability of reaching the conversion threshold before reaching the default threshold. Shareholders will accelerate their investment because, "*by investing earlier, when the value of equity is lower, equity holders are able to dilute the value accruing to holders of convertible debt once they convert their claims into equity, and, thus reduce the value of their option to convert their debt into equity*" (Lyandres and al, 2014).

Like this, old shareholders are reducing the value of the convertibles and increase the transfer of wealth from convertible debtholders to shareholders. By selecting the appropriate level of convertible debt and straight debt, the two opposite effects (underinvestment and accelerated investment incentives) can completely offset each other.

3.2.5 Adverse selection costs problem

Brennan and Schwartz (1988) explained in their paper that convertible bonds are often issued by companies that are seen as risky by the investors. Those firms usually have high risk, unpredictable investment policies and difficulties to evaluate all of the risks. Usually, managers and market investors disagree on the firm's risks. As a consequence, market investors will perceive a higher level of risk and the firm will have to pay higher interest rates on the debt. These problems may be partially solved by using convertibles. The higher perceived risk will result into a higher value of the conversion option. The debt part will be undervalued where the

conversion option is overvalued and results in a fair price. This will reduce the disagreement between managers and bondholders regarding the risk of a firm's activities

3.2.6 Issuing-costs reduction of convertibles and sequential financing

Mayers (1998) suggests that issuing convertible bonds is a good way to save money on issue costs. Issuing costs have variable and fixed components and as a consequence economies of scale can be realized on the fixed components of those costs. The convertibles leave the money in the company and will reduce the leverage when the option has a high value. If the option has no value, the money will go back to the bondholder at the time of the redemption.

3.2.6.1 Sequential financing with convertibles and overinvestment problems:

To explain the utility of a convertible bond in a sequential financing model, Mayers (1998) shows us different ways of financing on a two periods world. The first way would be done by issuing a two periods straight debt. The key idea behind this is that the money invested in the first period investment will generate enough profit to cover the cost of the second period issue and the remaining money will be used to finance the second period investment. The manager does not know what will be the value of the project in the second period, he only knows the value for one period. There is uncertainty about the project's value and managers have the money available from the first period project, so they will face what is called the overinvestment problem. On one hand, managers have an incentive to spend the money they have into the project, even if it turns out to be unprofitable. On the other hand, if the manager decides to issue straight debt for one period, and then after this period, returning on the market to issue new debt, he will have to pay twice the issuing costs but avoids the so called overinvestment problem.

Convertibles prevent this overinvestment problem by returning the money to the bondholder through redemption at the end of year one if there are no investment opportunities with a positive NPV. If not, he will convert into equity and the money remains inside the company. By using those convertibles, we can avoid the double issuing costs and also the overinvestment problem.

3.2.7 Dividend, variance and conversion rate effects on convertibles

These other determinants are influencing the valuation and the price of the convertibles but do not solve any specific issues. More information available in the appendix 2.

3.2.8 Mismatch between maturities of convertibles

Another problem that can rise when we are using convertible bonds is the mismatch between maturities. We have two different scenarios here. The first would be the one where the maturity of the convertible bond comes before the end (and the outcomes) of the first period project. In this case, convertible bonds are not very useful, and you will have to do a second issuing of debt to finance the second period projects. We are not avoiding the double issuing costs. Now, if the maturity of the bond comes after the first period project, a new feature comes up: the call provision.

This call provision will give the opportunity to the company to force the conversion if the option is in the money, and therefore, avoiding a second issuing cost as previously. Furthermore, (Asquith and Mullins Jr 1991) have demonstrated that firms usually use the call option when the value of the conversion is higher or equal to the call price. According to Brennan and Schwartz (1977), "*the best conversion strategy an investor has is the one that maximizes the value of the convertibles at each point in time.* ". On the other hand, "*the best call strategy to apply for a firm is the one that minimizes the value of the convertibles at any time*"(Brennan and Schwartz 1977). This idea of the firm for minimizing the convertible bonds values has a consequence of maximizing the value of the firm's equity.

Companies which have a positive credit rating change usually shorten the life of the convertible by calling it.

We created the following table to sum up the information collected until now : *Why do we use convertibles ?*

Has an effect on / Theory or tool	Investments opportunities	Financial constraints	Debt capacity	Other effects
Pecking order theory	-Gives some leeway to take advantage of opportunities	- Avoids dilution -Maximizes the capital structure	-Controls the costs of debt by promoting internal financing	-Reduces adverse selection costs
Warrants associated to convertible bonds	-Convertibles level down the incentive to go on risky projects -Change the shape of the payoff for the residual claimers : Debt and Equity holders share the risks			
Issues solved by convertibles	Investments opportunities	Financial constraints	Debt capacity	Other effects
Firms with unpredictable investment policies and difficulties to evaluate risks	-May have to pass by opportunities due to the difficulty to evaluate the risk	-An equity issue is too costly and has a negative signal effect -With the convertibles, the equity component does not have a negative signal effect and is cheaper than an equity issue. - Conversion option is overvalued	-Convertibles are less costly in terms of interest to pay than debt. -Debt component of the convertible bonds is undervalued	- Asymmetric information problem is reduced thanks to the debt and the conversion tool.
	-Investment		-Convertibles allows	-Convertibles

Agency costs and risk shifting problems	opportunities can be seized due to the wealth transfer from equity to debt holders by using convertibles		highly levered firm to issue debt in order to convert it later	mitigate distortionary incentives and reduce agency's costs
Debt overhang problem	-Convertibles force shareholders to accelerate their investments.		-Convertibles reinforced underinvestment problem by increasing the leverage.	
Convertibles combined with sequential financing	-Investment opportunities can be seized by converting the debt into equity and keep the money inside the firm.	-Issuing costs reduction due to sequential financing. -Reduction of the overinvestment problem by redeeming the money to the bondholder in case of no investment opportunities	- Increase the debt capacity by converting the debt in equity	

IV. Empirical analysis literature review

This next chapter consists of a literature review of some empirical analysis realized on convertible bonds. The main paper of this chapter is written by Lewis (2003) and will be used as a reference for the empirical analysis of this paper. We will focus on three main fields where convertibles have a real influence. These fields are the investment opportunities, the financial constraints and the debt capacity.

4.1 Company corporate structure and convertibles bonds

4.1.1 The call protection and Capex relation

Based on the findings of Korkeamaki and Michael (2013), we see that convertible issuers tend to have a higher ratio of Capex to book value of assets compared to the sector average. It means that issuing convertibles could be a good instrument to enhance investments for a company. Depending on the call protection, the ratio of Capex to book value of assets is increasing in case of no protection (callable at any time) and decreasing when the bond has an absolute protection. Last but not least, the longer the protection in terms of year, the smaller is the ratio.

Those findings are consistent with the idea previously identified by Mayers who says that firms that are issuing convertible bonds with weak and short length of call protection are the ones who invest more just after the issuance (and as a consequence have a very high Capex to book of asset ratio). Firms with fast growth in the capital expenditures tend to provide a weaker call protection in order to let the firm call the convertibles sooner and let the company finance their next investment sequence.
Based on those findings, we understand that convertibles are often used to give a chance to companies to seize investment opportunities.

4.1.2 Some evidence about companies using convertibles

Mayers (1998) identified some evidence related to the convertible bonds. Based on the results of Essig (1991), Mayers found out that firms with convertible bonds have some characteristics in common. For instance, *"the ratios of R&D to sales, market value to book value*

of equity, long-term debt to equity and volatility of the firm's cash flows are ratios that are often correlated with firms that use convertible bonds" (Essig 1991).

It is interesting to note that firms with high market to book ratio and low earnings to price ratio, are companies that have to handle high amount of financial distress costs and asymmetric information problems. On the other side, the costs of managerial discretion are more important for firms that have lower market to book ratios.

4.2 The decision process of issuing convertibles

4.2.1 All issuers

Before going further into the explanation, we must classify all the variables of the analysis. We followed the classification realized by Lewis (2003)

Investment opportunities	Financial constraints	Debt capacity
Market to book	Slack	Long term debt / Total Equity
MTB*Dummy change in asset	Volatility	
Net income / total assets	Preissue stock price runup	
Change in total assets	preissue market price runup	

Lewis (2003) found out that both investment related and financing related variables have a role to play in the decision of issuing convertibles. However, depending on the type of convertibles, the variables are not the same anymore. By having a look at the overall summary statistics realized by Lewis and Mayers (cfr. Appendix 3,9), we can see that firms that are issuing convertibles have higher profitable investment opportunities than other companies, but a lower growth rate in the investment. In general, convertible issuers seem to have better investment opportunities, are more profitable, have a bigger debt capacity, and have a bigger size.

4.2.1.1 Determinants in the issuance decision of convertibles for all issuers

By looking at the second table, realized by Lewis (cfr. Appendix 4), regarding the decision of issuing convertibles or not, we can have the following discernment. The decision process seems to be influenced by both financial constraints and the debt capacity. For example, the debt-related costs of debt capacity will increase with leverage (long term debt /Total assets)

and will decrease if the profitability of the investment opportunities is high (Net income / Total assets). Another example where the equity-related costs (financial constraints) would increases, are when internal cash flows are high. Thus the probability of issuing convertibles is higher when a company has a high amount of internal cash.

Therefore, we conclude that the issuing decision for convertibles depends on the financial constraints, the debt capacity and also investment opportunities.

4.2.1.2 Determinants in the two days return for all issuers of convertibles

Let us now look at the last table realized by Lewis (cfr. Appendix 5) where he identified the variables that are influencing the stock price movement right after a convertible announcement.

It seems like convertible announcements are influencing the price of the stock thanks to some financing constraints variables. He showed us that the return of the stock will be higher if the internal cash generated by the company is important, and that the return of stock will be smaller if we have a positive pre-issue stock price performance. We see here that only the financial constraints or more precisely the equity financing related costs are influencing the two days return after a convertible issue.

It can seem strange that only the financial constraints are influencing the price of the stock in the case of convertible issuance, but Dann and Mikkelson (1984) found the same results and explained them like this. Because investors are making some expectations by using investments-related and debt-related information, investors are already taking into account the possibility of a convertible issuance in the stock prices.

4.3 Type of convertibles issued

We are now going to discuss the different types of convertibles issued by companies. The analysis made by Lewis and all (2003), shows that we can have different type of goals when a company issues convertibles. He identified three different kinds of convertible issues: the debt-like issuers, the hedge-like issuers and the equity like-issuers. The difference between those three

types is the probability of conversion. The first category has a probability of conversion of 40% or below. The second has a probability that lies between 40 and 60 % and the remaining is for the equity-like issuers.

