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Debt overhang and return for investors: an inter-sector analysis

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Executive Summary

In this master thesis, we analysed companies' return in the US according to their leverage (debt to equity) ratio, in order to try determining to which extent the financial distress and debt overhang risk come under consideration for investors.

As from the S&P 1500 index, we divided our stock sample into 6 portfolios by sorting them firstly in two groups according to size (market capitalization) and further these two groups into three groups according to companies' leverage ratio. Next, we applied this method for each economic sector of our sample.

Our main results suggest that return decreases when leverage increases which is contrary to our initial expectation that the investor is supposed to be remunerated for the risk he bears and that investing in a highly leveraged company involves more risk than investing in a low-leveraged company. As a consequence of these results, low leveraged companies yield a higher return than more leveraged companies.

Then, we tried to determine whether this "over-performance" of low leveraged companies is due to differences in exposure to systematic risks. We regressed our annual excess returns (in excess of the one-year U.S. risk free rate) by using the same explanatory variables than those used in the literature and especially the three variables of the Fama & French three-factor model, namely the equity market risk (ERP), the size factor (SMB) and the value factor (HML). When comparing the risk exposure for these three factors among our portfolios, we observed that low leverage portfolios have more exposure to the SMB factor and that high leverage portfolios have higher loadings for HML than low leverage portfolios.

Our findings suggest that leverage ratio is an interesting variable to consider for investors.

Foreword

I would like to sincerely thank the people who helped me and supported me throughout this writing.

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Contents

List of Tables

List of Figures

Introduction

Issue and context/Motivations

Managerial Motivations

Debt overhang, a situation where a company has an excess of debt in its capital structure, causes a company to forgo new investments. The business magnate Warren Buffett warns against the accumulation of debt:

> *"I do not like debt and do not like to invest in companies that have too much debt..."*
>
> Warren Buffett (2010), in its annual letter to shareholders.

Literature is plentiful of models and studies on the importance of measures/metrics such as company's book value (residual income model), earnings and cash flows such as DDM (Gordon and Shapiro), DCF, "P/E model" (Gordon Growth Model[1]). In this respect, as Benjamin Graham emphasises:

> *"In the area of near-term selectivity, the current year's results of the company are generally common property on Wall Street; next year's results, to the extent they are predictable, are already being carefully considered. Hence the investor who selects issues chiefly on the basis of this year's superior results, or on what he is told he may expect for next year, is likely to find that others have done the same thing for the same reason".*
>
> B. Graham (1949), *The Intelligent Investor*, p. 31.

However, a stock' debt level (leverage ratio) related to its sector is less considered.

In this master thesis, starting from a sample of 1 203 companies, we create portfolios of companies selected according to their leverage ratio and we compare their stock price performance over a period of 25 years. The aim is to verify if debt level is an important variable for the investor in the same way as level of cash flows and price earnings ratio are.

[1] Pinto, Henry, Robinson, Stowe, and Cohen (2010).

We also want to know if it is more interesting to invest in the most leveraged or the least leveraged companies.

Our objective is to define what is the best choice for investors regarding the companies' returns according to the clustering of their debt levels. Although theories of optimal capital structure are extensive and well developed in the literature, debt overhang is not the focus of investors' attention while it should be brought into focus.

We also decide to have a deeper look by distinguishing the sectors of the economy as it is more relevant to compare debt equity ratios from companies belonging to the same sector.

Scientific Motivations

Models known in the literature like the one of Fama and French (1993) do not use the leverage variable, but we estimate that it is very important and is not reflected (at least not entirely) in the three factors.

We want to build portfolios constructed on the same way than those of Fama and French except that we want to analyse the debt to equity ("D/E") ratio instead of the book to market ratio.

Thesis' breakdown

In this first part, we present the main theories and concepts that will be necessary to grasp the meaning of the empirical work, including the optimal leverage ratio the companies should have according to theory. In concrete terms, we do a literature overview about the different theories of capital structure. Then, we present the advantages and disadvantages of debt and the incentives to reach the optimal D/E ratio. We also touch upon the following concepts: situations of financial distress, liquidation and bankruptcy. We also talk about the conflicts of interests that could arise between the different stakeholders, especially the debtholders and the shareholders but also the managers.

In Chapter 2, we define the concept of debt overhang and represent it graphically. Next, we talk about the consequences of debt overhang, the notion of equity buffer and the seniority structure between shareholders and the different types of debtholders.

In Chapter 3, we adopt an intra-sector perspective and try to understand how companies decide on their leverage ratio. In brief, companies tend to replicate the leverage strategies

of their peers and leverage ratios depend on the bankers' perceptions towards sectors, and more specifically, the cyclicality of the business.

The second part is the practical part. In Chapter 4, we develop the research objective: we analyse stock returns according to the company's leverage level. More specifically, we examine whether portfolios of highly leveraged stocks (likely to be in situation or close to debt overhang) outperform portfolios of low leveraged stocks taking into account the exposure to systematic risk factors. And we also present the different practical implications for investors that we hope to draw from our analysis.

Then, we explain the methodology we used: we have two strategies which are to invest in the companies the most and the least leveraged. We examine if their behaviours in terms of returns differ while taking into account the exposure to the systematic risks according to the three-factor model of Fama and French (1993). We also explain how we obtained our data and how we got together 5 groups of sectors starting from 10 sectors.

In Chapter 5, we present our main returns. We have two sections: the raw returns and the returns adjusted for risk. In these two sections, we split the results for the whole sample and for individual sectors.

In Chapter 6, we perform successfully statistical tests to analyse the relevance of our data and to check if our regressions do not suffer from any statistical problem that could impede their interpretation.

In Chapter 7, we present our limitations and weaknesses and share as well suggestions for future research.

Part I

Literature review about optimal capital structure and debt overhang

1 Optimal leverage ratio

The investor is remunerated for the risk he bears. Because the risk is higher for a shareholder than a bondholder, debt financing for a company is cheaper than equity financing. From the firm's perspective, levering up might increase firm value because there are market frictions[1]. Here, the market friction is the informational asymmetry: debtholders besides being in a safer position in case of company's default, have additional information on the firm than shareholders do have. The latter face more uncertainty as they do not know all the internal firm' projects and as a consequence underprice the company, or to put it another way ask a higher return.

Also, when leverage – computed as total outstanding debt on total shareholder's equity – increases, financial interests grow. When they become too large, it can lead to bankruptcy due to costs of financial distress (D'Mello & Farhat, 2008).

When debt financing increases, the eventuality of having more earnings increases too compared to the initial situation. Indeed, this capital can be used to finance new projects that eventually yield a return. If the new incomes generated in this way outweigh the interests on debt, shareholders could end up better off. On the other hand, if the new projects created through the increased use of debt do not generate enough return to offset the increased costs on the higher debt level, shareholders value may be adversely impacted. Also, if a profitable company levers up, she can enjoy tax shield gains.

A middle ground has to be found and the quantity of debt relative to the equity value must be dealt with cautiously otherwise it can lead a firm to bankruptcy.

We can sum up this introduction by saying that the leverage effect allows to create value (by the tax shield gain) but at a certain cost: the interests paid on debt increase hand in hand with the debt level.

[1]Examples of market frictions are taxes, transactions costs, agency problems, asymmetry of information.

1.1 The foundations of modern capital structure theory

In the Modigliani and Miller world (Modigliani & Miller, 1958), capital structure is irrelevant because it has no influence on firm value. The only consequence of capital structure is that it splits up cash flows between shareholders and debtholders.

In 1958, Modigliani's and Miller's "Capital Structure Irrelevance" Theorem, which shows that in a frictionless world, the capital structure of a firm is independent of its value, became a fundamental cornerstone of Corporate Finance. According to the MM-Theorem I, increasing equity leaves the total funding costs unchanged, as an increase in the amount of equity simply redistributes the total risk of the firm and therefore lowers the required return on equity and debt. Therewith, the MM-Theorem I proposes that, absent any frictions, the choice between equity and debt financing is irrelevant to the firm value.

In such a hypothetical market, some assumptions are given. There are no arbitrage opportunities and there is perfect competition: "investors and firms can trade the same set of securities at competitive market prices equal to the present value of their future cash flows" (Berk & DeMarzo, 2007, p. 483). We cannot gain from the imperfections of the market: the market price reveals the company price. Transaction costs are non-existent. It is useless to resort to tax optimization as there is no taxation. There is symmetry of information between insiders and outsiders (managers and investors). The market is liquid with a great number of buyers and sellers. The market is depth: it is characterised by the fact that it can absorb any quantity of transactions without changing the price of the stock; which is not true in reality. Finally, "a firm's financing decisions do not change the cash flows generated by its investments, nor do they reveal new information about them" (Berk & DeMarzo, 2007, p. 483).

In reality, capital markets are not perfect and there are many market frictions. One of them is informational asymmetry. One way to mitigate this market friction is to use capital structure as a signal for outside investors. That way, the manager gives a signal to the market about the quality of its company.

1.2 Trade-off theories (static/dynamic) and pecking-order theory

The trade-off theory, first introduced by Myers (1977) among others, is an essential theory of capital structure stating that a company offsets the benefits of debt capital with the costs of financial distress when deciding on the optimal leverage ratio. At this optimum, the enterprise value is maximised as taking on more debt would increase both risk and cost of debt and reducing the amount of debt would lower the amount of tax shield. This means that the more a company moves away from this optimum, the greater is its incentive to drive its leverage ratio towards the optimal leverage (D'Mello & Farhat, 2008).

Underneath, you can see a graphical representation of the trade-off theory from Shyam-Sunder and Myers (1999)[2].

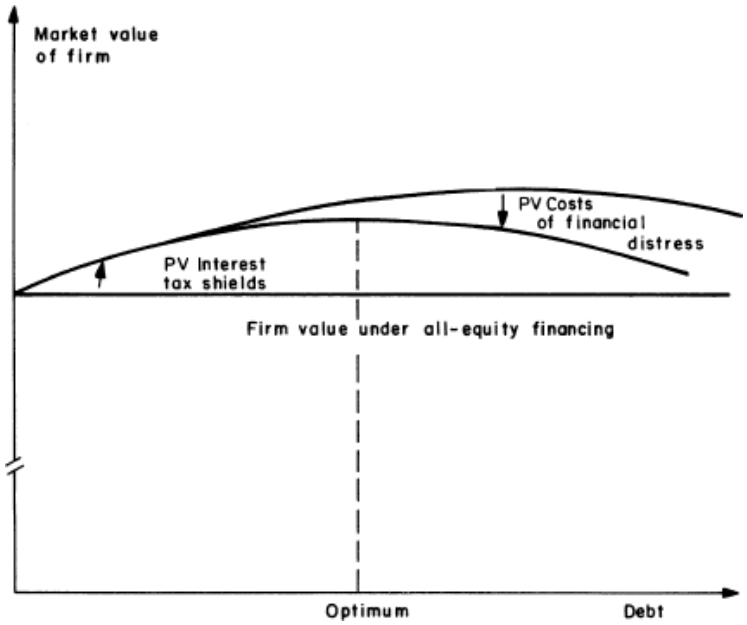

Figure 1.1: Graphical representation of the trade-off theory by Shyam-Sunder and Myers (1999); original title: "The static trade-off theory of optimal capital structure assumes that firms balance the marginal present values of interest tax shields against the costs of financial distress" (Shyam-Sunder & Myers, 1999, p. 220)

Parrino and Weisbach (1999) go along with this view. For them, the optimal ratio is reached when the marginal increase in the cost of debt is balanced with the marginal gain of tax shield.

We can express this theory by this formula[3]:

[2]This graph has first been drawn in Myers and Majluf (1984).
[3]Brealey, Myers, and Allen (2010, p. 447)

Firm's value = value if all equity financed + PV tax shield − PV costs of financial distress

But the trade-off theory is not the only one theory. Other theories exist and claim that there is no optimal capital structure. One of them says that "market timing financing decisions just accumulate over time into the capital structure outcome" (Baker & Wurgler, 2002, p. 29). The authors support the fact that companies "buy back equity when their market value is low and issue equity when their market value is high" (Baker & Wurgler, 2002, p. 1) and suggest that these repeated operations are lasting and form the current market value. Von Nitzsch and Rouette also support this theory[4].