4.4 Debt-like, hedge-like and equity-like convertibles

4.4.1 Debt-like issuers:

Companies that are likely to be debt-like issuers are often large companies with few growth opportunities. If we compare to other companies in the same industry sector (cfr Appendix 3) , they often have less growth in their investment (low investment opportunities) and a higher leverage (debt capacity). Companies which are debt-like issuers are often operating in a low market to book industry. This high debt capacity is usually followed by a low tax rate and a higher volatility in the equity value. Therefore, Lewis (2003) finds that those companies have a higher amount of debt-related costs of external finance (high debt capacity). We also have to notice that overall profitability (Net income/total assets) for debt like issuers is small compare to the sector. When market to book ratio is small (close to 1), asset substitution or overinvestment are often majors issues for debt-like convertibles issuers.

4.4.1.1 Determinants in the issuance decision for debt-like convertibles

Lewis (2003) finds out that every category has at least one significant variable (cfr Appendix 4). What we can conclude from this is the following: the investment opportunities and the investment growth are influencing the decision of issuing debt-like convertibles but not only that. Both debt capacity (long term debt to equity) and financing constraints variables (financial slack and pre issue run up stock price) are taken into account in the decision process of issuing debt-like convertibles.

4.4.1.2 Determinants in the two days return for a debt- like convertible issuance

Lewis found (cfr Appendix 5) that investment variables are not significant and therefore do not impact the price of the stock when a debt-like convertible is issued. Green (1984) explained these results by saying that because debt-like convertibles are reducing adverse investment incentives, there is less risk for facing these problems, and therefore, the investment variables do not influence anymore the stock price. On the other hand, external financing costs

have an impact on the stock price. If the firm is highly profitable (high net income/total assets), the debt cost related financing will increase and this effect increases the negative investor reactions. For the volatility, we see the opposite effect. When it increases, debt costs decrease but investors returns increase too. Financing constraints are also determinant in the stock price reaction. When a company has high enough financial slack, the investors reactions will be positive and returns of the stock should increase. Let us keep in mind that a high financial slack can be source of adverse selection costs.

4.4.2 Hedge-like issuers:

The second category called the hedge-like issuers are also large firms with relatively smaller growth opportunities or sometimes poor opportunities (negative coefficient of investment variable) than the others within the same sector (cfr appendix 3). The difference with the debt-like issuers is the volatility in the equity value. The volatility here tends to be lower than debt- or equity-like and is equal to the volatility of the firms from the same industry sectors that do not issue convertibles. This kind of convertibles (hedge-like) tend to be issued when asymmetric-information about risks and investments policies are a key criteria for the investors. Companies are often issuing this type of convertible when investments opportunities and overall growth are lower (growth in investment opportunities are computed on the change in total assets, the coefficient was negative in this case) than the industry sector.

4.4.2.1 Determinants in the issuance decision for hedge-like convertibles

The decision seems related to the investment opportunities variables and debt capacity variables (cfr appendix 4). Financing constraints of external finance seem to have a negative influence on the convertible debt issue decision in case of hedge-like issuers, but however, they are not significant in the issuing decision. It looks that the decision of issuing hedge-like convertibles relies on the same variables as the decision of issuing debt-like convertibles

4.4.2.2 Determinants in the two days return for a hedge-like convertible issuance

When leverage increases (debt capacity), share prices go down, which could mean that investors are not totally confident about the idea that hedge like convertibles mitigate totally the risk in case of high leverage (Brennan and Schwartz, 1988). The financing constraints variables are not all significant here. For example, the cash available variable (slack) is not significant in

this case. On the other hand, we see that both pre-issue stock price run up and market run up are significant. The stock price pre-issue variable has a negative coefficient which means that a good past return of the stock before the issuance leads to a lower return after the announcement. In case of hedge like issuance, debt capacity costs (long term debt/total assets) will have a negative impact on the share prices. The more leverage a company has, the less positive will be the two days return in case of convertibles announcement. The profitability of the investments opportunities should impact positively on the share prices but the later should also be reduced if the firm is growing too fast (MTB*dummy). Investors seem worried about the investment related costs that could come up with a rapid growth (cfr appendix 5).

4.4.3 Equity-like issuers:

Equity-like issuers are in general small firms (the total amount of assets in the firm is small) that have a lot of growth opportunities (cfr. Net income/total assets variable). They are often smaller compared to other firms in the same sector and they invest capital at higher rates compared to other types of convertibles. Companies that are issuing this kind of convertibles tend to have more adverse selection and underinvestment problems than the others.

4.4.3.1 Determinants in the issuance decision for equity-like convertibles

It is interesting to note that the investment growth rate (represented by the change in assets) is not significant in the decision making process because firms which are issuing this type of convertibles are competing in a highly profitable industry (Lewis and Verwijmeren, 2011). Investors are not worried about the potential growth as long as the investment opportunities are profitable. Topics that matter when a firm takes the decision of issuing convertibles (equity like), are the investment variables, the financial constraints (equity related costs) and the debt capacity (debt related costs). In this case, they are all positively significant.

4.4.3.2 Determinants in the two days return for an equity-like convertible issuance

The table of the price reaction to a convertible announcement shows us that this variation depends on the investment related performance variable (change in asset and market to book ratio). It looks like a firm share price will decrease when a company invests in high profitable opportunities (negative coefficient) but this effect will be reduced/mitigated if the proceeds from

this project are reinvested (positive coefficient). The positive effect should overcome the negative one. On the opposite with hedge and debt like issuance, the share price reaction to an equity like issuance does not seem to be influenced by the financing (debt or equity) related costs.

To sum up all the information regarding the analysis of Lewis, we realized the following table. The green boxes show that all the variables from the category are significant. Boxes in red mean that none of the variables from this category are significant. An orange box means that only a part of the variable inside this category is significant.

Type of variables / Type of convertible		Investment opportunities	Financial constraints	Debt capacity
All issuers	Issuing	-Investment opportunities variables (Market to book) are significantly positive in the decision process of issuing convertibles - Convertible issuers have more investment opportunities than the sector average.	-The variables related to the costs of equity (pre-issue stock price run up) and to the internal financing available (financial slack) are also significantly positive in the decision process	-The debt related costs (long term / total assets) are significantly positive. -Convertible issuers firms are more levered than the non convertible firms.
	Two days return	-Investment opportunities have no influence on the two days return	-The variables related to the costs of equity are the only ones that are influencing the two days return. A higher internal cash generates a better two days return.	-Debt capacities have no influence on the two days return

Equity like convertibles	Issuing	-(Same as the total issuers sample)	-(Same as the total issuers sample)	-(Same as the total issuers sample)
	Two days return	-Investment opportunities variables will only have a positive effect on the price if the proceeds are used to invest into new opportunities.	- Only internal cash available (Slack) matters for the two days return. The higher the cash, the higher price return will be.	- Debt related costs are not significant in the two days return.

4.5 Market reaction to convertible issues

Now, we are going to focus on the market reaction when they announce a convertible bonds issuance. Asquith and Mullins Jr (1986) reported a negative variation of 3% for common stock issuance. Dann and Mikkelson (1984) reported a variation around 2% for the announcement of convertible bonds and 0,3% when the announcement was made for straight bond issuances. We can clearly see here that the market anticipated a potential issuing of new stock when a convertible bonds announcement is made. The price goes down, not as much as the stock issuance announcement, but quite close to it.

4.6 Convertible bonds associated with a stock repurchase

In the past decades, there has been an increase in convertible issuance followed by an immediate stock repurchase. De Jong & al (2011) discovered that firms were using convertible bonds to allow a stock repurchase and giving the opportunity to debt arbitrageurs to make profit on shorting position over convertible bonds. On the other hand, the firm can negotiate a lower offering discount (therefore a higher price for the bonds) and avoid the huge negative price pressure that occurs around announcement dates due to the increase in the supply of stock thanks to the short selling activities. He found out that all convertible issues that were followed by a stock repurchase were showing no signs or almost zero abnormal stock returns on the announcement following days. In case of a normal convertible issuance, the announcement is followed by negative stock return.

V. Hypothesis development and methodology

Let us now state all the different hypothesis we want to verify through this paper.

The first hypothesis we want to verify is the following: Companies that are issuing convertibles should have higher investment ratios than the average of the sectors to which they belong.

This hypothesis is based on the finding of Stein (1992) who discovered through his analysis that convertible issuers had on average higher investment ratios as such as R&D to sales, market to book and P/E than the industry average. Those results can be explained by the theory of Mayers (1998) of the sequential financing. We want to verify if this is true for our sample or not.

In order to realize this first analysis, we selected some relevant ratios to analyse the capital structure, the rate of investment, the profitability and the size of the company. We took the following ratios: P/E, ROE, Lt debt to equity, Net profit Margin, Price to book, R&D to sales. The sample is composed of 46 companies that had convertible bonds on the market between 2011 and 2015. We found them in two different convertible fund holdings: the Lord Abbet mutual funds and the SICAV Amundi Funds. The lord Abbet document was from 2015 where the Amundi funds was from 2011. Regarding this, we took the data for each companies at the year corresponding to the fund they belong to.

The following data we had to collect were the sector average for the same ratios we had selected previously. To do so and to be able to compare it with our sample, we computed an average for each ratio by sector from 2011 to 2015. The data have been collected on Bloomberg, Capital IQ and google finance.

The test itself consists of a means test on the difference between the average of our sample by sector with the sector average for each ratio. By doing this, we will test if the sample is significatly higher or not than the industry average.

The second hypothesis that will be tested is the following: Among different sectors, do convertible issuers have the same capital structure and financial ratios?

This hypothesis is based on the discoveries of Mayers (1998) and Essig (1993) who found that convertible issuers had a similar capital structure and some similar investment and operating

ratios. By looking at their analysis, we see that they selected a large sample of companies but very few in each sector (1 to 4 companies). Based on that, we thought about doing a deeper analysis by reducing the number of sectors but increasing the size of the sample for each of them. By doing this, we are more able to take the specific characteristics of the sector into account which was not the case previously.

To realize this analysis, we will take the same data as for the previous hypothesis. We will select the companies ratios from 2011 to 2015 and apply a Principal Component analysis on it. We tried different combinations of the PCA on three dimension scales to maximize the representation quality of the data. The selected variables are the ones that are providing the highest quality of information into the model.

The third hypothesis that will be tested is the following: What are the investing and financing characteristics of the convertibles issuers that influenced the stock price (and therefore investors) after an announcement of convertible issuance?

This hypothesis is based on the findings of Lewis (2003) who already did this analysis on a sample that went from 1978 to 1992. We want to re-do this analysis on a sample that goes from 2001 to 2016 to see if his results still hold or if the drivers of stock price movement after an announcement have changed.

To realize this analysis, we first had to research in our sample of 46 companies all the dates of convertible issuance announcement. By doing this, we were able to find the two days return following the announcement. Now that we knew all the dates of announcement, we had to take the data for each company at the end of the year prior the issuance. The selected variables are the same as the ones chosen by Lewis in his own regression. For some variables, we had to compute the variation before and after the issuance (change in asset). The financial slack in our analysis corresponds to a measure of liquidity, the cash ratio. For other variables such as volatility, market and stock price pre-issue performance, we computed it on the past 75 days before the announcement day. We had to create a dummy variable for the change in asset if the total amount of assets increased (1) between the end of the fiscal year after the issuance and the end of the fiscal year prior issuance. This variable was created by Lewis (2003) to measure if the proceeds from the issuance were used to invest into project opportunities.