We can link the Baker and Wurgler theory with the signalling theory[5] concerning capital structure. Operations like issue of debt or equity have a specific purpose and happen in a specific context. Indeed, issuing equity will be perceived as a bad signal of the quality of the company unlike the issue of debt which will be positively perceived. Equity is issued if something bad will happen and so losses will be split with somebody else. On the contrary, debt is issued if something good will happen.

This signalling theory can be linked to the market for "Lemons" (Akerlof, 1970). It originates from the car second-hand market in which the buyer does not know if he buys a bad car or a good car, and so gives an average price. In order to avoid a discount, the seller has to send signals of the quality of the car. As a conclusion, voluntary disclosure can prevent the problem.

The lemons-problem relates to the valuation of companies. Entrepreneurs with bad ideas will try to claim that their ideas are as valuable as the good ideas. The consequence of lemons-problem is that investors value both good and bad ideas at an average level. They will apply a discount when valuating companies. The good entrepreneurs get penalized and leave the market, increasing the volume of bad ideas. Over time, investors lose confidence in this market.

Harris and Raviv (1991) made an overview of different subjects which have been confirmed or not empirically and so until 1990. The second subject they talk about is asymmetric information. What matters for us here is not the concept of asymmetric information but rather the solution provided to circumvent this issue, which is the pecking-order theory. Asymmetric information is a friction in the capital market that, as said above, results in the underpricing of the company by new investors. To avoid this underpricing, the solution

[4]Von Nitzsch and Rouette quoted by Talberg, Winge, Frydenberg, and Westgaard (2008)

[5]If you want more information about this subject, you can refer to Myers and Majluf (1984), Morris (1987) and Bayless and Chaplinsky (1996).

is to follow the logics described by Myers (quoted in Harris and Raviv (1991)) concerning pecking order theory. This theory asserts that when a firm need to finance a project, it will issue equity as last resort after having used retained earnings and having issued low-risk debt which are both low-informational sensitive securities. The actual shareholders prefer to renounce for the new project even with a positive net present value (NPV) value rather than issuing new equity with such a discount that it implies a loss for them.

In this respect, Shyam-Sunder and Myers (1999) back up the pecking-order theory and affirm that there exists no optimal debt ratio in it.

Before finishing this section, we present the distinction made between the static and dynamic trade-off theory put forward by Heider and Ljungqvist in 2015. The reason is that it broaches the subject of conflict of interest between shareholders and debtholders that will be presented in the next section.

In order to differentiate the static trade-off theory from the dynamic trade-off theory, Heider and Ljungqvist estimate the tax sensitivity of leverage following US states tax changes. They indicate that when tax rise, companies increase their leverage but do not following tax decreases. Their purpose is to "empirically quantifying the tax sensitivity of firm's debt policies and evaluating which class of trade-off model" works best (Heider & Ljungqvist, 2015, p. 1). In their paper, they explain both theories.

Static trade-off theory is about finding the optimal debt level by balancing the benefit of tax shield and the expected cost of default. In the static trade-off framework, the optimal response to tax changes is symmetric: "when tax rates fall, the marginal cost exceeds the marginal benefit" because as tax shield is reduced, it is now less interesting to have debt. In this case, "firm value would be higher if it had less debt" and so the company will lever down (Heider & Ljungqvist, 2015, p. 2). In any cases, the shareholders are the one who benefit from these firm's value increases (Jensen & Meckling, 1976). Shareholders have an unlimited increase potential: if leverage allows to increase return, the shareholders are the ones who take advantage of the firm value increase which is made possible by the cash flows' increase.

Unlike the static theory, in the dynamic theory, debtholders and shareholders are not aligned at a certain point which results in a conflict of interests. Following a tax rate decrease, shareholders will not decide to decrease leverage even though the marginal cost of default outweighs the marginal tax shield benefit. The reason is that if leverage decreases, the firm value increases (due to the rebalancing of benefit and cost of debt) but the whole

benefits go to the debtholders while the shareholders support the effort (they bear the risk). According to Heider and Ljungqvist (2015), decreasing leverage trims shareholders' option to default[6].

To put in another way, a firm has issued debt that obliges it to make a series of payments to bondholders. Shareholders have the option to default on these repayments in which case the bondholders take ownership of the firm's assets. Thus if the shareholders decide to reduce leverage following a tax rate decrease, the option's strike price that shareholders have on debt will decrease as quantity of debt is lower. And this loss for shareholders is a gain for debtholders.

In dynamic trade off models, firms respond asymmetrically to tax changes. Firm value might not be maximized due to conflict of interest. There are two reasons for this asymmetric behaviour: first, the free riding among existing debtholders: if a company deleverages due to tax decrease, the company repurchases debt. Why should any debtholder will give his shares if after the operation they are higher valued? Second, the shareholder's option to default which has been explained above.

It is not profitable for shareholders to decrease leverage if tax falls because the benefits go to the debtholders. Shareholders have "no incentive to reduce leverage: they do not internalize the benefit of debt reductions (lower expected bankruptcy costs) that accrues to debtholders" (Heider & Ljungqvist, 2015, p. 4). If you decrease leverage, firm value would increase but the proceeds would go to the debtholders, so shareholders will never decide that. Firm value increases due to the trade-off between the probability of default and the gain from tax shield[7]. If your cost associated to the probability of default is higher than tax shield, you decrease leverage and firm value increases. In other words, given the lower tax rate, the gain from tax shield becomes less valuable and smaller than the cost associated to the probability of default if we remain at the actual leverage.

[6]The debts of the company are zero coupon bonds. At maturity, shareholders what can they do? Debt value is the strike price of that option. Shareholder's option to default is the fact that shareholders have a put option on the company and the higher the strike price of the put option, the more valued it is.

[7]We note that unlike profitable firms, loss-making firms do not borrow more in response to tax rises: loss-making firms have no profits to shield from taxes.

1.3 Conflict of interest between debtholders and shareholders

Merton refers to the fact that once debt is in place, a conflict of interest between equity holders and debtholders gives shareholders an incentive to engage in excessive risk taking, since any downside risk is borne by creditors only, whereas shareholders gain from the upside potential (Merton, 1977).

We can find conflict of interest between these two stakeholders in a lot of scenarios. As with the dynamic trade-off theory, a conflict of interest exists between shareholders and debtholders when there is a debt overhang. As a consequence of this conflict, shareholders might forgo positive NPV projects.

Parrino and Weisbach (1999) say that managers for the sake of pleasing shareholders, will tend to invest in projects where stockholders' wealth is maximized regardless of the potential negative effect on firm value.

The solution to reduce this conflict of interest is simply to use less debt in the capital structure because if we use less debt, the chance to come to an extreme conflict of interest is reduced.

In the shareholders-lenders relationship, it is not that much at issue to listen to each other. Both parties have their own rights and lenders must make sure to have well negotiated the indenture to end up with enough rights. But in the end, both parties strive for their own interest and in some circumstances, there can have a huge conflict of interest for some decisions.

"The distortion from stockholder-bondholder conflicts can be represented as the difference between the minimum rate of return for the project to be in the interest of stockholders and the minimum rate of return for the project to have a zero NPV" (Parrino & Weisbach, 1999, p. 5).

The authors also argue that there are low debt levels in American corporations because the costs of agency (of debt) counterbalance the benefits of the tax shield making the latter not that interesting.

Parrino and Weisbach also explain the underinvestment problem and the overinvestment problem in this context of conflict of interest. Underinvestment and overinvestment both harm firm value. Managers will be inclined to favour projects which are beneficial to

shareholders and to neglect projects bringing in money for debtholders but being detrimental to shareholders' value.

In this way, managers will accept projects whose shareholders' gain is weaker than the loss incurred by debtholders. In total, firm value will be lower. This situation represents an overinvestment problem.

On the contrary, managers will refuse projects which are profitable for the firm and whose lenders' gain is greater than the shareholders' loss. This case represents an underinvestment problem (Parrino & Weisbach, 1999).

For Zhang (1998), it is recommended to avoid a capital structure with only equity as the company misses out the advantage of the tax shield and as a consequence lowers firm value. In order to minimise an underinvestment problem, it is desirable to have a mixed capital structure.

1.3.1 Agency relationship

The shareholder-manager relationship refers to the agency relationship.

An agency relationship is a contract under which the principal (the shareholders) engage an agent (the management) and delegate him some decision-making power.

The principal watches and control the agent through provisions in the indenture contract to prevent him from doing actions that could be detrimental to shareholders[8]. These clauses can for instance limit future debt issues or restrain dividends payment. These provisions have a cost but are born by the company at the moment they sell their claims (Jensen & Meckling, 1976).

This agency problem is linked to the separation of ownership and control and to asymmetry of information. Shareholders do not have the ability to rule a firm neither to yield an income on their funds; the manager does not have the funds and needs money to keep the firm running (Shleifer & Vishny, 1997).

The potential conflicts that could arise between the manager and the equity holders will depend on the size of his shares. The biggest the portion of shares he owns, the bigger will be his efforts to invest in the firm (Jensen & Meckling, 1976).

In the context of agency costs, Harris and Raviv (1991) imagine two scenarios. In the first

[8] Also look at Berk, DeMarzo, and Harford (2013).

scenario, there is a conflict between managers and shareholders because managers do not own 100% of the residual claim[9]. The solution is to increase debt financing because the number of shares that shareholders own compared to the manager will be proportionally lower. In the second scenario, there is a conflict between debtholders and shareholders. Here it is assumed that shareholders invest sub-optimally. It is stated in the debtholders' contract that in the event of large returns exceeding the face value of debt, shareholders capture most of these benefits. But if the project turns bad, debtholders bear the costs and the value of debt decreases. Therefore, there is more to win than to lose when shareholders invest in new projects including risky projects with poor returns.

The authors conclude by saying that debt constraints the managers' leeway as it forces them to have unencumbered cash to honour debt contract and consequently prevents them from paying themselves private benefits.

However, if debtholders anticipate future equity holders' behaviour when debt is issued, the latter bear the costs.

1.4 Benefits and drawbacks of debt: trade-off tax shield against costs of financial distress

In this section, pros and cons of the use of debt in the capital structure will be given. We will use the terminology and definitions of Berk and DeMarzo (2007) for listing the disadvantages and advantages of the use of debt.

1.4.1 Disadvantages of debt

When a company has both forms of capital in its structure, a conflict of interest may exist if investment decisions impact on an unequal way the value of the debt and the value of the equity. In some cases, the manager may act in the interests of the shareholders who will benefit from it at the expense of debtholders and to the detriment of firm value. The reason is that most of the time, managers hold a large portion of shares and are hired from the board of directors, which itself is chosen from the shareholders (Berk & DeMarzo, 2007).

[9]The residual claims are what the owners can claim for on the company's assets after the bondholders and preferred shareholders have been paid in case of bankruptcy.

When referring to disadvantages of debt, we are commonly talking about agency costs of leverage. There exist many of them.

One cost of leverage is the "**excessive risk-taking and asset substitution**: shareholders can gain by making negative-NPV investments or decisions that sufficiently increase the firm's risk" (Berk & DeMarzo, 2007, p. 573). If the firm is so leveraged that the value of the assets in place is lower than the face value of the debt, shareholders may decide to take risks with debtholder's money by replacing "low-risk assets with riskier ones"[10] because they have more chance to win than to lose in investing in a risky project. The outcomes of this strategy can either be very harmful for debtholders or on the contrary can generate a return for shareholders in addition to paying back the loan on the debt. From the debtholders' perspective, it is not advantageous to them at all as the company exposing itself to more risk put lenders' safety at risk and on the other hand cannot gain anything given that their loan's repayment rate is fixed beforehand and does not change. This scenario may seem worthwhile for shareholders but it reduces firm value.

When entering into the capital, debtholders will anticipate these contingencies by applying a discount which is not a good thing for the company. This situation can cause over-investment.

Another disadvantage is **debt overhang and under-investment**. In context of near financial distress, "shareholders may be unwilling to finance new, positive-NPV projects" (Berk & DeMarzo, 2007, p. 573) for the firm. The reason is that most of the benefits will accrue to the debtholders while the former will have to pay for the project. Because of this behaviour, the firm can forget perspectives of a better horizon which would have made possible with profitable future growth opportunities. This situation can therefore be considered as an agency cost of leverage which emerged from the divergence of interests between stakeholders.

To have an idea of the magnitude of debt overhang, Berk and DeMarzo affirm that in order to get the project accepted, a NPV higher than 0 is not enough, "the project's profitability index (NPV/I)"[11] must be greater than a cut-off equal to the riskiness of the debt times the ratio of leverage debt on equity. Once again, the project with a NPV higher than 0 would be profitable for the firm, but for the shareholders, it is not enough. This leads to under-investment.

[10] Berk and DeMarzo (2007, p. 554).
[11] Berk and DeMarzo (2007, p. 556).

Another downside is **cashing out**: again in context of financial distress, the situation is very uncertain for shareholders. If things get worse, the debtholders can take possession of the firm leaving nothing for the shareholders. The latter could therefore be tempted to pay themselves dividends to have something and this at the expense of the survival of the firm and in spite of financial fallout for lenders. "Shareholders have an incentive to liquidate assets at prices below their market values and distribute the proceeds as a dividend" (Berk & DeMarzo, 2007, p. 573).

One more disadvantage is the following: "when a firm has existing debt, debt overhang leads to a **leverage ratchet effect**"[12]: equity holders may be tempted to lever up no matter the adverse impact on firm value. On the other hand, despite potential financial benefits for the firm, they will not be motivated to lever down by putting some money in since they estimate the risk too large. In this respect, we can make the connection with the dynamic trade-off model described in Chapter 1.2.

Given these disadvantages that could lead us to think that shareholders are the bad guys, we have to remember that ultimately the shareholders are the ones who lose everything when the firm goes bankrupt due to the seniority and priority rule[13]. This rule specifies the order of repayment between stakeholders. Usually, the typical order is that senior creditors are paid first, then junior creditors and finally shareholders[14]. Once a firm files for bankruptcy, "banks and other creditors gain influence on firm decisions, as control rights are triggered by default" (Ayotte, Hotchkiss, & Thomburn, 2013, p. 2). Normally priority rule among creditors is applied. The court has to approve the adjudication because sometimes the distributions are not fair. The seniority and priority rule aims to protect creditors when the firm is liquidated.

Van Binsbergen, Graham, and Yang "find that the cost of being overlevered is asymmetrically higher than the cost of being underlevered and that expected default costs constitute approximately half of the total ex ante cost of debt" (van Binsbergen, Graham, & Yang, 2010, p. 2089).

All these cons of leverage depend on the level of leverage and debt maturity. Indeed, the higher is the leverage, the higher will be the agency costs. As for debt maturity, a short-term debt or a debt that becomes due puts constraints on firm's liquidity to reimburse and decreases the flexibility of shareholders to launch new risky projects or to pay themselves

[12]Berk and DeMarzo (2007, p. 574).
[13]It is decided when the firm goes bankrupt but materialises only if the company is liquidated.
[14]For more information, please refer to Chapter 2.3.1.

dividends (Berk & DeMarzo, 2007).

Keep in mind that all of these issues for debtholders can in some way be controlled through the covenants that are agreed on at the moment of contracting a loan. Debtholders can decide on contingencies in the contract that limit the freedom in the shareholders' and managers' actions who would act in harmful ways for the money-lenders. The inconvenient of these covenants is that they can avoid positive NPV projects to happen (Berk & DeMarzo, 2007).

1.4.1.1 Importance of the covenants: case study

It emerged from Fagron[15] 2015 year-end results[16] that they diverged in an immoderate way from their optimal D/E ratio and breached covenants that were agreed with their lenders. Therefore, the debtholders took ownership and ordered the company to take actions to return to normal situation. It ended up with a balancing of their leverage ratio which has been thought well of by the market as the cost of financial distress became too large.

1.4.2 Advantages of debt

But having debt in its capital structure does not involve only drawbacks. Three agency benefits of leverage are given here.

The first agency benefit is **increased ownership concentration**.

Large investors reduce agency problems because they can monitor the management, and put pressure on them through voting control (Edmans, 2014).

For the sake of argument, let us imagine the following simplistic framework. The Company 1 has 100 of equity and a debt of 0 and counts four shareholders (A, B, C and D) who each own 25% of shares. The Company 2 has 50 of equity and 50 of debt with this time two shareholders (G and F) who now each own 50% of shares. The second company will be considered better run and have a better return due to the more efficient management which is overseen by debtholders; but at the expense of a higher risk. Indeed, it runs the risk of not being able to pay interests on debt as they come due and the managers risk to be expelled.

[15] "Fagron is a Belgium-based company that provides products and services for professionals and institutions active in the healthcare sector" (Reuters, 2016).

[16] Banque nationale de Belgique (2016).

The consequence of this monitoring is that "managers with higher ownership concentration are more likely to work hard and less likely to consume corporate perks" (Berk & DeMarzo, 2007, p. 574).

The second benefit is **reduced free cash flow**: "firms with less free cash flow are less likely to pursue wasteful investments" (Berk & DeMarzo, 2007, p. 574).

The third benefit is **reduced managerial entrenchment and increased commitment**: "the threat of financial distress and being fired may commit managers more fully to pursue strategies that improve operations" (Berk & DeMarzo, 2007, p. 574).

Berger, Ofek and Yermack offer an interesting analysis on managerial entrenchment. For them, "firm leverage is affected by the degree of managerial entrenchment" (Berger, Ofek, & Yermack, 1997, p. 1436). If the CEO is not disturbed during his tenure, the firm will have low leverage. But if he undergoes pressure and his seat is unsafe, the leverage will be higher. This will impact positively the value of the firm. The increase in leverage will be carried out by issuance of new debt whose purpose will be to pay special dividends or to finance operational restructurings.

The authors emphasise that this strategy is not only a temporary tactical move in order to deter from corporate raiders but most firms have less leverage in their capital structure than the optimal ratio and so managers lever up permanently as a way to protect themselves when they feel threatened.

From this article, we can conclude that one advantage of debt is to minimize managerial discretion (from Jensen's argument in 1986, quoted by Berger, Ofek and Yermack).

If we want to put a figure on the interest of debt, we can quote Korteweg who did research on the magnitude of the benefits of leverage. After his computations, "the median firm captures net benefits of up to 5,5% of firm value" (Korteweg, 2010, p. 2137). Furthermore, "companies are on average slightly underlevered relative to the optimal leverage ratio at refinancing. This result is mainly due to zero leverage firms" (Korteweg, 2010, p. 2137). Also, "net benefits are increasing in leverage for low-debt firms but decrease as leverage becomes very high, implying the existence of an optimal capital structure" (Korteweg, 2010, p. 2168).

To conclude this section, Graham recommends risk averse firms to ask themselves if they should use more debt. By a cost-benefit analysis, companies will decide on levering up or not and to buy back shares through tax shield savings (J. R. Graham, 2001).

In the Table 1.1, we summarize the pros and cons of debt that have been enumerated above.

Advantages of debt	**Disadvantages of debt**
Increased ownership concentration	Excessive risk-taking and asset substitution
Reduced free cash flow	Debt overhang and under-investment
Reduced managerial entrenchment and increased commitment	Cashing out
	Leverage ratchet effect

Table 1.1: Advantages and disadvantages of debt

1.4.3 Consequences of being overleveraged

So far, we have talked about the existence of an optimal leverage ratio and we have talked about the dangers of being overleveraged. Now, we will present the straw that broke the camel's back; in other words, what are the consequences of a company having too much leverage or being into financial trouble.

First of all, we take the definition of **financial distress** of Wruck: it is a "situation where cash flow is insufficient to cover current obligations" (Wruck, 1990, p. 421).

We do not have to confound *financial distress* with *economic distress*. Financial distress is the fact that a company has not enough cash to pay its debts. In no way the viability of the business is put in doubt in this case. However, a company facing an economic distress is a company whose financial viability is uncertain due to poor performance even if it has no debt in its capital structure (Jiang, Kim, & Zhang, 2014). This differentiation goes in the same direction than the distinction made between strategic and liquidity defaulter which will be developed in Chapter 2.3.

How a company gets in financial distress?

It only concerns the firms that have debts. "In an all-equity firm (no leverage), poor performance does not lead to financial distress" (Wruck, 1990, pp. 420–421). There can have many reasons that can lead to financial distress. For example, an important company's client is forced into liquidation and is not able to pay back an important invoice creating uncertainty for the company's suppliers and lenders about the company's financial health and in turn encouraging the rating agencies to downgrade the firm's rating.

What are the consequences of financial distress?

Financial distress involves some advantages and some disadvantages.

The advantages are that it entails a change in management and governance: there will be a better decision making and governance; it induces organizational changes: there is a refocus on the strategy, and restructurings are undertaken (Wruck, 1990).

The drawbacks are that the company faces distress costs which are costs that a company confronts around the event of bankruptcy. Before the filing for bankruptcy, the company has financial difficulties and lenders will demand higher rate of interest; the company's rating will be downgraded; suppliers will be tougher when dealing with the company. Once the company has filed for bankruptcy, there are many costs involved with it.

Why debtholders would decide to file for bankruptcy?

There can be bankruptcy either if the company has not been able to honour an expired debt or that it violated one of the contract's clause with debtholders.

What happens once the company filed for bankruptcy/went bankrupt?

When there is bankruptcy, there is no equity value left. Debtholders become equity holders. They are the ones who have the rights for the assets, they have the control. There is a switch of principal (Wruck, 1990).

Distinction between bankruptcy and liquidation.

It is important to understand that a bankruptcy does not mean the company's death. According to Wruck (1990), bankruptcy is a "court-supervised process for breaking and rewriting contracts" whereas liquidation is a "sale of the firm's assets and distribution of proceeds to claimants" (Wruck, 1990, p. 422).

It[17] is related that a private equity (Apollo Global Management LLC[18]) made a lot of money by accumulating debt of a company (LyondellBasell Industries NV) declining just before it filed for bankruptcy. To sum up briefly the story, the company was in trouble in 2007 and Apollo bought a part of its debt. At the peak of the crisis in 2008, the debt price declined from "80 cents on the dollar" to 20 cents and the private equity kept increasing its share. In 2009, the company filed for bankruptcy, and the private equity firm bought a part of the LyondellBasell' most senior debt which is the most secured debt. The next year, it exchanged debt for equity to own almost 30 percent of the equity.

This story proves that this bankruptcy did not lead to a cessation of business activities or a liquidation. Quite the reverse, the company put things right and made up with its

[17] Bloomberg (2016).
[18] "The third-largest U.S.-based private-equity firm" in 2013, according to the article.

drop during the crisis as it returned from a $2 billion cash flow to $6 billion through the intervention of its new creditors and the debtor-in-possession loan.

In the United States, when a company goes bankrupt, it can choose to use Chapter 11. This allows "the company to reorganize its business and try to become profitable again. Management continues to run the day-to-day business operations but all significant business decisions must be approved by a bankruptcy court"[19].

The implications of Chapter 11 filing are that the debtor managers keep their position in the firm through an automatic stay that restricts creditors to engage in a collective action to seize collateral and sue on debts. Also, the debtor's authority rights over the company's assets are limited (Ayotte et al., 2013).

1.5 How to define the optimal debt ratio?

Flannery and Rangan (2006) find that companies set a target leverage ratio, try to reach it[20] and if ever a company would come to divert from its target level, it rapidly comes back to it.

But the authors recognize that their theory is not unique and not unanimous. They mention the pecking order theory and market timing theory which are both opportunistic theories. According to these theories, if it is beneficial for the firm to modify its capital structure, it will do it, otherwise it will not. Additionally, companies do not try to attain their particular target.

As for the market timing theory, the manager takes advantage of informational asymmetries and sells shares when the market to book value is high and buys shares when the equity is undervalued (Flannery & Rangan, 2006).

[19] U.S. Securities and Exchange Commssion (2016).

[20] This is supported by Graham and Harvey (2001) quoted by Flannery and Rangan (2006) who "show that 81% of firms consider a target debt ratio or range when making their debt decisions" (p. 470).

2 Impact of debt overhang

Debt overhang problem is an under-investment problem.

2.1 Definition of debt overhang

We adopt the definition of Berk and DeMarzo: debt overhang is the situation "when shareholders choose not to invest in a positive-NPV project because some of the gains from investment will accrue to debtholders" (Berk & DeMarzo, 2007, p. 1050). Moyen goes in the same direction and affirms that debt overhang is what a levered firm loses as soon as it invests with the aim of optimizing its equity value instead of augmenting the value for all its claimants (Moyen, 2007).