It is important to mention that we will susbtract all the data to their sector average in order to be able to compare them with each other.

We run the regression:

Two days returns = β_0+ β_1 (Market to book) + β_2 (Market to Book*dummy change in asset) + β_3 (Net income / Total assets) + β_4 (Change in assets) + β_5 (Long term debt to Equity) + β_6 (Market cap) + β_7 (Financial slack) + β_8 (Volatility) + β_9 (Pre-issue stock performance) + β_{10} (Pre-issue market performance).

The following step was to run the same regression for all the equity-like convertibles. To do so, we followed the formula that Lewis used to compute the probability of conversion.

$$d_2 = \frac{\ln\left(\frac{S}{X}\right) + \left(r - div - \frac{\sigma^2}{2}\right)T}{\sigma\sqrt{T}}$$

The formula explanation is available in Appendix 7. Once we had all the probabilities of conversion for our sample, we classified them in three categories: equity-, debt- or hedge-like (cfr Appendix 8). We could now run the regression again but only on the equity sample. Unfortunately, the sample size for the debt- and hedge-like convertibles were too small to do so.

The fourth hypothesis that will be tested is the following: Is the two days return after an announcement significantly different from zero when this announcement is followed by a stock repurchase?

This hypothesis is based on the theory of Jong & All (2011) who says that stock price return should be equal to 0 or a bit positive when the announcement is followed by a stock repurchase. We wanted to verify at the same time the findings of Dann & Mikkelson (1984) who found that convertible issuance are followed by negative stock return in average. This statement should be true in case of no repurchase. Finally, we also verify if the theory presented by Ross (1977) in the information signaling model hold in case of convertible bonds. The idea behind this model says

that when a company increases its leverage, this should be seen as a positive sign for the market and will resulted in a stock price increase.

The data selected for this analysis are the same as the ones taken for the third hypothesis. We will apply a two sided t-test and a single side t-test to see if the results are currently higher, lower or equal to 0. We will apply this to two different samples: one where the convertibles announcement is followed by a stock repurchase and the other without one.

The fifth hypothesis that will be tested is the following: Which are the investing, financing and debt capacity related variables that influenced the issuance decision of the convertible bonds?

This hypothesis is based on the findings of Lewis (2003). We want to verify if the issuance decision drivers from Lewis analysis (1978-1992) are still the same today (2001-2015). The idea is that issuance drivers may have changed due to the market evolution and needs. For example, we know that today convertibles are often issued to do a stock repurchase right after the issuance (De Jong & al, 2011), therefore investment opportunities variables should not be really significant compared to the situation in 1978-1992 because they do not rely on this issue to invest into new projects opportunities.

To do so, we will run a logit regression with the dependent variable issue [1: yes; 0: no]. This regression will be run on the total sample of convertible issuers and then, if it is possible, we will do the same for the equity like issuers. We need to mention that to be able to run this regression, we had to create a new sample made of non convertibles issuers.

The problem here was to define a sample of non convertible issuers. To do so, we selected 19 companies from the three different sectors that could be seen as “representative” in terms of size, market to book ratio and long term debt to equity ratio. For each variable of the regression, we calculated an average for the non issuing company samples from 2001 to 2015. The volatility and pre-issue stock price run up were computed on the 75 days before 8 of April 2016.

Once we had the two samples, we were able to run the following regression:

Issue [1:Yes ; 0: No] = β_0+ β_1 (Market to book) + β_2 (Net income / Total assets) + β_3 (Change in assets) + β_4 (Long term debt to Equity) + β_6 (Market cap) + β_6 (Financial slack) + β_7 (Volatility) + β_8 (Pre issue stock performance).

VI. Data

To select the companies, we have collected the constituents of two mutual funds, Amundi and Lord Abbet convertible funds . Those funds have convertibles that were issued from 2011 to 2015 but a large part of the ones selected came from recent issues. We have selected 46 companies through 3 different sectors: 18 companies from the technological sector (hardware, software and technologies), 14 from the pharmaceutical sector and 14 from the energy sector (electricity, gas and crude oil). All those companies are American companies that are currently traded on the US stock market. Those companies have different sizes and market cap that give us a good representation of the market of the convertible bonds through those three different sectors. The statistics summary of the sample are available in appendix 6.

VII. Discussion of results

7.1 First hypothesis

We wanted to verify the hypothesis stated by Stein (1992) which says that companies that are issuing convertibles should have higher investment ratios than the other companies within the same sector.

To realize this analysis, we had to remove 5 companies (CIEN, INCY, TSRO, WLL, BCEI) from the sample due to extreme data (outliers).

We found the following results:

	Basic Material Oil and Gas		Technology		Healthcare		T test P-values
	Sample Average / Median	Industry mean / Median	Sample Average / Median	Industry mean / Median	Sample Average / Median	Industry mean / Median	
Market cap	13.82 / 7.61	2.7 / 0.159	34.99 / 13.006	4.33 / 0.4339	34.96 / 13.91	3.31 / 0.854	0.06714
P/E	25.086 / 18.309	23.636 / 17.860	31.239 / 19.231	25.086 / 20.858	77.871 / 56.28	65.728 ./ 22.91	0.1672
ROE %	0.674 / 0.656	15.014 / 9.368	13.144 / 14.69	22.343 / 3.83	5.396 / 6.336	20.475 / 4.354	0.01367
Long Term debt to Equity	81.228 / 71.776	49.945 / 45.266	23.482 / 15.43	141.223 / 3.674	85.073 / 55.235	71.527 / 14.126	0.6566
Net profit margin (%)	1.0717 / 1.757	1.779 / 4.43	6.7584 / 12.79	19.049 / 4.246	1.414 / 6.473	17.755 / 5.921	0.1721
Price to Book ratio	1.554 / 1.438	1.8882 / 1.8747	3.3352 / 2.8604	3.338 / 2.2263	9.6978 / 6.720	11.2694 / 3.671	0.314
R&D to sales	1.36621 / 0	0.540644 / 0	14.6991 / 13.286	53.950 / 13.421	40.830 / 19.840	2980.66 / 20.480	0.4152

By looking at the results, we can clearly see a common behavior between convertible issuers. We are going to analyze each variable and try to find an explanation for it.

First of all, the market cap of the convertible issuers are larger than the average for the three different sectors. This goes against the idea presented by Mayers (1998) that small cap companies tend to issue more convertibles due to the fact that they have more agency costs and overinvestment problems. It also may be explained by the fact that nowadays, large cap companies tend to issue more convertibles to combine them with a stock repurchase.

We can see that the average P/E ratio (Investment opportunities variable) of the sample is above the industry average P/E. It means that investors are willing to pay more for one dollar of earnings. This is consistent with the idea that convertibles are often used to apply a strategy of sequential financing (Mayers, 1998). Firms are often issuing convertibles to be able to invest into

projects opportunities and to keep the money in the company, in order to reinvest it later. Unfortunately, the P-value of the P/E ratio is not significant at 10% and we cannot conclude any information from this ratio.

The ROE (Financial constraints) ratio is interesting because it shows that the investors returns with convertible bonds are smaller than in the sector. This phenomenon could be explained in the following way. Even if investors are willing to pay more for good project opportunities, convertibles are well known for having a low growth of investment (Lewis, 2003). Furthermore, due to the conversion tool inside the convertible, the total wealth may have to be diluted between the old and the new shareholders that decided to convert (Lyandres and al, 2014). Therefore, the return on equity should be smaller than in the industry. The P-value is significant at 5%. We can be sure, based on those results, that in general, the ROE ratio for convertible issuers should be smaller than in the industry.

The ratio of long term debt to equity (debt capacity) is in this case, going in the same direction of the findings of Rogalski and al (2003). Firms that are issuing convertibles tend to have more leverage than the average firm of the sector. They often have high debt-financing related costs. They cannot issue straight equity, due to the asymmetric-information problem (Stein, 1992), therefore they have to raise a high amount of straight debt. Another hypothesis could be that firms are willing to issue more debt than the equilibrium suggests, due to the fact that firms are expecting to invest the money in profitable projects and, as a consequences, convertibles holders are expecting to convert their debt to equity. The total amount of debt will be then reduced in the future. We can see here that in the technology sector, the debt to equity ratio in the sample is way smaller than the industry average. On the other side, the two other sectors have a higher ratio than the industry average. We can only suppose here that the specific characteristics of the sector are determining this ratio. This might explained why the p-value is not significant.

The net profit margin shows that the sample had in average lower results than the sector. According to the P value which is not significant, but still small, we can see that convertible issuers had a smaller profit than their industry average. Based on the pecking order theory, convertible issuers may not be able to take over positive NPV project due to the debt-overhang

problem. As shown previously, we can see that the amount of debt for convertible issuers seems higher than the industry average and therefore, profits from investment opportunities may be consumed by the interests over the debt. Convertibles may be a partial solution for the debt overhang problem but still, the profit for those companies seems lower.

The price to book ratio is always smaller than the sector average in our analysis. This is consistent with the findings of Lewis (2003) that convertible issuer firms have a lower price to book ratio than the average sector. He explained this by the fact that even if those firms have projects opportunities, they are not highly rewarded. The ROE seen previously confirms it.

Finally, the R&D to sales variable here is not significant at all (p-value = 0.415). We explained that by the size of the sample and some missing data. Some data were missing on the Bloomberg services and a lot of firms from the healthcare and Oil & gas sectors had zero R&D expenses to sales. What we know from our previous readings is that convertibles issuers tend to have a higher amount of R&D and CAPEX due to the investment following the issuance.

Conclusion from the first analysis

We can conclude from this first analysis that the findings found previously by different authors hold for the three different sectors. It seems that the sequential financing theory hold due to the investment ratio such as PE, Market to Book, R&D, long term debt to equity ratio are higher than the industry average. Convertible issuers are investing more, have a higher leverage, but their investment seem not to be that profitable. The debt-overhang problem may already be an important issue when companies decide to issue convertibles. The cost of debt may consume a good part of the profit but investors remain confident about the future growth and profit of the company according to the P/E ratio which is higher than the industry average.

7.2 Second hypothesis

The second hypothesis we wanted to test is the following. Among different sectors, do convertible issuers have the same capital structure and financial ratios?

We want to ensure that the capital structure of convertible issuers is the same through different sectors. To do this, we apply a principal component analysis and a correlation matrix on the following ratios and characteristics of the companies. We have to notice that two companies (SYNA and CIEN) were removed from the sample due to extreme data (outliers).

The PCA was realized with three different dimensions, the two dimensions PCA had a too small R^2 to be interpreted. The R^2 of the three dimensions PCA is equal to 69.66%. The first dimension explained 32.81399 % of the variance, the second explained 23.2577% of the variance and the third explained 13.59% of the variance.