Sundaresan and Wang remind us that "the conventional wisdoms of debt overhang (Myers, 1977) are that the pre-existing debt discourages the firm from investing because part of the value increase from new investment accrues to existing debtholders due to the debt priority and seniority structure; and anticipating this debt overhang, the firm lowers its initial debt issuance" (Sundaresan & Wang, 2006, p. 1).

Sundaresan and Wang say in a context where companies are already active and want to expand their activities by investing in new projects (Asvanunt, Broadie, & Sundaresan, 2009), existing debt may discourage a company to invest (Sundaresan & Wang, 2006). The investments can be disturbed by conflicts between debtholders and shareholders and also between existing and prospective debtholders. In fact, Sundaresan and Wang notice that existing debt may delay the appropriate time to fund new projects.

Also if the company gets into more debt, actual lenders will ask for a higher interest rate to adjust their initial loans by the accrued risk. As a result, new debtholders who finance the company's projects will see the earnings mostly go to the initial debtholders.

The solution to anticipate these eventual problems and to avoid debt overhang is to lower the initial D/E ratio at the creation of the company.

2.2 Graphical representation of debt overhang

In the Figure 2.1 below[1], we try to represent the cost of financing for a company and to highlight the zones of debt overhang.

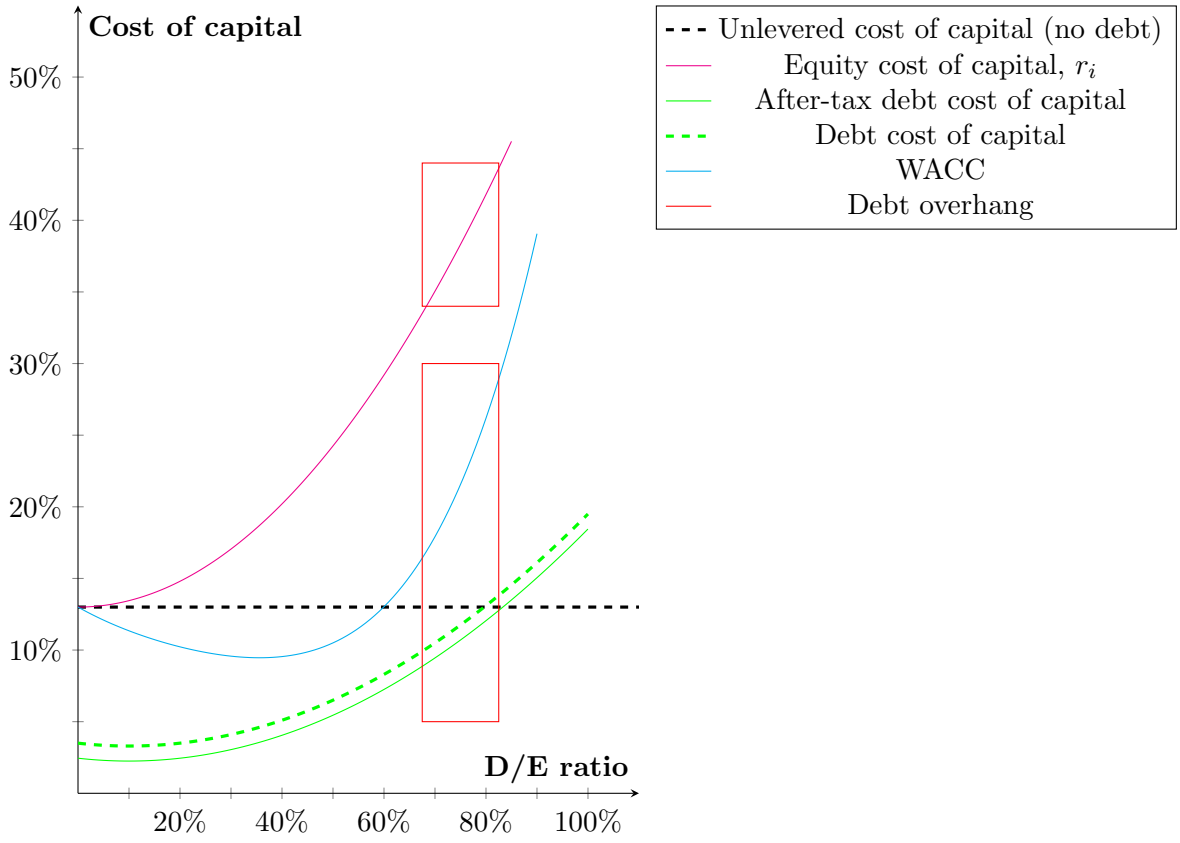

Figure 2.1: Cost of financing and debt overhang

In our figure, we imagined the case of a cyclical company with a beta of 2,5, a risk-free rate of 0,5% and an Equity Risk Premium (ERP) of 5%. We chose 5% taking into account the following reasons. Some studies say that historically the average is between 5% and 6%; at the moment because of the current low-rate environment it is close to 0%; the Federal Reserve database in St. Louis[2] uses 6,11% as a geometric average for 2006–2015; finally, other sources say it is lower, as Dimson, Marsh, and Staunton (2011) who have a geometric average of 4,5% for 1900–2011. Therefore, after our assumptions and this formula[3], for the unlevered cost of capital[4] (the cost of financing for the company with a leverage of 0), we obtained a rate of 13%.

As for debt cost of capital, we took 3,5% because we estimate it is low due to the historically

[1] Drawn using LaTeX.
[2] Federal Reserve Bank of St. Louis (2016).
[3] As a reminder, Cost of equity $= r_f + (\beta \times ERP)$.
[4] Presented here above.

low risk free rates environment[5]. Also, we found that the yield to maturity of the US corporate bond index is 2,78%[6]. It is lower than our 3,5% but this index includes junk companies.

We assumed a tax rate of 30%. Therefore, the after-tax cost of capital is equal to 2,45%[7].

The reason that the unlevered cost of capital is flat is that the WACC[8] formula

$$\text{WACC} = \left(\frac{E}{E+D} \times r_e\right) + \left(\frac{D}{E+D} \times r_d \times (1-t)\right)$$

is only equal to the required rate of return of shareholders because there is no debt. As company risk is constant, the cost of capital remains constant too.

Finally, concerning the curve WACC with taxes, while debt equity ratio is relatively low, the company takes advantage of the tax shield which lowers the WACC but as from a certain point, around a threshold of 50 to 60% of leverage, the company's situation is getting too risky due to the excessive leverage, and WACC increases as a consequence and ends up by skyrocketing.

The zones framed around in red represent problems of debt overhang.

2.3 Consequences of debt overhang

The first consequence of debt overhang is that shareholders will forgo growth opportunities. They will refuse to start new projects because the proceeds will go to the debtholders in times of near financial distress and this will impact performance. Actually, if the company gets a very risky profile, lenders will accept to continue lending only at very high rates – let's say 15 to 20% – and in a way, claim the potential upside for themselves. Indeed, interest rate required by lenders soars as they now bear the equity risk. The reason is that there is no **equity buffer** anymore above them to absorb the losses first. This concept of equity buffer refers to the fact than when a firm goes bankrupt, there is no equity value left (equity = 0) and debtholders become equity holders as explained in Chapter 1.4.3. The figure below of Wruck (1990) helps to visualise the usefulness of the size of the equity buffer from a debtholder's perspective in case of liquidation.

[5] Asness (2003).
[6] Bloomberg, retrieved on 8 July 2016.
[7] $3,5\% \times (1 - 0,3)$.
[8] WACC or Weighted-Average Cost of Capital is the firm's cost of capital taking into account all sources of financing by weighing all its components by the sum of the sources of financing.

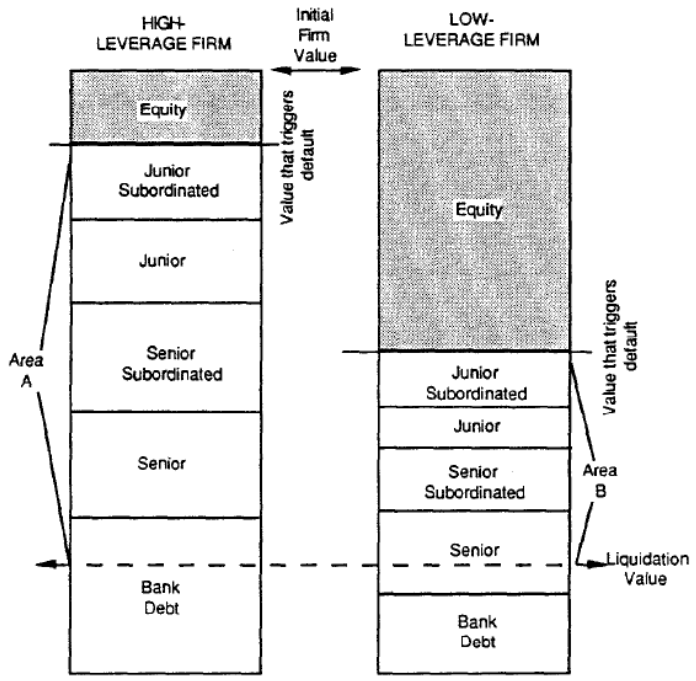

Figure 2.2: Seniority between shareholders and types of debtholders. Original title : *"Incentive for more highly leveraged firms to reorganize privately"* (Wruck, 1990).

We see that for the low-leverage firm, bank debt (which is the most senior debt) and a part of the senior debt are the only one to be refunded when the company is liquidated whereas for the high-leverage firm, due to the thin equity buffer, even bank debt is impacted as they will not recover their full value. We notice than when a company has a lot of debt (relatively to its equity value), a lot of debtholders are drifted away by the liquidation and get back nothing even though shareholders are supposed to be the ones to take the losses.

So we can round off this paragraph by saying that a firm must use of debt within reason in order to diminish its WACC but not go too far otherwise the cost of debt will increase exponentially owing to the risk of financial distress which increases in turn.

As per Moyen's maximizing equity value model, debtholders forecasting that shareholders will underinvest, lend less money which negatively impacts firm value (Moyen, 2007). Moyen analyses the capacity of a firm to invest at any time it wants when it has short-term and/or long-term debt in order to measure how far having debt is constraining. What is the underinvestment caused by debt overhang?

She measures the debt overhang cost as the quantity of investment shareholders would have invested if the company was not in a risky situation, near to default. The reason that the company passes up opportunities is that the incomes generated by the project will go to the debtholders (Myers, 1977 quoted by Moyen). To put it another way, debt

overhang can be measured as the difference between the optimal investment level to satisfy both shareholders and lenders and the optimal investment level to maximise shareholders' value[9] (Moyen, 2007).

In order to examine the consequences of debt overhang in a good and a bad state of the world, she uses two proxies: one is an all-equity financed firm where investment and financing decisions are not linked, and the other is a company with a mixed capital structure. What distinguishes the two benchmarks is that only the second one can see its firm value impacted due to the tax shield and the expected costs of default (Moyen, 2007).

Her results show that when the economy is deteriorating, long-term debt is more detrimental to the company than short-term debt but on the other hand, underinvestment caused by short-term debt continues to be high in period of expansion (Moyen, 2007).

Moyen says that if the company levers up, the company's situation gets riskier which increases the likelihood of default and that when default's probability is important, shareholders do not launch new projects which could earn a return (this is a problem of underinvestment). To illustrate the underinvestment concept, let us imagine that we are in period of near financial distress, shareholders are not ready to invest in new projects because the incomes that will result from the project will go to debtholders if the company defaults. For instance, if shareholders need to pay 500 for an expected return of 750 whose 500 will go to debtholders leaving 250 for shareholders; the latter will not accept the project. Basically, out of the amount of earnings that the project will have generated; that is, 750, 500 will come down to lenders as there is no other money in the "cash drawer" to refund them.

As far as we understood the author's opinion, we estimate it is a bit of leap to say that increasing leverage results in an underinvestment problem. In fact, increasing leverage puts the company in a riskier situation, which in turn increases the chance of default and makes shareholders less keen to invest in new projects (underinvestment).

On the premise put forward by Modigliani and Miller (1958) that "a firm's investment decision is independent of its financing decisions", Moyen makes her contribution to this literature by saying that "investment interacts with financing through the traditional debt financing frictions – a tax benefit and a default cost" (Moyen, 2007, pp. 436–437).

[9] Equity optimum is lower than the firm optimum.

2.3.1 Debt overhang and asset illiquidity

Shleifer and Vishny (1992) offer an interesting perspective on this subject. In their view, "optimal debt levels are limited by asset illiquidity" and are determined by the extent to which peer firms take advantage of debt.

They create a model where there is an industry with two firms and two states of the world: prosperity and depression.

In the good state, shareholders in order to keep managers from investing in negative NPV projects create a debt overhang composed of short-term and long-term debt. "Short-term debt forces the firm to come to the capital market when it wants to invest, even if its cash flow is high" (Shleifer & Vishny, 1992, p. 1347); long-term debt avoids the firm to borrow in good state.

These debts have a cost in the depression period. In period of recession, imagine that the firm cannot afford to pay its short-term debt. It cannot neither borrow more because of long-term debt overhang. If the firm cannot reschedule its debt, it is forced into liquidation.

Through their model, the authors show that companies must take into account the asset illiquidity cost in period of downturn if ever all competitors would have to be impacted by the crisis. Consequently, companies have to adjust downward their leverage ratio to integrate the state of the world where the company would not be able to pay its debts.

Besides, asset liquidity is important as it allows a company to take on more debt as assets can be used as collateral to reduce credit risk. The ideal is to find the good equilibrium between debt and equity and to anticipate the future to see how long it takes to sell its assets.

Finally, they claim that "asset liquidity" and the "optimal" leverage ratio are not constant and fluctuate depending on the economy's ebb and flow (Shleifer & Vishny, 1992, p. 1365).

2.4 Strategic and liquidity defaulter

According to Giroud, Mueller, Stomper, and Westerkamp (2012), a *strategic defaulter* is a company who defaults due to debt overhang. In this case, banks accept to cancel debt. On the other hand, a *liquidity defaulter* defaults due to demand shocks: the company works well but the economic environment is bad, it is bad luck. Maturity is rolled over but debt

is not cut. The manager is exerting effort as he should do.

When there is debt overhang, there is a conflict of interest between shareholders and debtholders. Shareholders might forgo positive NPV projects. There is a risk shifting problem, the ones who profit are debtholders and the downside risk is for equity holders. Indeed, debtholders want the company to generate enough profit to be able to pay the interests on debt and to pay back the face value whereas shareholders want to maximize their value. If it goes well, debtholders are paid their due interests and shareholders are happy. If it goes bad, shareholders will lose, but especially the debtholders because the company will not be able anymore to pay interests on debt. And worse, firm value decreases under the face value of the bonds. So the company is given to debtholders. In the end, shareholders have nothing and debtholders lose a bit.

3 Average leverage of the sector

In this section, we try to find what is the best method to find the optimal leverage ratio per sector.

Practically speaking, what investors want to know about markets is how to integrate these theories and concepts in their investment strategies. How to integrate the debt component included in debt/equity in their investment strategies? Is it recommended to avoid overleveraged companies, are there sectors where debt overhang turns bad, in a more frequent way than other sectors? These are questions that matter for investors and we will try, by our empirical part to bring some insights.

For instance, in the biotechnology sector, a leverage ratio of 1 is a lot[1]. Firms in this sector have low leverage because banks do not want to finance risky projects. So these firms will be mainly financed by equity[2]. However, in heavy industries like airports or manufacturing, a higher leverage ratio is imaginable and banks continue to lend them money.

As a result, it is very important to divide firms into segments.

To hypothesize the optimal leverage ratio a company should have, it has been found by D'Mello and Farhat that "the moving average debt measure exhibits characteristics that are most consistent with the theoretical optimal leverage ratio" (D'Mello & Farhat, 2008, p. 213).

Another chapter of the literature is suggesting that a firm's leverage can only be compared to others companies within its sector. For example, companies in heavy industries which have a lot of assets – machines, equipment, factories – may allow themselves to borrow more and have a higher leverage because in case of default or bankruptcy, their assets can be seized and cashed out. This is not the case for companies in sectors or industries with a few assets and a lot of research and development people or consultancies firms; they will be less leveraged because except from the office that they rent, the computers and the internet connection, they do not have heavy assets.

[1]The average leverage ratio for the period 1990-2015 is exactly 0,556. This computation has been done for the 19 companies composing the Biotechnology Industry Global Industry Classification Standard (GICS) classification.

[2]For more information about biotechnology sector, you can refer to Harrington (2009).

Concerning riskiness, a company with higher leverage is riskier than its peers with lower leverage as the higher is the leverage, the riskier it is to default on payment of interests and/or the principal. In other terms, financial distress risk and refinancing risk are increased.

The fact that companies compare with others and repeat the leverage decisions of their peers is supported in the literature and we decided to adopt this approach in our empirical work.

Leary and Roberts offer an interesting view on the manner firms proceed to decide on their leverage ratio. According to these authors, firm's leverage ratios are mostly influenced by changes in capital structures and, to a lesser degree by the main features of equal companies within the same sector[3]. In addition, they find that weaker and smaller companies tend to replicate the capital structure decisions of larger competitors. In this way, decisions to issue equity or debt will be very dependent on the peer's actions: if competitors increase their leverage, a firm will increase its leverage too, and similarly for equity issue. The authors analyse the impact of "peer firm idiosyncratic equity [return] shocks" (Leary & Roberts, 2014, p. 141) and observe that it will incite other companies to issue equity and to use less debt.

Their outcome is that "a one standard deviation increase in peer firms' leverage ratios is associated with a 10% increase in firm i's leverage ratio" (Leary & Roberts, 2014, p. 142).

We start from the observation made by Bradley, Jarrell, and Kim[4] that leverage is influenced by sector elements. We can give two reasons for this, firstly companies have the same behaviour and secondly when we adopt the lenders' point of view, we see that the loans they grant hinge on an analysis based on two factors: the company's securities and collaterals and the business cyclicality. Thus, the loan rates, the quantity of money lent and the companies' leverage ratio that result from these loans depend on the bankers' perceptions towards sectors. We have to take into account that when a company gets into debt, there is the managers and shareholders' viewpoint but also the lenders' point of view.

If a bank is inclined to lend three times the net debt amount to the firm A from the sector X, the bank will most likely also lend with a leverage of 3 to the firm B from the same sector.

[3]This is supported by Welch (2004), MacKay and Phillips (2005), and Frank and Goyal (2009) quoted by Leary and Roberts (Leary & Roberts, 2014, p. 139)

[4]Quoted by MacKay and Phillips (2005).

To sum up, we could claim that there are two general criteria that determine how much the bank will lend: the securities that the bank could seize if the company defaults (that is why the firm needs tangible assets) and the business cyclicality. Hence, an infrastructure company which owns a lot of tangible assets and is generally low-cyclic will benefit from higher leverage.

It seems that MacKay and Phillips (2005) bring out new results that show that what matters to define the firm-leverage ratio is its sector (the leverage used by its peer firms) and that the leverage-variation within a sector is more decisive than the variation among sectors. But their essential outcome is that the firm characteristics (such as corporate image and net margin) best explain the leverage decisions. We will not further expound this subject as it is advanced and differ from our topic.

Part II

Empirical part

4 Research objective and Methodology

In this Chapter, we explain the objective of the practical work and the approach employed to reach it.

4.1 Research objective

We have two research objectives in this thesis.

4.1.1 Comparison between the returns obtained with high and low leverage portfolios

Our main mission in this master thesis is to analyse stock returns according to the company's leverage level. More specifically, we examine whether portfolios of highly leveraged stocks (likely to be in situation or close to debt overhang) outperform portfolios of low leveraged stocks taking into account the exposure to systematic risk factors. These factors are variables that affect the entire market and consequently our portfolios and are not diversifiable. It is expected that the more leveraged the company is, the riskier and the higher the investor's return will be. We want to know if the risk premiums associated with more leverage portfolios are higher than those for low leverage portfolios. For the sake of argument, let us assume that we do reach this conclusion. The logical order of reasons that could explain the fact that highly leveraged stocks outperform portfolios of low leveraged stocks and which form our objective in this study are the following.

- First, it is due to the systematic risk factor that we took into account: the *debt overhang* in addition to the three other well-attested factors which are ERP (market beta), SMB (size effect) and HML (value effect). We decided to use only those three variables as they form the basis to explain the variation of stock returns as per Fama and French (1993).
- Secondly it is due to another risk factor that we did not take into account among our 4 factors.

- Thirdly, there is an irrational fear from investors for overleveraged companies and therefore neglect them. Hypothetically, let us imagine the following scenario. Portfolio 1 is low leveraged and we make an investment of 100. Its value in n years will be 110. Portfolio 2 is highly leveraged and we make an investment of 100. According to the CAPM theory, and so after beta, expected return in n years should be 120 for Portfolio 2. If we observe ex post that the portfolio is 125, that means that after the CAPM theory, we did not pay enough, it was cheap. It was not that risky all in all. Actually, we priced too much risk due to the irrational fear.
  On the other hand, if we get 115, that means that we underestimated risk of debt overhang: we paid too much (or to put in another way, we have not been remunerated enough) for a risky asset: we earned only 15 whereas we expected a return of 20.

4.1.2 Expected recommendations for investors

Among all stakeholders (shareholders, bondholders, management) involved in debt overhang considerations, we adopt investors' point of view. The aim is to see if over 25 years with the S&P 1500 sample, significant differences appear between portfolios and sectors and a premium brings out.

1. Is it good for them to invest in companies with relative (compared to the sector) high or low leverage?
2. Are there sectors where value is created through high leverage? Are there sectors where debt has a greater impact on firm value?
3. What are the consequences on a company if it is too much or not enough leveraged?
4. Do highly leveraged sectors outperform sectors with a lower leverage?

4.2 Methodology

4.2.1 General approach

We use two investment strategies based on the leverage ratios.

The first strategy is that investor goes for the highest leveraged companies (using the percentiles 1/3 and 2/3) so that means to invest in the companies that are among the 33,3% most leveraged in the sample. The second strategy is that the investor goes for the lowest leveraged companies; so that means to invest in the companies that are among the 33,3% least leveraged in the sample.

We first do this for the entire sample without distinguishing the sectors. We then do it for each U.S. sector of the economy to take capital intensity differences into account which we believe is really important as we outline in Chapter 3.

These two types of portfolios are rebalanced each year (if a company levers down, it will be out of our scope if it is not anymore in our percentile group).

To evaluate the stock performance, we build portfolios of respectively low, medium and high D/E stocks.

Then we compare the performance of the two strategies (high D/E stocks versus low D/E stocks) while controlling for systematic risk exposures according to the three-factor model of Fama and French (1993). In other terms, we compare these returns on a risk-adjusted basis. If the return on the portfolio is higher than expected, then we have alpha: "return earned on a portfolio in excess of that predicted by the capital asset pricing model" (Hull, 2012, p. 595).

In the literature, there are two models that have been broadly used to adjust the returns for risk, namely the Capital Asset Pricing Model (CAPM) and the Fama & French three risk-factor model. The CAPM contains an equity risk premium factor $(R_m - R_f)$[1]. This expected risk premium is proportional to its beta.

In the years following the development of the CAPM model, several studies started to see imperfections in this model[2]. That is why we only use the Fama & French three-factor

[1] According to the CAPM, $E(R_i) = R_f + \beta_i\,(E[R_m] - R_f)$ where $E(R_i)$ is the expected return on the security; R_f is the risk-free rate; β_i represents the sensitivity of stock i to market changes and is measured as the fraction of historical covariance between the security returns and the market returns on the historical variance of market returns $\beta_i = \frac{Cov(R_i,R_m)}{Var(R_m)}$; $E[R_m]$ is the expected return of the market.

[2] See for example, Fama and French (2004).

model: SMB, HML and ERP (with their respective coefficients). This model has the advantage over the CAPM that it corrects the loopholes of the latter, such as taking into account the size factor and the value factor[3].

Fama and French (1993) found that small size companies have higher returns than big size companies because they are riskier and more financially constrained. Livdan, Sapriza, and Zhang (2009) also reached the same conclusion.

But Lamont, Polk, and Saá-Requejo (2001) say that their explanation is not true. They find that the financial constraint has nothing to do with the size factor. In fact, the financial constraint is another systemic risk factor (other than beta market, beta HML and beta SMB) and it is not possible to explain it in economic terms: the authors find that a weak exposure to the financial constraint factor[4] yields a high return, which is the opposite to the common explanation derived from the size factor which states that the smaller is the company, the more it is financially constrained and so finds it difficult to reach the optimal D/E ratio (because they do not instil trust as much as bigger companies do) and as a consequence yields higher return because the investors are compensated for the systematic risk that the company is a small size company.