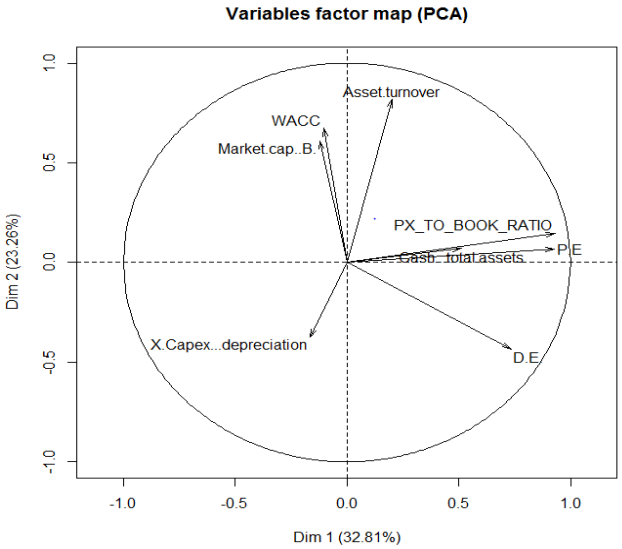
Correlation matrix

	Asset turnover	Cash to total assets	D/E	Market Cap	P/E	Price to book ratio	Wacc	Capex to depreciation
Asset turnover	1	0.6538176	-0.09606196	0.36561896	0.26860582	0.36829841	0.29636687	-0.3240783
Cash to total assets	0.6538176	1	0.3848339	-0.0464223	0.7320902	0.77708048	0.21323882	-0.28294354
D/E	-0.09606196	0.3848339	1	-0.2307403	0.66096664	0.60664569	-0.5982808	-0.13256368
Market Cap	0.36561896	-0.0464223	-0.23074034	1	-0.1184423	-0.04739793	-0.0214309	-0.20295484
P/E	0.26860582	0.7320902	0.66096664	-0.1184423	1	0.98440486	-0.0817506	-0.05708409
Price to book ratio	0.36829841	0.77708048	0.60664569	-0.0473979	0.98440486	1	-0.053393	-0.08524743
Wacc	0.29636687	0.21323882	-0.59828083	-0.0214309	-0.0817506	-0.053393	1	-0.11048911
Capex to depreciation	-0.3240783	-0.28294354	-0.13256368	-0.2029548	-0.0570841	-0.08524743	-0.1104891	1

By computing the correlation matrix, we see that the Price to book, P/E and Debt to equity variables are quite highly correlated. We noticed that the Wacc seems to be negatively correlated with the D/E ratio which is normal in a world of tax. By increasing the amount of Debt, the Weighted average cost of capital decreases until companies reach the threshold where the risk becomes too important. Another interesting fact to mention is the relation between the cash available and the asset turnover. According to the correlation matrix, they are positively correlated at 0.65, which means that when there is cash in the company, it may have a higher asset turnover than other companies without cash.

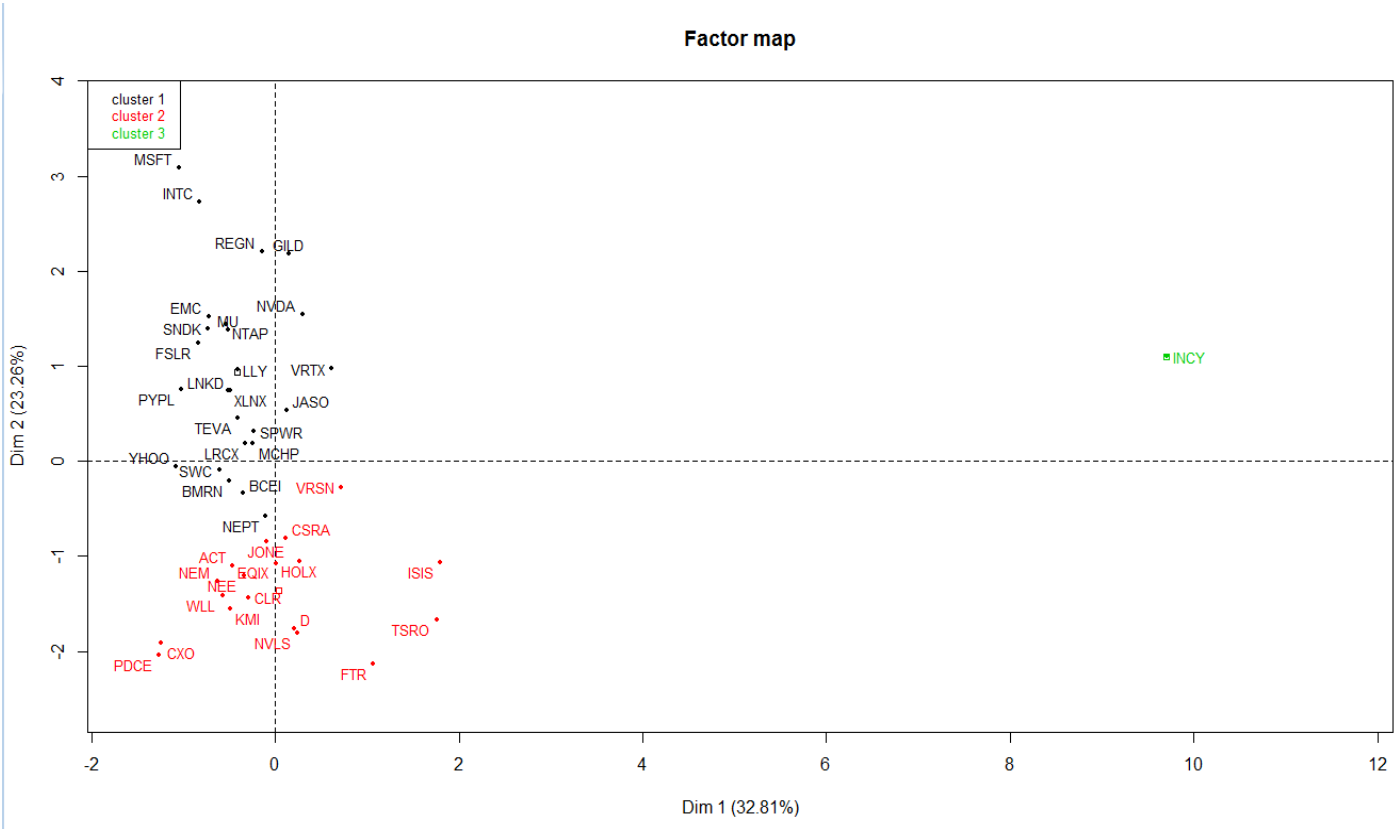
Representation quality of the variables

COS2	Dim	Dim.2	Dim.3
D.E	0.54140795	0.18905332	4.82E-02
WACC	0.01097118	0.45533935	3.14E-01
P.E	0.86094726	0.00460595	4.58E-03
Asset.turnover	0.04105367	0.6706812	2.65E-03
Market.cap	0.0146943	0.37287244	3.12E-01
Cash to total.assets	0.26188796	0.00492657	2.96E-01
Capex to depreciation	0.02767257	0.14140068	1.09E-01
Price to book ratio	0.86648439	0.0217408	4.86E-06



According to the COS squared which represents the variable quality representations into the dimensions, the first dimension is mainly explained by the price to book ratio, but also by the price to earnings ratio and the Debt to equity ratio.

The second dimension is mainly explained by the asset turnover and the WACC. The correlation between them is equal to 0.296%. The third dimension is not well explained by the variables we have selected but is still relevant to increase the total quality of the representation.



According to the cluster analysis realized with the PCA, we can see three different clusters appearing. Cluster number three is due to extreme data (outliers) and should not be considered as a representative cluster. By having a look at the two other clusters (1-2), we can spot a difference between the sectors. Cluster two is composed by a majority of the oil industry firms (65% of the oil sample) and the healthcare sector (46% of the healthcare sector). Cluster number one has 82% of the technology firms into it and the remaining of the healthcare and oil firms from the sample.

If we compare the results of the factor map with the quality representation of the variables and the data we collected, we cannot see a clear difference between the sectors in terms of price to book value and P/E ratio. We can see that almost all the companies on the right side of 0 according to dimension 1, are healthcare companies. But still, it contains only half of the healthcare sample. The only thing we can say here according to the PCA is that the P/E or Price to book ratio seems a bit higher in the healthcare sector. On the opposite, the D/E ratio shows that the amount of debt is much smaller in the technological sector than in the healthcare and oil & gas industry. We can clearly see here that according to dimension 1, the capital structure (D/E) of the technological sector is different from the oil and healthcare sectors. We see that 64 % of the oil & gas industry and 42 % of the healthcare sample are located on the bottom right, thus they tend to have a higher ratio of Debt to equity compare to the Technological sector.

The second dimension mainly explains the asset turnover (67%), the WACC (45%) and the market cap (38%). We can see in the data that the asset turnover ratio is higher for the technological sector than for the two other sectors. A high asset turnover means that the company is more efficient for generating revenues per dollar of assets. This result is consistent with the previous analysis where the ROE of the technological sector was much higher compared to the other sectors. The asset turnover ratio can be interpreted as an investment indicator which means that the technological sector is investing more when it uses convertibles than the other convertibles issuers in different sectors.

The analysis of the WACC shows us that the technological sector has a higher WACC than the two other sectors, but at the same time, we know that the D/E ratio is smaller. The Weighted

average costs for the two remaining sectors are smaller but those sectors have a higher debt to equity ratio. Therefore, we can assume that the technological sector has a higher cost of equity.

Conclusion from the second analysis

To conclude this analysis and to answer the hypothesis that there is a common capital structure between the convertibles issuers according to Mayers (1998) and Essig (1993), I want to point out some interesting facts. We can see a real common structure between the oil and healthcare sectors but on the opposite, the technological sector seems to have a smaller debt to equity ratio, a higher investment rate (asset turnover), and a higher WACC.

We can see that the characteristics of the sectors are reflected in the firms ratios and capital structure, even if they are convertible issuers. By combining the two analysis, we can agree that convertible issuers tend to have common ratios below or above their industrial average but when comes the time to compare them between each other, the results are not consistent with the previous findings. I would explain this difference with the findings of Mayers (1998) and Essig (1993) by the size of the sample per industry sector they used, which was much smaller compared to this one. Furthermore, in the nineties, convertibles were not used for the same reasons as today. Nowadays, large cap companies are issuing convertibles in order to do shares repurchases with the proceeds of the issuance. This was not the case when Mayers did his analysis. This could explain the difference between some ratios like P/E or Price to book ratio. The major difference with the previous papers realized on the subject is that sector characteristics were not taken into account. The technological sector for example will not have the same amount of R&D or asset turnover as the oil & gas sector even if they are both convertible issuers in our sample.