In a nutshell, Fama and French stated that small size companies have higher return because they are more constrained. Lamont, Polk and Saá Requejo dispute this argument by proving that unconstrained firms yield more than constrained firms.

Muradoglu and Sivaprasad (2011) analysed the return on the 2673 companies (before excluding the financial firms) listed on the LSE stock exchange from 1965 to 2008. They classified firms based on their leverage ratio[5]. They came to the conclusion that returns are negatively related to leverage.

We follow the same methodology than Lamont, Polk and Saá Requejo except that these authors use an index composed of 5 accounting variables[6] which measures the degree of financial constraint that a company faces, whereas we decided to only focus on the D/E ratio. We also follow the methodology of Fama and French for creating our portfolios.

[3]It had been found that the small firms' returns were higher than for the big firms and that firms with high book value had greater returns that firms with low book value.

[4]A low degree of financial constraint.

[5]But with a different measure than ours: they express leverage ratio as $\frac{\text{Debt}}{\text{Equity+Debt}}$

[6]Which are: "cash flow to total capital, market to book ratio, debt to total capital, dividends to total capital, and cash holdings to capital".

4.2.2 Data and detailed methodology

Sample

We use the S&P 1500 composite index which contains 1 506 stocks. This index "combines three leading indices, the S&P500, the S&P MidCap 400, and the S&P SmallCap 600 to cover approximately 90% of the U.S. market capitalization" (S&P Dow Jones Indices LLC, 2016).

The period of the sample covers monthly data from January 1990 until April 2016. They have been retrieved from Datastream. But we compute **annual** returns and not monthly returns. We only use the different data we need (D/E, book-to-market, net debt/EBITDA, etc.) in July of each year from 1990 to 2015.

Percentiles

In order to carry out the two investment strategies, a separation is made between firms with a low, medium and high debt level. Percentiles 1/3 and 2/3 are used in order to have large portfolios.

So by matching the two size groups and the three leverage groups, we end up with **6 portfolios**: Small market value/Low leverage ("S/L"), Small market value/Medium leverage ("S/M"), Small market value/High leverage ("S/H"), Big market value/Low leverage ("B/L"), Big market value/Medium leverage ("B/M"), Big market value/High leverage ("B/H"). Or quite simply, following the order given above we call them portfolios 1 to 6.

Construction and computation of the evolution of the portfolios' returns

We form our portfolios on the 1st July of each year and keep them for one year. The next year, we rebalance them for taking into account coming and going of firms that move from one category to another because their leverage and size are not fixed over time. The reason of July is that we want to make sure that all information such as figures and ratios of companies have been disclosed since the end of the previous year. Fama and French (1993) do the same. We use the market value, the total debt and shareholders' equity of 1st July.

We count the companies that respond to the repartition rule (leverage ratio lower than

1/3, higher than 2/3 or in between). Starting in 1990 with a portfolio of \$10 000 we divide this amount by the number of companies which gives us the allocation per stock. We then divide the amount available per stock by the company's stock price to count the number of shares of this stock we can buy. Finally, the 30th June 1991 we multiply the number of shares we bought the 1st July 1990 by the stock's price of 30th June 1991. By summing all companies in one year, we obtain the new portfolio value. This new portfolio value will serve again to count the allocation per stock of the creation of new portfolios the 1st July 1991 (the portfolios are rebalanced each year).

We compute the difference in portfolio value from one year to another by using the following formula: $\frac{\text{Price year}N+1}{\text{Price year}N} - 1$.

The returns are computed with a **geometric mean** as per the CAGR formula: $\left(\frac{\text{Ending portfolio balance}}{\text{Beginning portfolio balance}}\right)^{\frac{1}{26}} - 1$ which pretty much gives the same results than using this formula: $1 + (R_1 \times R_2 \times ... \times R_n)^{\frac{1}{n}} - 1$.

Procedure to compute the alpha

Here is our procedure to compute the expected return when we want to find the alpha. Firstly, we use a moving average to determine our expected risk premiums. For each variable ($R_m - R_f$, SMB, HML), each year we take the average of the 30 preceding years of this variable that we find on the Fama & French library.

Secondly, for the coefficients of these variables (the 3 beta), from 1990 to 2004, we use the coefficients generated by Excel when regressing our data for the whole period (1990 to 2015). As from 2005, as we now have 15 years of past data, we redo a regression for the period (1990-2004) and use the coefficients for the year 2005. Then we repeat the operation for the other years with a moving average again. We do not proceed on this way for the years before 2005 due to our lack of data and the fact that we use annual returns.

Sector

The classification per sector is as per Thomson Reuters classification[7].

We decided to remove from the sample the financial firms because the optimal D/E ratio theory cannot be applied to these companies (banks, insurance companies, real estate

[7]The Datastream variable is TR1N. You can find in the Appendix A the "Business sectors"/core business activities of type of companies composing each economic sector.

investment trusts). These companies are not financed in the same way than the companies in the other sectors. We end up with 1 203 companies. It is frequent in the academic world to withdraw the financial firms. For instance, we are in line with D'Mello and Farhat who decided to exclude based on SIC codes, "all regulated firms (SIC codes 4900–4999), financial firms (SIC codes 6000–6999) and firms that are non-classifiable (SIC codes 9900–9999)" (D'Mello & Farhat, 2008, p. 215).

We also decided to merge the sectors of Telecommunication Services and Utilities for two reasons. The first one is that it makes sense on a theoretical point of view. Indeed, they share the same type of capital structure as their respective business activities require the same intensity of capital. The second one is that we observe in the sample that they have a close similar D/E ratio and that they have the highest leverage levels. On a practical point of view, it is also easier to get them together as the size of these sectors is relatively small compared to the size of the other sectors.

We also based our categorisation on the article of MacKay and Phillips (2002) who used the ratio of fixed assets divided by labour costs in order to have an insight of the intensity of capital structure for each sector. As we did not manage to obtain the labour costs variable on Datastream, we decided to multiply fixed assets % common equity by common equity and then to divide by the market capitalization. In the Table 4.1 below, you can find the average of these ratios for all companies composing each sector.

We chose to assume that if sectors have approximately the same intensity of capital structure (have the same ratios), they have the same type of assets held and cost structure and therefore finance themselves identically.

Sector	**Average**
Technology	26 095
Healthcare	36 770
Industrials	111 592
Consumer Cyclicals	241 378
Consumer Non-Cyclicals	296 070
Telecom and Utilities	322 793
Basic Materials	330 364
Energy	501 476

Unit: fixed asset/market capitalization (in thousands)

Table 4.1: Repartition by capital intensity structure

Based on this new perspective, we obtained 5 groups of sectors.

First, we decided to add the Basic Materials sector to Telecommunication Services and

Utilities[8] because they have very close ratio of fixed assets on market capitalisation.

Our second group is the Energy companies[9] which has the highest ratio of fixed assets on market capitalisation.

Our third group is the Consumer Cyclicals and Consumer Non-Cyclicals[10].

Then we have the Industrials[11] sector in the fourth group.

Lastly, we joined Healthcare companies to Technology companies[12] as they have the lowest leverage ratios and by far the smallest ratio of fixed assets on market capitalisation.

Control of variables

We control the size effect with the companies' market value. Otherwise it could influence the variation in stock return. So we made sure that in each portfolio of low, medium and high leverage we encounter companies of small and high market value. In other words, we verified that each of these portfolios are diversified from a size company's perspective to avoid that returns are due to the size effect.

We also use as variables the equity risk premium according to the CAPM framework; and we use two other additional factors from the three-factor model which are the SMB and the HML factors.

HML is a variable measuring the return obtained by subtracting a portfolio made of low book-to-market companies from a portfolio made of high book-to-market companies. To obtain the book-to-market ratio, we computed the inverse of the price-to-book value[13].

SMB is a variable that measures the return obtained by subtracting a portfolio made of big market capitalization companies from a portfolio made of small market capitalization companies.

Variables used

In order to obtain the leverage ratio, we divided total shareholders' equity from total debt.

[8] 170 companies.
[9] 93 companies.
[10] 254 companies in Consumer Cyclicals + 97 companies in Consumer Non-Cyclicals = 351.
[11] 245 companies.
[12] 197 companies in Technology + 147 companies in Healthcare = 344 companies.
[13] Whose Datastream code is PTBV. We have not found the book-to-market ratio on Datastream.

As said in the literature review, leverage ratio is defined in this study as total outstanding debt on total shareholder's equity.

As per Datastream definitions, "total shareholders' equity represents the sum of preferred stock and common shareholder's equity"; "total debt represents all interest bearing and capitalized lease obligations. It is the sum of long and short term debt".

Leverage ratios with negative value have been marked by a "NaN" (Not a Number) in the Excel file as it does not make any sense.

Net debt/EBITDA

We used the net debt to EBITDA[14] metric in order to compare the returns of companies classified into level of net debt on EBITDA with the portfolio returns classified by leverage.

This measure gives information about a firm's capacity to settle its debt. A higher ratio means that the company is quite in debt. This ratio is not distorted by financing decisions (the debt limit and in particular the tax shield) and by accounting operations. The net debt is equal to Debt − Cash. We can also write the ratio as $\frac{\text{Debt}-\text{Cash}}{\text{EBITDA}}$.

We excluded companies with negative EBITDA in our computations as it does not make sense. On the other hand, it is possible to have a negative net debt (and so a negative ratio net debt to EBITDA) if the company has a lot of cash.

In our sample, we see that on average for the 25 year-period of analysis, 50% of the companies have a ratio higher than 0,91[15].

Recently, UBS found that the Net debt/EBITDA ratio for the second quarter 2015 was 2,38 for U.S. investment-grade non-financial bond issuers[16].

[14]EBITDA stands for earnings before interests, taxes depreciation and amortization.
[15]We base our words on the percentile 50%.
[16]UBS (2015).

5 Empirical work on debt overhang

5.1 Main results

5.1.1 Introduction

Before starting our explanations and developing step by step, section after section how we computed our returns and what is our analysis, we straight away show the main results of our empirical work.

Overview of results: answers to the research questions

Q1 "Do PTF of highly leveraged stocks outperform PTF of low leveraged stocks?"

1.1. Raw returns

Leverage ↑ ⇒ return ↓

Return PTF low D/E > return PTF high D/E

Consequences: **Our expectations in 4.1. are not verified**

Check SMB & HML effects

We found that F&F factors effects are valid in our study:

- *Size factor ↑ ⇒ return ↓*
  ⇒ This is consistent with FF size premium
- *Value factor ↑ ⇒ return ↑*
  ⇒ This is consistent with FF value premium

1.2. Returns adjusted for 3 systematic risk factors

Comparison of alphas

- Alpha for low D/E PTF is higher than for high D/E PTF in all sectors
- Especially for sectors of Consumer Cyclicals & Non-Cyclicals (12% vs. 6%) and Healthcare & Technology (22% vs. 10%)

Regression analysis

- ERP: β ↑ with leverage and size
  ⇒ More leveraged and bigger companies are more sensitive to the market movements
- SMB: low leverage PTF have more exposure to the size factor
- HML: high leverage PTF have more exposure to the value factor (financial distress)

Q2 "Recommendations to investors"

- Favour low leveraged companies in all sectors except Energy
- In particular, significant alpha can be generated for Consumer Cyclicals & Non-Cyclicals and Healthcare & Technology sectors
- Overall, highly leveraged companies tend on average to produce relatively lower return