7.3 Third hypothesis

The next fact we wanted to test was the relation between the two days return after an announcement with the following variables: the investment opportunities, financial constraints and debt capacity. The idea here is to identify how the investors react to a convertible announcement based on the financial and investing characteristics of the convertible issuers. After running the regression that we explained in the hypothesis, we obtain the following results:

Two days regression results

	All Issuers		Equity-like Issuers	
	Coefficient	P-Value	Coefficient	P-Value
Intercept	-0.02561	0.6542	-0.224	0.0544 *
Market to Book	0.009951	0.0327 **	0.01828	0.0355 **
MTB*Dummy change in asset	-0.01148	0.1089	-0.02854	0.1389
Net Income / total assets	0.1801	0.0163 **	0.002491	0.9817
Change in asset	-0.07901	0.0703 *	-0.06563	0.274
Long term debt to Equity	0.0004926	0.3201	-0.000345	0.6331
Market cap	-1.806E-07	0.5124	-3.03E-07	0.8606
Financial Slack	0.002418	0.6892	-0.007372	0.5144
Volatility	-0.1346	0.0782 *	0.3937	0.0791 *
Pre issue run up Stock price	-0.0347	0.5008	-0.1765	0.2589
Pre issue run up market	-0.0813	0.7398	1.366	0.0723 *
	Adjusted R squared = 0.2188	BIC value = -52.55409	Adjusted R squared = 0.2452	BIC value = -36.6296

Results interpretation: full sample

We can see that 4 different variables are statistically significant at 10% or less and are influencing investors behavior that results in an increase or decrease in the two days post announcement equity return.

The market to book ratio (investment opportunities variable) shows that higher investment opportunities for the firms result in an increase of the returns of stock. Lewis explained that convertibles are used by firms as a bonding mechanism against overinvestment. Because this fear of overinvestment is disappearing, investors are more confident about the performance of the firm and the stock price increase.

The profitability of the asset in place (net income/total assets) in the firm has a positive impact on the stock returns when an announcement is made. We can interpret this as the following: Because the assets in place are currently profitable, an issuance of convertible bonds can be seen as a sign that we will increase the number of assets in place and therefore increase the income too.

The change in assets here is a measure of the investment growth (investment opportunities variable). It looks like a high investment growth has a negative impact on the stock returns. According to Lewis (2003), this can be explained by the concern of the investors about the incremental investment related costs of rapid growth. A fast growth can lead to very important costs and we know plenty of examples where companies grew too fast and got into trouble due to the costs they had, to maintain their growth. In the Lewis analysis, the change in assets was not significant.

Finally, we can see that the volatility of the stock is a concern to the investor. It is interesting to observe that in the analysis of Lewis realized on data from 1978 to 1992, the volatility was not a concern at all for any type of issuers. Today, a high volatility in the past 75 days would send a negative message to the investors and will reduce the value of the stock in the two days post announcement. Even if a high volatility can also lead to an increase in the stock price, investors who are investing in convertible bonds have a higher risk aversion than in general.

Before concluding, it is interesting to give more information on the variable "MTB*change in asset[2]". As we know, a positive market to book shows that investors react positively to the firm's investment opportunities but they react negatively when the proceeds of the issuance are used for

[2] Change in assets corresponds to the difference between the number of assets at the end of the fiscal year after the issuance with the number of assets at the end of the fiscal year before the issuance.

new investment opportunities. Indeed, when the change in assets is equal to one, the coefficient of the variable is negative. Therefore, reinvesting seems to have a negative effect in total. This theory goes against the Stein (1992) backdoor equity hypothesis, in which the convertibles are used to overcome adverse selection problems and to use the proceeds of the issuance to invest in new project opportunities. In this theory, if the firm has no plan for the use of the money that will come from the issuance, the investors` reaction should be negative.

On the other hand, our coefficient for MTB*change in asset is consistent with the idea presented by De Jong & all (2011), that an issuance of convertible bonds should not lead to a negative reaction of stock price if the proceeds are used to make a stock repurchase. Our results show that if the proceeds are used in investment opportunities, the stock price reaction will be negative.

Results interpretation: Equity-like sample

We see that three different variables are significant at 10% or less in our regression. The first one is the market to book (investment opportunities), the second one is the volatility (financial constraints) and the third one is the pre-issue run up in stock price (financial constraints).

It is really interesting to see, that for the volatility variable, the sign of the coefficient switched from negative to positive. Equity-like investors will react much more positively in case of high volatility. This can be explained by the fact that equity investors are willing to convert their bonds and that a high volatility increases the probability of high profit at the time of conversion. The volatility was not significant in the case of the Lewis analysis.

The pre-issue run up in the market is a significant variable that is also very important from an investor`s point of view. When the market has well performed in the last 75 days before the issuance, investors are more likely to react positively to an issuance. If we combined this findings with the volatility, we see that a good performance of the market with a high volatility will have a positive effect on the investor's reaction, and therefore, on the stock price. Here again, the pre-issue run up in the market was not significant in the Lewis analysis.

Something interesting to point out here is the coefficient of the pre-issue market run up and the pre-issue stock price run up. We can see that the coefficient of the former is positive where the latter is negative. This evidence goes along with the theory of Choe & all (1993) which found that stock prices reactions are negatively related with the pre-issue stock price performance, but positively related with the market pre-issue performance. This implies that investors are facing a problem of adverse selection. Investors seem to not have the same information as the firm. This might come up when investors do not really know what the company is going to do with the proceed or when they do not know about the project opportunities that the company has.

Conclusions of the analysis

To conclude here, we cans see that all the investment opportunities variables seems significant today (All issuers) which was not the case when Lewis did it. We also can see that in each case, the financial constraints identified by Lewis previously are not the same anymore. The only thing that remains the same is debt capacity that is not significant in either case. Nowadays, investors seem way more worried about the proceeds of the issuance and are requiring reinvestments in investment opportunities to have a positive return. At the time of Lewis, investment opportunities were only significant for the equity like sample were today all issuers are concerned about it.

Significant Variables in the analysis.		Investment opportunities	Financial constraints	Debt capacity
Lewis results	All issuers		-Slack -Pre-issue run up stock price	
	Equity like	-MTB -MTB*Dummy change in assets	-Slack	

Own empirical analysis	All issuers	-MTB -Change in assets -Net income/total assets	-Volatility	
	Equity like	-MTB	-Volatility -Pre-issue run up market	

7.4 Fourth hypothesis

In this fourth hypothesis, we wanted to verify the one stated by Jong & All (2011) which says that the two days return after a convertible announcement should be null very close to it if the issuer announces that he will use the proceeds of the issuance to do a share repurchase.

Two days return with/without repurchase analysis

	DF	Mean of the sample	Confidence Interval high Side	Confidence invertval small side	P-value
With repurchase two sided test	8	0.868%	2.58%	-0.84%	0.2755
With repurchase one sided test Ha < 0	8	0.87%	2.25%	-Inf	0.8623
No repurchase two sided test	20	-1.65%	1.49%	-4.79%	0.2853
No repurchase one sided test $H_a < 0$	20	-1.65%	0.94%	-Inf	0.1427

Two days return with repurchase: results interpretation

We see that the average two days return after an announcement is positive in case of repurchase, and negative in the other case. When a repurchase is announced, the p-value cannot be used to reject the null hypothesis. This means that the average return of an issuance followed by a repurchase could be equal to 0.

On the other hand we see, thanks to the one sided test, that we do not reject the null which says that the probability of having $H_0 >= 0$ is around 86 %. The theory presented by Jong & All (2011) seems to hold due to the high result of the two sided test of the P-value. We cannot reject the theory that the average return could be equal to 0 if an announcement was followed by a repurchase.

Furthermore, Jong & All (2011) also found that this repurchase announcement has a positive effect on stock prices. They demonstrated that the probability of having 0 or positive returns was much higher than negative ones.

Two days return without repurchase: results interpretation

In this study, we see that the p-value is not significant at 28,53 %. This means that we cannot be sure that the average return will be different from 0. Based on the findings of Dann & Mikkelson (1984) and Asquith & Mullins Jr 1986, the average two days return following a convertible announcement should be negative and around 2%.

Our P-value does not confirm this hypothesis but, thanks to the one sided test we did on the two days return with no repurchase, we can see some interesting findings. The one sided test shows us that the probability of having $H_0 >= 0$ is around 14%. Which means that our return should be negative in general with a 85 % confidence level.

Confrontation of the results with the theoretical content

Our results are close but not exactly the same to confirm the theory of Dann & Mickelson (1984). On the opposite, the theory of Jong & all (2011) seems to hold. The restricted sample may be the origin of those shady results. It might be useful to increase the size of the sample, which will give us more reliable results.

Another theory that we should mention is the leverage-related information theory presented by Ross (1977) in the information signaling model. It says that issuing debt will increase the company's leverage and give a positive signal effect to investors. However, using convertible

would increase the leverage of the company and therefore should also have positive effect on the stock price due to the positive signal effect.

He explained that because debt financing is costly and that low quality firms cannot afford having too much leverage, debt financing is often used by high quality firms that can sustain higher level of debt and try to avoid share dilution. As a consequence, investors see debt issuances has a positive news on the firm's health.

We clearly saw in the previous table that the theory of Ross does not hold if we do not have the information regarding the proceeds of the issuance. Issuing convertibles does not have a positive effect on the stock price due to the equity component that allows the conversion and therefore, reduces this positive effect of leverage. Moreover, issuing convertibles increases leverage but less than an equivalent face value amount of straight debt.

What does the theory of Ross do is giving us a clue to reduce the asymmetric information problem and making the distinction between the high quality firm and the low one.

7.5 Fifth hypothesis

The last hypothesis we wanted to solve is the following: Which are the investing, financing and debt capacity related variables that influenced the issuance decision of the convertible bonds?

We found the following results :

Convertible issuance drivers-results

	All issuers	
	Coefficient	P-Value
Intercept	7.985	0.02189**
Market to book	0.5046	0.04065**
Net income / total assets	-12.17	0.01659**
Change in asset	4.31	0.10637
Long term debt to equity	-0.03388	0.00804***
Market cap	-2.35E-05	0.01167*
Financial slack	-0.5204	0.15285
Volatility	-3.667	0.03702**
Pre issue run up stock price	-0.139	0.94843
		AIC value = 45.707

Issuing decisions: Results interpretation

To interpret those results, we have to consider them in comparison with the industry sample firm. We see that companies tend to issue more convertibles for companies with high market to book ratio (investment opportunities variables). It means that investment opportunities are very important for the companies in the issuing decision process. The more opportunities they have, the higher the market to book ratio will be and therefore, the incentive to issue convertibles. This is consistent with the idea that equity like issuers are competing in a high market to book industry.

Furthermore, it seems that the investment growth rate (change in assets) is not significant here. Investors do not seem worried about the growth of the investment opportunities in which they want to invest.

Convertible issuers seem to have a lower past profitability than non convertible issuers. This can be explained by the theory of the debt overhang problem of Mayers (1977). We know that convertible issuers are companies that are facing important costs of debt compared to the industry average. The roots of this high costs of debt could be the adverse selection costs problems (Brennan & Schwartz, 1988) or the high amount of debt. The consequences of this debt overhang problem is the consumption of an important part of the revenues in order to pay the interest of the debt.