Figure 5.1: Overview of results: answers to the research questions

5.2 Realised returns

5.2.1 Raw returns for the 6 portfolios

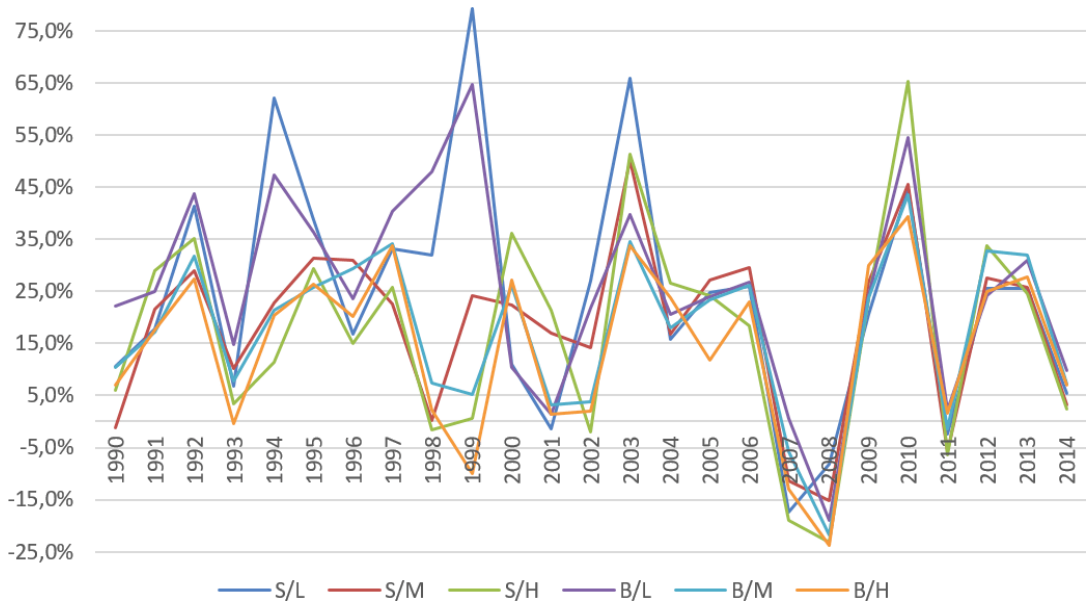

Figure 5.2: Evolution of returns for each portfolio

This graph represents the evolution of returns for the six portfolios for all non-financial companies on the period 1990–2015[1]. We see that overall, the tendency is the same and that the returns fluctuate hand in hand except for the portfolios S/L, and B/L who tend to peak for some years. But when we take a closer look, we observe (in the Table 5.1 below) that the **return decreases as leverage increases**. These outcomes are interesting because they are in line with Lamont, Polk and Saá Requejo's results (2001). As explained in Chapter 4.2.1. of this thesis and by generalising[2], these authors also found that low leveraged firms have higher return than more constrained firms.

From this table we can observe that **returns are higher for low leverage portfolios**. This is verified for both size groups (small size and big size). S/L portfolio brings in an excess[3] return of 20,6% and B/L portfolio yields an excess return of 22,1%.

[1]We remind that portfolios are created the 1st July of each year and held until the 30th June of next year. We stopped in end of June 2015 and we did not create other portfolios the 1st July as the year 2016 is not over yet.

[2]In their paper, they analysed the firm's financial constrained measure whereas we evaluate the leverage ratio.

[3]We chose as risk-free rate the one-year U.S. risk free rate from the Board of Governors of the Federal Reserve System. Federal Reserve Bank of St. Louis (2016).

Portfolio #	Portfolio name	Return	Excess return
1	Small size/Low leverage	24,0%	20,6%
2	Small size/Medium leverage	18,6%	15,1%
3	Small size/High leverage	17,2%	13,8%
4	Big size/Low leverage	25,5%	22,1%
5	Big size/Medium leverage	17,4%	14,0%
6	Big size/High leverage	14,4%	11,0%

Average Low PTF: 21,3%
Average High PTF: 12,4%

Remark: The annual returns have been computed with a geometric mean.

Table 5.1: Average realised return per portfolio for the period 1990–2015

5.2.1.1 Size and Value effects

Furthermore, we can also say from the Table 5.2 that portfolios of **small size have higher returns than big size portfolios** (except for the low leverage subgroups). When we look at the average of the CAGR computed within a size group, we see that the average is slightly higher for small size portfolios. This is consistent with the **size risk factor** of Fama & French's theory.

Portfolio #	Portfolio name	CAGR
1	Small size/Low leverage	21,1%
2	Small size/Medium leverage	16,7%
3	Small size/High leverage	14,8%
4	Big size/Low leverage	23,1%
5	Big size/Medium leverage	15,7%
6	Big size/High leverage	12,7%

Average Small size: 17,5%
Average Big size: 17,2%

Table 5.2: Return of portfolios Small versus Big

Muradoglu and Sivaprasad also reached the same conclusion that returns "are slightly higher for small companies with low leverage" (Muradoglu & Sivaprasad, 2011, p. 266).

The Table 5.3 shows the returns of portfolios classified by size and book-to-market ratio. We can observe that the portfolios of higher book-to-market have higher return than portfolios of lower book-to-market. This is true for small size and big size portfolios. This is consistent with the **value risk factor** of Fama & French's theory.

5.2.2 Raw returns for individual sectors

After having created 6 portfolios for each group of sector(s), we compared the average realised returns obtained. These returns are not adjusted for the three systematic risk

Portfolio #	Portfolio name	Return	Excess return
1	Small size/Low book-to-market	13,0%	9,5%
2	Small size/Medium book-to-market	16,9%	13,5%
3	Small size/High book-to-market	29,1%	25,7%
4	Big size/Low book-to-market	17,6%	14,1%
5	Big size/Medium book-to-market	17,5%	14,1%
6	Big size/High book-to-market	21,8%	18,4%

Average Low = 11,8%
Average High = 22%

Table 5.3: Return of portfolios Low versus High book-to-market

factors.

It emerged from the study (please refer to the Table 5.4 below) that the sectors of **Healthcare and Technology** companies get the highest average return for the period 1990–2015 with 26,6%[4]. As for the group of sectors including **Basic Materials, Utilities and Telecommunication Services**, we obtained the lowest average return for the same period with 13,2%. It is important to emphasize that companies in Healthcare and Technology sectors are the companies with the lowest average leverage ratio and companies in the second group (Basic Materials, Utilities and Telecommunication Services) are the companies with the highest leverage ratios (please refer to the Table 5.5).

Sector #	Sectors	Average return	Average excess return
1 + 9 + 10	**Basic Materials + Utilities + Telecom**	**13,2%**	9,8%
7	Industrials	16,8%	13,4%
4	Energy	19,0%	15,5%
2 + 3	Consumer Cyclicals + Non-Cyclicals	19,6%	16,2%
6 + 8	**Healthcare + Technology**	**26,6%**	23,1%

Table 5.4: Average realised return per group of sector(s)

Leverage ratios sorted from the smallest to the biggest

Sector	
Technology	**37%**
Healthcare	**53%**
Energy	63%
Industrials	72%
Consumer Cyclicals	81%
Consumer Non-Cyclicals	88%
Basic Materials	**98%**
Utilities + Telecom	**140%**

Table 5.5: Average of the leverage ratios per sector

It proves that low leverage companies (in Technologies and Healthcare sectors) have higher

[4]Remark: using the excess returns does not change anything in the ranking of the sectors who have the highest returns.

returns than high leverage companies. Also, our results back up the observations from the portfolios of all non-financial companies: we see that generally among sectors, the lowest leveraged companies and small size companies get higher returns than their counterparts with the highest leveraged ratios and higher size companies.

These results are the opposite to what we expected. Our forecasts were that higher leverage companies would generate higher returns than small leverage companies because investors are compensated for the risk involved and we assimilated a higher risk with a higher D/E ratio. But our results indicate that the more leveraged the company is, the lower is its return.

5.2.3 Implications for investors

Based on these results (Table 5.6), we can observe that investors should **be careful with high leverage** especially for the following groups of sectors: Basic Materials, Utilities & Telecommunication Services; Consumer Cyclicals & Non-Cyclicals; Industrials; Healthcare & Technology. The excess return is really lower for portfolios of higher leverage. Obviously, this report does not hold for Energy sectors where high leverage portfolios get higher return than low leverage portfolios. So concerning one of our research questions of whether there are sectors where value is created through high leverage, our results suggest that Energy would be the only sector of our analysis where value is created through high leverage. For the 4 other groups of sectors, it would be recommended to investors to **favour low leverage portfolios**.

5.3 Returns adjusted for systematic risk exposures

We proceed on two manners to estimate this risk-adjustment. The first way is by computing the alphas and the second method is by comparing the coefficients of our variables derived from our regressions. We want to explain the exposure to risk factors. A bigger coefficient means that there is a higher exposure to risk, implying a higher risk premium (assuming the risk factor is positive) and leading to a higher realised return.

Excess return per portfolio per sector

Portfolio	Basic Materials + Utilities + Telecom	Consumer Cyclicals and Non-Cyclicals	Energy	Industrials	Healthcare + Technology
S/L	12,3%	16,6%	15,8%	14,1%	25,5%
S/M	16,4%	18,7%	14,7%	11,6%	25,9%
S/H	7,2%	12,2%	19,4%	14,2%	19,0%
B/L	12,7%	20,8%	15,0%	15,1%	27,8%
B/M	4,2%	14,1%	12,5%	12,6%	23,8%
B/H	5,8%	14,5%	16,0%	12,5%	16,6%

CAGR per portfolio per sector

Portfolio	Basic Materials + Utilities + Telecom	Consumer Cyclicals and Non-Cyclicals	Energy	Industrials	Healthcare + Technology
S/L	13,3%	17,9%	13,8%	14,7%	23,5%
S/M	14,0%	19,4%	11,2%	13,1%	25,0%
S/H	8,7%	12,7%	13,3%	15,1%	19,5%
B/L	14,1%	21,8%	13,8%	16,7%	26,3%
B/M	6,5%	15,4%	11,6%	14,1%	23,4%
B/H	7,9%	15,2%	14,4%	13,7%	17,7%

Remark: this Table is the same as the Table 5.4 but is more detailed as it displays returns per portfolios per sectors.

Table 5.6: Realised excess return per portfolios per sectors

5.3.1 Risk-adjusted returns for the 6 portfolios

5.3.1.1 Alpha

We measured the financial alpha for our portfolios. The alpha is the difference in return between the realised return (unadjusted for risk-free rate) and the theoretical/expected return derived from our three-factor model. Our equation is Realized return − Expected return with Expected return $= R_f + \left(\beta_{R_m - R_f} \times (R_m - R_f)\right) + (\beta_{\text{SMB}} \times \text{SMB}) + (\beta_{\text{HML}} \times \text{HML})$

We obtained the average alpha for the 25 year-period of our 6 portfolios in the following table:

We see that portfolios of low D/E have a higher alpha than portfolios of high D/E.

Here is a brief summary of what we are going to do in the following sections. We first apply the methodology than Lamont et al. (2001), by computing their own variables which are BIG, SMALL and FC except that we are analysing the leverage ratio and not the degree of financial constraint and that they use 9 portfolios whereas we use 6, so we adapted their formulas. The aim of using these variables is to test the existence of a *leverage factor* that

PTF #	Portfolio name	Alpha
1	Small size/Low leverage	12,10%
2	Small size/Medium leverage	7,20%
3	Small size/High leverage	4,40%
4	Big size/Low leverage	17,50%
5	Big size/Medium leverage	8,40%
6	Big size/High leverage	5,20%

Average Low D/E: 14,80%
Average High D/E: 4,80%
Average Small: 7,90%
Average Big: 10,37%

Table 5.7: Alpha for the whole sample

could explain partially the fluctuation in stock returns.

Then, we use the SMB and HML factors from Fama & French' database.

Finally, we compute our own $R_m - R_f$, SMB and HML factors with all non-financial companies in our sample in order to adapt to fit our stock universe.

5.3.1.2 Testing the existence of a leverage factor

BIG this variable is found by computing the average return of less leveraged portfolios of medium and big size. As we do not have medium size companies, we did BIG $= \frac{B/L+B/M}{2}$[5] except when the dependent variable is in both sides of the equation. In that case, we remove it in the right-side[6].

SMALL This variable is found by computing the average return of less leveraged portfolios of medium and big size: SMALL$BIG = \frac{S/L+S/M}{2}$.

FC [7] In our study, we obtained FC by subtracting the average annual excess returns of low leveraged companies of all sizes from the average annual excess returns of high leveraged companies of all sizes. In other words, FC = HIGHDE − LOWDE with HIGHDE being equal to the average of the sum of the portfolios of high leverage (S/H and B/H) and LOWDE being equal to the average of the sum of the portfolios of low leverage (S/L and B/L).

[5]Terminology: the first letter B or S stand for Big and Small (size), and the second letter L, M or H stand for Low, Medium or High (leverage).
[6]You can find the formulas used in the Appendix B.
[7]FC stands for Financial Constraint.