By looking at the coefficient of the long term debt to equity (debt to capacity), we see that the issuers sample has a smaller amount of debt compared to the non issuers sample. This is not consistent with the findings of Essig (1991) that convertible issuers are more levered firms than the industry sector average. The only remaining thing that can explain a lower profitability without being too levered is the adverse selection cost problem where firms have to pay high interest due to the risk, the unpredictable investment policy and the difficulty to identify the risk.

The negative market cap coefficient is significant here and goes along with the findings presented by Mayers (1998). When he realized his analysis, he found that the convertibles issuers where usually small cap companies. He explained it by the fact that small cap do not have the same access to the straight debt as the large cap companies. Since small firms tend to be highly levered, raising straight debt can be difficult and adverse selection costs can be an issue too. Therefore, they must provide more guarantees that could be offered by the convertibles with the debt and equity tool. Raising equity would have been too costly due to the asymmetric information problem. We can see that the pecking order is followed in this case.

The financial slack and the pre issue run up stock price do not seem to be relevant here in the decision of issuing convertibles. On the contrary, the volatility is significant and it seems that companies with lower volatility issue more easily convertibles than those with higher ones.

Conclusion of the fifth analysis:

To conclude here, the decision of issuing convertible bonds relies on investment opportunities variables, on the profitability of the company, the financial constraints, the debt capacity variables and on the firm's size. Issuing firms have in common that they are small cap companies, with important investment opportunities, suffering from a low profitability but without being too levered. Those companies are likely to suffer from adverse selection costs problems and issuing convertibles will help to solve these problems by reducing the risk and in consequence, the cost of debt.

Our results are not totally consistent with the ones of Lewis, it seems that not every investment opportunities variable is significant here compared to Lewis. Furthermore, the financial constraints are totally different from the Lewis results. In the Lewis analysis, there was a real concern about the equity related costs which may render common equity financing too expensive. It does not seem to be a concern nowadays.

Significant Variables in the analysis.		Investment opportunities	Financial constraints	Debt capacity
Lewis results	All issuers	-MTB -Net income/total assets - Change in assets	-Slack -Pre-issue run up stock price	-Long term debt to equity
Own empirical analysis	All issuers	-MTB -Net income/total assets	-Volatility	- Long term debt to equity

VIII. Conclusions

Through this paper, we wanted to understand why companies are issuing convertibles instead of equity or debt. We covered the most important issues that companies are facing today through the literature review and, thanks to convertibles, we have understood how to get rid of these problems.

Based on this first chapter, we wanted to see if the analysis of Stein (1992) of the capital structure and investment opportunities still hold or not.

Afterwards, we decided to replicate the analysis of a well-known author called Lewis (2003) in order to identify if the two days return and the issuance decision drivers where the same as the ones found by Lewis at his time (1978-1992). Finally, once we had the drivers of the two days return for convertibles issuers, we wanted to verify the following statement of Dann & Mikkelson (1984) that the two days return is negative in average for convertibles issuers. According to Jong & Al (2011), this is true as long as the proceeds of the convertibles are not used for a stock repurchase.

Our analysis of the capital structure showed us that the findings of Stein (1992) still hold. What we think that was not taken into account are the specificities of the sectors. From a sector to another, the leverage, R&D expenses etc… can vary dramatically and convertibles are not always higher than the sector average. However, we could clearly see that convertible issuers had higher investment ratios than their industry in average but, it also showed us that those investments were less profitable than the sector average. The only explanation we found for this lower profitability was the consequence of the debt overhang problem that is heavily present for companies that are issuing convertibles. Therefore, a main part of the profit created with the investment opportunities was consumed by the costs of the debt. We provide the following picture of the convertible issuers: Convertible issuers tend to be high growth companies with important investment opportunities, not very profitable, highly levered with high debt- and equity related financing costs.

The replication of Lewis's analysis gave us different results from the ones found previously. Our results show us that nowadays, the two days return after an announcement is mainly influenced by the investment opportunities variables and less by the financial constraints as the cash inside the company or the past performance of the stock. The investors concerns over the investment opportunities may be explained by the time period we selected. Our data were taken from 2001 to 2015 were a major crisis occur in 2008 that last for three years. Due to the small amount of investment opportunities and the small profitability at that time, investors may have been worried about the use of the proceeds of the issuance. Furthermore, today, the financial constraints that influence the price fluctuation are financial market performance related. At the time of Lewis, investors were concerned about the return of their stock price before the issuance where now, it is the market fluctuation as a whole that determines the two days return. Investors are worried about the performance of the market and we can easily make the link between the performance of the market and the investment opportunities. When the market is improving, investment opportunities and the whole economy seem to have a bright future ahead. That was not the case between 2007 and 2011 and might explain those changes in investors behaviors.

The second part of the replication was about the issuing decision drivers. Our findings almost showed the same results as the one presented by Lewis. When the investors want to issue some convertibles, they are taking into account the investment opportunities of the market, the debt capacity and costs related to this debt capacity, and finally the financial constraints. The real differences here with the previous results, are the financial constraints which are not the same. Investors seem more concerned by the market on the whole than the available cash or the performance of the company stock. These results can be explained in the same way as previously with the market crisis of 2008.

Finally, we could not prove the theory of Dann & Mikkelson (1984) which says that convertibles issuance is always followed by a negative stock price return except if there is a stock repurchase following the issuance. The results of our analysis are going in the same direction as the one stated above, however, due to the small size of the sample, we could not be confident at 95 %. Still, we can see a real trend of null or positive return in case of repurchase after the issuance. We explain that by the fact that firms are giving the opportunity to arbitrageurs to take advantages of this strategy by shorting the convertibles at a pre agreed price and, as a consequence, firms can more easily negotiate a lower offering discount on the bond's price. Arbitrageurs do not face the risk to engage in open-market short sales at an indeterminate price and issuers can negotiate a better price in return of being a counterparty for the arbitrageur.

IX. References

Ammann, M., et al. (2003). "Are convertible bonds underpriced? An analysis of the French market." Journal of Banking & Finance **27**(4): 635-653.

Asquith, P. and D. W. Mullins Jr (1986). "Equity issues and offering dilution." Journal of Financial Economics **15**(1–2): 61-89.

Asquith, P. and D. W. Mullins Jr (1991). "Convertible Debt: Corporate Call Policy and Voluntary Conversion." Journal of Finance **46**(4): 1273-1289.

Autore, D., & Kovacs, T. (2004). The pecking order theory and time-varying adverse selection costs. *Department of Finance, Pamplin College of Business, Virginia*.

Brennan, M. J. and E. S. Schwartz (1977). "CONVERTIBLE BONDS: VALUATION AND OPTIMAL STRATEGIES FOR CALL AND CONVERSION." Journal of Finance **32**(5): 1699-1715.

Brennan, M. J. and E. S. Schwartz (1988). "THE CASE FOR CONVERTIBLES*." Journal of Applied Corporate Finance **1**(2): 55-64.

Brito J. A., John K., 2002, "Leverage and growth opportunities: risk avoidance induced by risky debt", working paper University of New York, Salomon Centre (Stern School of Business).

Cariola, Alfio and La Rocca, Maurizio and La Rocca, Tiziana, Overinvestment and Underinvestment problems : Determining factors, Consequences and Solutions (October 2005)

Choe, H., et al. (1993). "Common stock offerings across the business cycle: Theory and evidence." Journal of Empirical Finance **1**(1): 3-31.

Dann, L. Y. and W. H. Mikkelson (1984). "Convertible debt issuance, capital structure change and financing-related information: Some new evidence." Journal of Financial Economics **13**(2): 157-186.

de Jong, A., et al. (2011). "Why do convertible issuers simultaneously repurchase stock? An arbitrage-based explanation." Journal of Financial Economics **100**(1): 113-129.

Donaldson, C., 1961, Corporate debt capacity. Harvard University.

Dutordoir, M., et al. (2014). "What we do and do not know about convertible bond financing." Journal of Corporate Finance **24**: 3-20.

Edmans, A. (2014). "Blockholders and Corporate Governance." Annual Review of Financial Economics **6**(1): 23-50.

Green, R. C. (1984). "Investment incentives, debt, and warrants." Journal of Financial Economics **13**(1): 115-136.

Isagawa, N. (2000). "Convertible debt: an effective financial instrument to control managerial opportunism." Review of Financial Economics **9**(1): 15-26.

Jensen, M. C. (1986). "Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers." American Economic Review **76**(2): 323.

Jensen, M. C. and W. H. Meckling (1976). "Theory of the firm: Managerial behavior, agency costs and ownership structure." Journal of Financial Economics **3**(4): 305-360.

Korkeamaki, T. and T. B. Michael (2013). "Where Are They Now? An Analysis of the Life Cycle of Convertible Bonds." Financial Review **48**(3): 489-509.

Korkeamaki, T. P. and W. T. Moore (2004). "Convertible Bond Design and Capital Investment: The Role of Call Provisions." Journal of Finance **59**(1): 391-405.

Kraus,A and Litzenberger ,R.H., "A State-Preference Model of Optimal Financial Leverage", Journal of Finance, September 1973, pp. 911-922.

Lemmon, Michael L. and Zender, Jaime F., Asymmetric Information, Debt Capacity, and Capital Structure (September 25, 2012)

Lewis, C. M., et al. (2003). "Industry conditions, growth opportunities and market reactions to convertible debt financing decisions." Journal of Banking & Finance **27**(1): 153-181.

Lewis, C. M. and P. Verwijmeren (2011). "Convertible security design and contract innovation." Journal of Corporate Finance **17**(4): 809-831.

Loncarski, I., et al. (2009). "The Rise and Demise of the Convertible Arbitrage Strategy." Financial Analysts Journal **65**(5): 1-16.

Lyandres, E. and A. Zhdanov (2014). "Convertible debt and investment timing." Journal of Corporate Finance **24**: 21-37.

Mayers, D. (1998). "Why firms issue convertible bonds: The matching of financial and real investment options." Journal of Financial Economics **47**(1): 83-102.

McConnell, J. J. and H. Servaes (1995). "Equity ownership and the two faces of debt." Journal of Financial Economics **39**(1): 131-157.

Miller, M.H. and K. Rock, 1982, Dividend policy under asymmetric information, Unpublished manuscript (University of Chicago, Chicago, IL, and University of Pennsylvania, Philadelphia, PA).

Modigliani, F. and M. H. Miller (1958). "THE COST OF CAPITAL, CORPORATION FINANCE AND THE THEORY OF INVESTMENT." American Economic Review **48**(3): 261.

Murray, Z.F. and Vidhan, K.G., "Trade-Off and pecking order theories of Dent (December8,2007)

Myers, S. C. (1977). "Determinants of corporate borrowing." Journal of Financial Economics **5**(2): 147-175.

Myers, S. C. and N. S. Majluf (1984). "Corporate financing and investment decisions when firms have information that investors do not have." Journal of Financial Economics **13**(2): 187-221.

Myers, S. C. (1984). "The Capital Structure Puzzle." Journal of Finance **39**(3): 575-592.

Ross, S. A. (1977). "The Determination of Financial Structure: The Incentive-Signalling Approach." The Bell Journal of Economics **8**(1): 23-40.

Stein, J. C. (1992). "Convertible bonds as backdoor equity financing." Journal of Financial Economics **32**(1): 3-21.

https://en.wikipedia.org/wiki/Trade-off_theory_of_capital_structure

X. Appendix

1. Pecking order demonstration (Myers, 1984)

Myers demonstrate in his papers that if we aggregate a large number of firms, we can see that there is a real majority that follows the theory of the Pecking order. The first idea behind that theory is that managers want to avoid to be subject of the rules of the capital market. If they choose the external financing, they will have to pay issue costs that can be very high compare to using the cash realized inside of the company. The choice to do or not an external financing depends not only on the issue costs. Indeed, it is also influenced when we have asymmetric information inside a firm. Myers and Majluf (1984) demonstrated it like this :

Demonstration (Myers 1984) :

- N is the amount of dollar we need to raise for a project.
- Y is the NPV of an opportunity project. X is the value of the firm if the project is passed by.

Managers exactly know the value of X and Y but the shareholders do not, therefore we see a joint distribution of value that could be possible (ẋ,ẏ) for them.
The benefit of raising N amount of money should be equal to Y, the NPV of the project.
There is also a risk of possible costs in the case of the new shares sold by the firm are worth less than their real value.

- N_1 is the value of the new shares from the managers point of view , they exactly know the value of the shares.
- ΔN is the amount by which the share is over or undervalued. In fact, managers are worried about the value of the old shareholders shares.

➔ Managers will invest only if $y \geq \Delta N$.
If the information known by the managers is unfavorable, ΔN will be negative and they will issue, even if the project has a NPV equal to 0. Acting this way will be a negative signal for both

new and old shareholders. The contrary can also happen if the inside information is positive, but the firm may decide to ignore this project to avoid the issuance of undervalued shares. In order to avoid that problem, we need to create a new variable called V, the market value of the firm if the last does not issue, or V' if the firm does issue. The value of the new shares just issued is include into the V'. A rational equilibrium would be the following :

$$V = E(\dot{x} \mid no \text{ issue}) = E(\dot{x} \mid y < \Delta N)$$
$$V' = E(\dot{x} + \dot{y} + N \mid issue) = E(\dot{x} + \dot{y} + N \mid y \geq \Delta N$$

Myers makes an assumption that the amount of dollars raised is fix, but not the number of new shares created. He knows that ΔN is endogenous and depends on V'.
If the firms issue , the value of shares for the new stockholders will be equal to N/V'.
From the managers point of view, remind that they have all the information available, the new value of the shares will be :

$$N_1 = \frac{N}{V'} (x + y + N)$$

Myers and Majluf (1984) conclude from that, with a N, x and y given (assumption) and if the firm decide to issue, the greater the price per share (V'), the less value will be received for the new stockholders and the less will be ΔN.
They say that asymmetric information create new costs, due to the fact that firms can choose to do or not a project with a positive NPV. If a firm decides to not undertake this project, it must creates enough internal cash to cover the NPV of the project it rejected.
When a manager has to take a decision about a project, the first thing he has to think about is to choose à project that has $y \geq \Delta N$. The main idea would be to try to reduce the ΔN, knowing that Δ represents the difference (over or undervalued) of shares value caused by the asymmetric information. In order to reduce it, it will issue the safest securities as possible. For example, if a company has to raise 15 million (= N) and issues shares that worth 20 million ($=N_1$), the value must be at least equal to 5 million (= Y). If the value is less than 5 million, for example 4.5 million, the company will not raise the money to undertake the project but the old shareholders will be better off by 0.5 million. When we have a ΔN to important, it means that we are diluting

the value of the existing shares in the firms. When issuing safest securities from the market, the information only known by the manager has less influence when it is revealed to the market.

We can find some examples of debt issuing where the ΔN is equal to 0. When a manager is issuing default risk free debt, there is no risk about the debt. The value of the share should not be over or undervalued. Based on that, every project should generate positive net present value. In a general way, if we take the absolute value of ΔN, it will be always smaller if we decide to issue debt rather than equity. This is why firms prefer debt over equity. This is true if the managers has a favorable information (positive ΔN, underpriced). On the other hand, Myers says that if the information is unfavorable (negative ΔN, overpriced) the firm will probably try to have the larger ΔN as possible to take advantage of new shareholders. Then it should be better off by issuing equity instead of debt.

"*Issue debt when investors undervalue the firm, and equity, or some other risky security, when they overvalue it*." (Myers,1984)

Majluf (1984) identified a major issue with this theory, if a firms issues bonds when the shares value are underpriced and if it issues equity when the shares are overvalued, then why should an investor invest in equity shares ? He already knows that the real value of the share is lower than expected and thus will not buy any equity. The investors force the firms to follow the Pecking order theory even if she do not want to.

2. Conversion terms, Dividends and variance effects.

Conversion terms :

The conversion ratio is a very important determinant of the convertible bonds value. When the conversion ratio is equal to zero, we do not have a convertible bond but a simple straight bond. The higher the conversion rate, the higher will be the value of the convertible bond (Brennan and Schwartz, 1977). This is true only if the firm value is high enough to not face a risk of default. If the firm value is low, the difference in the conversion ratio does not matter, there is a high probability of default and as a consequence, the conversion will not occur. We should also take into account that the date of the first call of the bond as an impact on the value of the convertible.

For high value firms, with no prospect of default, the longer the deferred call period, the higher will be the value of the convertible bond. For example, if we have a convertible bond with a deferred call period of 10 years and another one of 2 years, the value of the latter will be smaller than the former.

Dividends and variance effects :

As explained by Brennan and Schwartz (1977), a high amount of dividend payments reduces the value of the bond. He argued that dividends have two different effects on the convertible bond's value. The straight debt value of the bond is affected due to the increasing probability of default and therefore there are less assets available for bondholders in case of default. The second effect is that when we have a small probability of default, hence a large firm value, the conversion premium is lower. This effect limits the incentive of increasing dividend payments to stockholders because bondholders will converts and take those payments for themselves. The higher the coupon for a convertible, the more likely the bond will be called for refinancing and as a consequence, the shorter will be the life of the bond.

The effect of variance is not very easy to determine. Indeed, when we increase the variance, the value of the convertible can increase or decrease. If the firm value is very low, the variance has no effect on the value of the bond because the firms is expected to default anyway. The bondholder is not expecting to convert his bond. When the value of the firm increases, if we have an higher variances, the probability of default will increase, but at the same time, the prospect of conversion increases and gains from this conversion also. In case of high firm value, we can assume that the debt is closed to a risk free debt, thus *" the convertible bond is equivalent to a riskless straight bond plus a warrant with an exercise price equal to the straight bond value*" (Brennan and Schwartz 1977). We know that warrant value increases with the variances and that this effect is confirmed for high value firms.

3. Lewis Statistics summary (2003)

Table 3
Summary statistics for the convertible issuer's industry 1978–1992

	All issuers (588 observations)		Debt-like issuers (62 observations)		Hedge-like issuers (74 observations)		Equity-like issuers (452 observations)		Kruskal–Wallis
	Mean	Median	Mean	Median	Mean	Median	Mean	Median	*p*-value
Total assets (millions)	273.3	48.1	538.4[a]	53.5	373.7[a,b]	87.5	214.2[b]	42.9	0.0168
Sales	231.3	59.4	308.3[d]	72.2	253.4[d]	99.0	215.3[d]	48.8	0.1047
Market-book	1.150	0.875	0.965[b]	0.706	0.823[b]	0.649	1.234[a]	0.978	0.0001
Earnings-price	0.048	0.043	0.065[a]	0.058	0.072[a]	0.067	0.041[b]	0.037	0.0001
Long-term debt/total assets	0.225	0.168	0.258[d]	0.209	0.232[d]	0.200	0.218[d]	0.158	0.0870
Change in assets	0.245	0.146	0.140[d]	0.085	0.259[d]	0.211	0.259[d]	0.143	0.1893
Slack	0.076	0.063	0.065[d]	0.053	0.076[d]	0.062	0.078[d]	0.063	0.3349
Taxes/total assets	0.005	0.001	0.006[b]	0.002	0.008[a]	0.004	0.004[b]	0.001	0.0001
Net income/total assets	0.036	0.037	0.033[d]	0.035	0.039[d]	0.041	0.035[d]	0.037	0.4105
Volatility	0.028	0.025	0.026[a,b]	0.023	0.025[b]	0.024	0.028[a]	0.026	0.0021
Preissue runup in stock price	8.55%	8.2%	8.8%[d]	8.9%	11.5%[d]	10.4%	8.0%[d]	8.0%	0.2817

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4. Lewis issuing Decision process (Logit Model)

Logit analysis of issuer and issuer's industry characteristics for 588 convertible debt offerings 1978–1992

Independent variables	All issuers (1)		Debt-like issuers (2)		Hedge-like issuers (3)		Equity-like issuers (4)	
	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value
Intercept	−5.395	0.0001***	−6.482	0.0001***	−4.948	0.0001***	−5.868	0.0001***
Market-book	1.373	0.0001***	2.935	0.0001***	2.468	0.0001***	1.121	0.0001***
Net income/total assets	17.108	0.0001***	8.056	0.0344**	8.807	0.0001***	26.869	0.0001***
Change in total assets	−0.336	0.0218**	−1.453	0.0628*	−1.284	0.0161**	−0.175	0.3016
Long-term debt/total assets	3.676	0.0001***	3.789	0.0193**	3.565	0.0138**	4.011	0.0001***
Firm size	0.001	0.0001***	0.001	0.0593*	0.001	0.0084***	0.001	0.0001***
Slack	4.808	0.0001***	11.004	0.0155**	−4.133	0.2979	8.345	0.0001***
Volatility	5.863	0.4443	11.805	0.6627	8.893	0.5864	−9.888	0.4079
Preissue stock price runup	3.360	0.0001***	3.955	0.0562*	2.462	0.1142	3.574	0.0001***
Pseudo-R^2	0.442		0.461		0.435		0.541	
Percentage correct	91.8%		91.4%		91.6%		94.0%	

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5. Lewis two days return regression

WLS estimates of coefficients in cross-sectional regressions of the two-day announcement date excess return on indicated explanatory variables for 588 convertible debt offerings 1978–1992 and sorted by actual security design

Independent variables	All issuers (1)		All issuers (2)		Debt-like issuers (3)		Hedge-like issuers (4)		Equity-like issuers (5)	
	Coefficient ×100	*p*-value	Coefficient ×100	*p*-value	Coefficient ×100	*p*-value	Coefficient ×100	*p*-value	Coefficient ×100	*p*-value
Intercept	−0.825	0.121	−0.796	0.134	−5.497	0.047**	1.317	0.436	−1.118	0.111
Market-book	−0.011	0.963	−0.699	0.106	0.927	0.725	3.124	0.056*	−0.924	0.049**
Market-book × change in asset dummy	–	–	0.864	0.059*	−0.770	0.736	−4.441	0.021**	1.235	0.014**
Net income/total assets	−3.292	0.243	−3.081	0.274	−4.958	0.785**	−7.552	0.329	−5.292	0.170
Change in total assets	0.082	0.780	−0.051	0.865	−1.395	0.414	0.445	0.701	−0.041	0.902
Long-term debt/total assets	−0.619	0.550	−0.647	0.531	−2.290	0.668	− 5.603	0.093*	−0.481	0.676
Firm size	−0.003	0.983	−0.014	0.914	0.245	0.660	−0.560	0.139	0.082	0.586
Slack	3.396	0.052**	3.533	0.043**	18.515	0.018**	−14.598	0.181	3.277	0.081*
Volatility	2.995	0.708	4.788	0.551	117.887	0.044**	−10.872	0.467	5.688	0.769
Issue size	0.299	0.804	0.085	0.927	−2.051	0.770	1.448	0.720	0.349	0.735
Preissue runup in stock price	−5.340	0.013**	−4.991	0.020***	−0.894	0.912	−18.307	0.005***	−3.334	0.174
Preissue runup in market	1.460	0.131	1.233	0.204	3.538	0.613	8.406	0.035**	0.567	0.598
Adjusted R^2	0.0119		0.0174		0.1419		0.1229		0.0102	

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6. Statistics Summary of the Data's sample

Sectors	Technology		Healthcare		Oil and gas	
	Average	Median	Average	Median	Average	Median
LT Debt / E	764.442057	15.78645	122.295642	82.7727	83.5615333	86.2737
P/E	31.2392067	19.2312	536.871667	75.0928	21.6111615	17.6882
WACC	10.1810333	10.55075	7.55182857	7.76295	7.43259231	7.1185
ROE	-3.92463571	14.2577	-16.7654909	6.3184	-2.923225	-0.32645
Asset turnover	0.58721333	0.6128	0.42940833	0.36335	0.32876667	0.24505
Market cap (B)	33.1204859	2.6883	31.5603801	13.9191647	12.0058804	5.37943985
Capex / depreciation	1.47588182	1.4019	2.9916	1.9016	40.7818857	3.9964
R&D expenses to net sales	14.2549813	13.2974	4122.33868	31.761	1.36621111	0.00000
Cash / total assets	21.6735067	11.4746	27.9709083	13.61325	7.336975	1.42015
Price to book ratio	8.13811176	3.0799	22.01217	7.4059	1.38075714	1.17565
Net profit margin %	5.5596	12.302	-6607.79238	2.8658	-20.0465308	-1.6422

7. Probability of conversion Formula

$$d_2 = \frac{\ln\left(\frac{S}{X}\right) + \left(r - div - \frac{\sigma^2}{2}\right)T}{\sigma\sqrt{T}}$$

S is the current stock price; X is the conversion price; r is the continuously compounded yield for a 10 year treasury bond on the issuance date; div is the dividend yield continuously compounded taken on the fiscal year-end before the year of issuance; σ is the standard deviation of the common equity return computed on the period -240 to -40 trading days before the issuance; T is the number of years remaining until maturity of the convertible bond.

8. Probability of conversion computation-results

	Date of announcement	Year of announcement	Maturity	Today date	S	X	r	r continious div		Sigma	T	ln(S/X)	(r-div-sigma sq/2))*T	Sigma* Root	D2	N(d2)	Proba of conversion	
EMC	14-nov-06 repurchase	2006	Expire															
INTC	21-juil-09 repurchase	2009	01-08-39	29-03-16	31.72	22.68	3.50%	3.440%	3.98%	0.5922314	23.356164	1.39858907	-4.20805716	2.8621487	-0.981594	0.163149943	16%	Debt like
SNDK	24-oct-13 repurchase	2013	15-10-20	29-03-16	75.83	92.19	2.53%	2.499%	1.28%	0.2739951	4.5506849	0.82254041	-0.11393395	0.5844955	1.2123385	0.887308592	89%	Equity like
SYNA	01-12-04 no	2004	01-01-24	29-03-16	73.09	50.53	4.38%	4.287%	0%	0.6729155	7.7643836	1.44646745	-1.417835693	1.875055	0.0152698	0.50609154	51%	Hedge like
XLNX	03-06-10 repurchase	2010	01-06-17	29-03-16	47.04	30.29	3.39%	3.334%	2.52%	0.2805884	1.1753425	1.55298778	-0.036041773	0.3041948	4.9867578	0.999999693	100%	Equity like
EQIX	21-09-07 no	2007	Expire	29-03-16														
NTAP	03-06-08 repurchase	2008	expire	29-03-16														
VRSN	14-08-07 repurchase	2007	01-01-37	29-03-16	89.03	28.64	4.73%	4.622%	1.76%	0.280482	20.775342	3.10858939	-0.200171911	1.2784362	2.2749805	0.98854645	99%	Equity like
YHOO	19-11-13 repurhcase	2013	01-12-18	29-03-16	738.84	53.43	2.71%	2.674%	0%	0.2747704	2.6767123	13.8281864	-0.028505348	0.4495426	30.697163	1	100%	Equity like
NVDA	25-11-13 repurchase	2013	01-12-18	29-03-16	34.9	20.16	2.74%	2.703%	2.46%	0.2070339	2.6767123	1.73115079	-0.049871211	0.3387211	4.9636098	0.999999654	100%	Equity like
LNKD	04-11-14 no	2014	01-11-19	29-03-16	108.68	294.54	2.35%	2.323%	0%	0.4187041	3.5945205	0.36898214	-0.230612013	0.7938303	0.1743069	0.569187879	57%	Hedge like
MCHP	04-02-15 no	2015	15-02-25	29-03-16	48.81	68.66	1.81%	1.794%	3.12%	0.2454197	8.890411	0.71089426	-0.384202715	0.7317627	0.4464447	0.672361957	67%	Equity like
MU	05-02-13 no	2013	01-01-31	29-03-16	10.45	18	1.83%	1.813%	0%	0.4275385	14.769863	0.58055556	-1.079596971	1.643098	-0.3037198	0.380670679	38%	Debt like
LRCX	16-05-01 no	2001	01-05-19	29-03-16	81.94	63.02	5.48%	5.335%	0%	0.9422248	3.090411	1.30022215	-1.202459687	1.6563902	0.0590214	0.523532468	52%	Hedge like
MSFT	08-06-10 no	2010	Expire	29-03-16														
ACT (AGN)	06-04-06 no	2006	01-01-26	29-03-16	273.52	105.55	4.90%	4.784%	0.33%	0.1949067	9.7671233	2.59137849	0.26083773	0.6091302	4.6824409	0.999998583	100%	Equity like
TEVA	16-01-04 no	2004	01-01-24	29-03-16	54.95	75.81	4.04%	3.961%	0%	0.2970279	7.7643836	0.72483841	-0.0288274	0.8276575	0.8409408	0.799809458	80%	Equity like
GILD	26-07-10 repurchase	2010	01-05-16	29-03-16	92.2	45.41	3.03%	2.985%	1.52%	0.2606815	0.090411	2.03038978	-0.001706726	0.0783828	25.881738	1	100%	Equity like
HOLX	03-12-07 no	2007	01-01-37	29-03-16	34.5	77.1875	3.89%	3.816%	0%	0.3261911	20.775342	0.44696356	-0.297094066	1.4867783	0.1008015	0.540145985	54%	Hedge like
INCY	06-11-13 no	2013	15-11-20	29-03-16	69.25	51.76	2.67%	2.635%	0%	0.5598752	4.6356164	1.33790572	-0.602769713	1.2054382	0.6098496	0.729019273	73%	Equity like
BMRN	07-10-13 no	2013	15-07-20	29-03-16	78.76	94.15	2.65%	2.615%	0%	0.4684568	4.2986301	0.83653744	-0.357757398	0.971258	0.4929483	0.688975455	69%	Equity like
ISIS	10-11-14 no	2014	15-11-23	29-03-16	57.567	68.81	2.38%	2.352%	0%	0.6254916	7.6356164	0.83660805	-1.311950821	1.7283972	-0.2750194	0.391650667	39%	Debt like
TSRO	22-09-14 no	2014	01-10-21	29-03-16	45.73	35.13	2.57%	2.538%	0%	0.7264386	5.5123288	1.30173641	-1.312797224	1.705558	-0.0064852	0.497412814	50%	Hedge like
VRTX	10-02-04 no	2004	Expire	29-03-16														
REGN	17-10-11 no	2011	01-10-16	29-03-16	367.37	84.02	2.19%	2.166%	0%	0.6175214	0.509589	4.37241133	-0.086001473	0.4408208	9.7237023	1	100%	Equity like
NEM	10-07-07 no	2007	15-07-17	29-03-16	26.95	46.21	5.16%	5.031%	0.88%	0.2576225	1.2958904	0.5832071	0.012460404	0.2932702	2.0311218	0.97887868	98%	Equity like
PDCE	17-11-10 no	2010	15-12-16	29-03-16	59.29	42.4	2.89%	2.849%	0%	0.5113764	0.7150685	1.39834906	-0.072831804	0.4324287	3.0652852	0.998912687	100%	Equity like
SWC	11-10-12 no	2012	15-10-32	29-03-16	10.91	16.53	1.70%	1.686%	0%	31.10539	16.558904	0.6600121	-8010.463507	126.57602	-63.280574	0.00	0%	Debt Like
D	04-12-03 no	2011	15-12-23	29-03-16	74.64	88.32	4.23%	4.143%	5.14%	0.1859121	7.7178082	0.8451087	-0.203608605	0.5164815	1.2420583	0.892892476	89%	Equity like
JASO	12-08-08 no	2008	Expire	29-03-16														

9. Mayers (1998) Summary statistics between convertible issuers and non convertible issuers

Table 3
Summary statistics comparing characteristics of firms calling convertible bonds during the period 1971–1990 with matching industry medians

	Calling firms mean/ median	*N*	Matching industry mean/ median	*N*	Two-sample test *p*-values	
					t-test	Wilcoxon
Equity capitalization ($ millions)	613.9/224.2	289	198.6/38.8	250	0.0001	0.0001
Total assets ($ millions)	1739.1/346.9	289	460.5/40.8	279	0.0001	0.0001
Leverage (LTD/Equity)	0.94/0.47	286	0.53/0.30	248	0.0001	0.0012
Convertible debt/total debt	0.30/0.23	263	0.01/0.00	238	0.0001	0.0001
Total convertible/total debt preferred	0.31/0.24	261	0.01/0.00	238	0.0001	0.0001
Market/book of equity	2.12/1.60	289	1.64/1.40	250	0.0090	0.0002
R&D/sales	0.03/0.02	119	0.04/0.01	224	0.1842	0.0986
Tangible/total assets	0.97/0.99	228	0.99/1.00	250	0.0001	0.0001