The final average of FC is −7,5%. Once again, this figure means that investors either underestimated the risk of debt overhang: they expected to earn a better return by investing in high leveraged companies but in fact it is risky; or that they underestimated the opportunity of being underleveraged: actually, low leveraged companies offer the advantage of taking a chance at any moment by levering up to invest in new projects which bring in more returns than high leveraged companies.

In the Appendix C, the returns on the three independent variables are displayed for Portfolio 1 (Small size/Low leverage companies).

In the Table 5.8 below, we regressed the annual excess returns on the three explanatory variables BIG, SMALL and FC for the 6 portfolios. We see that BIG is not significant for the small size portfolios. The reason is that BIG averages big size firms. For portfolios 4 and 6, SMALL is not significant and it makes sense because it averages small size firms. The model seems to very well explain the variation of returns. The R^2 for the 6 portfolios' regressions have an R^2 varying between 0,860,86 and 0,93. The most important is that the FC coefficients are always significant and higher for medium and high DE portfolios than low DE portfolios. Similar to Lamont, Polk, and Saá-Requejo results, **we observe that there exists a leverage factor in stock returns**.

		Regression results				
	PTF #	**Intercept**	**BIG**	**SMALL**	**FC**	R^2
Small size						
Low DE	1	−0,053	0,207	0,983	−0,746	0,88
		[−1,906**]	[0,783]	[3,933***]	**[−5,924***]**	
Medium DE	2	0,029	0,187	0,695	1,208	0,89
		[1,485*]	[1,061]	[4,837***]	**[6,111***]**	
High DE	3	−0,005	0,337	0,853	0,682	0,87
		[−0,189]	[1,310**]	[3,670***]	**[6,750***]**	
Big size						
Low DE	4	0,038	1,046	−0,108	−0,675	0,86
		[1,701**]	[3,401***]	[−0,385]	**[−4,092***]**	
Medium DE	5	0,008	0,591	0,324	1,259	0,93
		[0,571]	[5,273***]	[3,164***]	**[10,891***]**	
High DE	6	−0,022	0,903	0,005	0,422	0,89
		[−1,148]	[4,972***]	[0,035]	**[6,876***]**	

* t-statistics significant at 90%
** t-statistics significant at 95%
*** t-statistics significant at 99%

Table 5.8: Testing the existence of a leverage factor

5.3.1.3 Risk-adjusted return according to systematic risk model: CAPM

In the Table 5.9 below[8], we regressed the excess return when using only the market risk Rm-Rf from the CAPM. The equation is Excess return = (Intercept) + $\beta(R_m - R_f)$. We see that the market beta has a coefficient of 1,675 and is significant at the 90% level. The coefficient is significant at the 90% level. The intercept is 0,206 and the closer is the intercept to zero, the better is the model (the variables explain well the variation of the return). The R^2 is highlighted in orange and we see that it is low (0,10).

	Coefficients	**Standard Error**	**t-stat**	**p-value**	**Lower 95%**	**Upper 95%**
Intercept	0,206	0,046	4,470	0,000	0,110	0,301
$R_m - R_f$	1,675	1,065	1,573	0,130	−0,533	3,884

Regression Statistics	
Multiple R	0,32
R Square	0,10
Adjusted R Square	0,06
Standard Error	0,22
Observations	24

Table 5.9: $R_m - R_f$ as explanatory variable

In the Table 5.10 below, we included as explanatory variable the HML factor and we see that the R^2 is a little bit higher but is not as good as the R^2 obtained in Table 5.12.

	Coefficients	**Standard Error**	**t-stat**	**p-value**	**Lower 95%**	**Upper 95%**
Intercept	0,209	0,045	4,622	0,000	0,115	0,303
$R_m - R_f$	1,739	1,043	1,668	0,109	−0,423	3,902
HML	−1,516	1,444	−1,050	0,305	−4,511	1,479

Regression Statistics	
Multiple R	0,39
R Square	0,15
Adjusted R Square	0,07
Standard Error	0,22
Observations	25

Table 5.10: $R_m - R_f$ and HML as explanatory variable

In the Appendix D, we regressed the average FC return on the equity risk premium and in the Appendix E you can find the same regression but without intercept. We see that our results are worse without intercept so we decided to always use the intercept in all further regressions.

[8]We did our regressions with the Data Analysis button on Excel.

5.3.1.4 Risk-adjusted return according to systematic risk model: Fama & French's three factors

Data retrieved on Fama & French's database

We used the market risk premium ($R_m - R_f$), the SMB and HML factors of Fama & French by uploading the data from their database[9].

We took excess return as ordinate and $R_m - R_f$, SMB and HML as abscissa. Here is the equation we use for the three-factor model:

$$R_i - R_f = \alpha_i + \left(\beta_{i,R_m-R_f} \times (R_m - R_f)\right) + (\beta_{i,\text{SMB}} \times \text{SMB}) + (\beta_{i,\text{HML}} \times \text{HML}) + \varepsilon_i$$

With i: asset i; ε_i: residuals.

We obtained logical incomes. First, the **coefficient SMB** for portfolios 1, 2 and 3 which are small size companies are each time higher than their peers which have the same leverage ratio but not the same size (portfolios 4, 5 and 6 respectively). Second, we see that the **beta** of the **HML** factor is increasing with leverage, indicating that more leveraged companies are more exposed to the value factor, as HML is a proxy for financial distress. Third, we observed that the **market risk** ($R_m - R_f$) coefficient **beta** is increasing with leverage and increasing with size which means that more leveraged companies and bigger size companies are more sensitive to the market movements. Also, all our $R_m - R_f$' beta are positive which make sense because only gold has a negative beta.

Unfortunately, we observe that the coefficients for SMB and HML are not significant for our 6 portfolios. Indeed, they all have t-stats lower than 1,285[10] except for 2 out of 12. As a consequence, we can consider them to be not significant at the 90% level. Being significant at the 90% level means our regression is 90% likely to explain 46% (the best R^2 we have for Portfolio 6) of the variation of the portfolio return. It means that our model is valid but only up to 46% of the variation is explained when we use these variables.

In the Table 5.11 below, we present the outcomes of the regression for the first portfolio (S/L) using the three explanatory variables from Fama & French' database.

[9] French (2016).

[10] When dealing with a normal distribution, a coefficient is significant at the 90% level, if the t-stat is higher than 1,285; significant at the 95% level, if the t-stat is higher than 1,645 and significant at the 99% level if the t-stat is higher than 2,325.

	Coeffi-cients	Standard Error	t-stat	p-value	Lower 95%	Upper 95%
Intercept	0,238	0,050	4,754	0,000	0,134	0,342
$R_m - R_f$	0,862	1,236	0,697	0,493	−1,709	3,432
SMB	2,488	1,946	1,278	0,215	−1,559	6,534
HML	−1,650	1,428	−1,156	0,261	−4,619	1,319

Regression Statistics	
Multiple R	0,46
R Square	0,21
Adjusted R Square	0,10
Standard Error	0,22
Observations	25

Table 5.11: SMB and HML from the Fama-French database

We also observed that R^2 **is increasing with leverage** which means that the three-factor model seems to better explain stock returns for firms with high D/E ratio. In other terms, it means that leverage is an important variable to take into account for predicting stock return when dealing with relatively high leveraged companies. On the other hand, it seems that the three-factor model does not explain a lot of variation for low-leveraged companies; it indicates that other explanatory variables that we do not have in our equation are needed in order to better explain the regression (the excess return).

Our own realised risk premiums ($R_m - R_f$, SMB and HML factors)

The advantage of using our own $R_m - R_f$, SMB and HML factors over Fama & French's factors is that ours are **more tailored** as they do not include for example financial companies which are irrelevant in this thesis subject.

In order to obtain the SMB and HML factors, we created **new portfolios**. We followed the procedure explained by Fama and French in doing so (1993). We split our sample of 1 203 companies[11] in two groups with the percentile 50% (small and big market value) and we further split these two groups into three groups based on their level of book-to-market ratio (low, medium and high book-to-market) using the same percentiles as the ones used for creating the leverage portfolios: 1/3 and 2/3. We then computed the evolution of the portfolio value of the 6 portfolios year by year. Finally, we computed the SMB and HML factors year after year by using the subtractions stated in Chapter 4.2.2.

As for the $R_m - R_f$ factor, we used our entire sample (without doing the distinction with percentiles), and we followed the same procedure than the one explained in Chapter 4.2.2.

As above, we regressed the annual excess returns for each of the 6 portfolios (classified by

[11] The financial companies being excluded.

market value and leverage) but this time with our own explanatory variables $R_m - R_f$, SMB and HML that we computed[12]. The first difference we notice is that our R^2 are really better. For instance, we obtained an R^2 for the first portfolio of 0,85 against an R^2 of 0,21[13]. The highest R^2 we obtained is 0,95 for the portfolio B/M (Big market value/Medium leverage) whereas the highest R^2 we obtained with the database' SMB and HML factors is 0,46 for the portfolio of Big market value/High leverage.

In the Table 5.12 below, you can observe our regression with our own factors for Portfolio 1. We see that our explanatory variables' coefficients are significant at the 99% level (t-stat $>$ 2,325).

	Coefficients	**Standard Error**	**t-stat**	**p-value**	**Lower 95%**	**Upper 95%**
Intercept	0,09	0,03	3,00	0,01	0,03	0,15
$R_m - R_f$	1,02	0,13	7,85	0,00	0,75	1,29
SMB	1,36	0,31	4,36	0,00	0,71	2,02
HML	−0,58	0,13	−4,54	0,00	−0,85	−0,31

Regression Statistics	
Multiple R	0,92
R Square	0,85
Adjusted R Square	0,83
Standard Error	0,10
Observations	25

Table 5.12: Our own realised risk premiums

5.3.1.5 Summary of our findings

Underneath, the Table 5.13 summarises all our results described above.

The numbers displayed represent the coefficients of the variables. The figures in brackets represent the t-statistics.

We will not announce that the Lamont, Polk, and Saá-Requejo's methodology is better than Fama and French' methodology on the basis of the R^2 (please refer to Table 5.8). Our goal is not to compare the models out there in the litterature and to affirm that one is more appropriate than another only because of the R^2. In our understanding, the research objective of Lamont, Polk, and Saá-Requejo was to find which model explains best the constraints factor and they found that asset pricing models are not very good at it because of the mispricing factor which is higher. In this thesis, **we distinguish from**

[12]Except the variable $R_m - R_f$ which still comes from the Fama and French database.
[13]When using Fama & French variables.

	Intercept	$R_m - R_f$	**SMB**	**HML**	R^2
CAPM					
FC as excess return	−0,08	0,73 [−2,38***]	/ [0,95]	/	0,04
"Normal" excess return	0,21	1,68 [4,47***]	/ [1,57*]	/	0,10
2 factors					
$R_m - R_f$ and HML	0,21	1,74 [4,62***]	−1,52 [1,67**]	/ [−1,05]	0,15
Fama & French 3 factors					
Fama & French 3 factors' database	0,24	0,86 [4,75***]	2,50 [0,70]	−1,65 [1,28]	0,21 [−1,16]
Our 3 factors	0,09	1,02 [3***]	1,36 **[7,85***]**	−0,58 **[4,36***]**	**0,85 [−4,54***]**

* t-statistics significant at 90%
** t-statistics significant at 95%
*** t-statistics significant at 99%

Table 5.13: Summary of results

these authors because what we want to do is to adjust the return from risk; and we decided to use the three-factor model.

5.3.2 Risk-adjusted returns for individual sectors

5.3.2.1 Alpha

In the Table 5.14, we performed the same equation than in Chapter 5.3.1.1. for our 5 groups of sector(s) taken individually:

Portfolio	**Basic Materials + Utilities + Telecom**	**Consumer Cyclicals and Non-Cyclicals**	**Energy**	**Industrials**	**Healthcare + Technology**
S/L	3,4%	9,4%	8,8%	1,4%	19,2%
S/M	2,0%	10,0%	3,7%	4,0%	20,2%
S/H	0,9%	3,1%	8,4%	4,8%	10,9%
B/L	8,1%	15,3%	8,3%	9,4%	24,0%
B/M	0,1%	9,4%	5,4%	6,7%	20,2%
B/H	1,5%	9,3%	6,1%	5,9%	9,8%

Warning: Only positivre returns due to survivorship bias

Table 5.14: Alpha per portfolio per sector

First of all, all portfolios have generated a positive alpha. This is due to the survivorship bias and enables investors to invest only in firms that did not disappear during our period of study.

Then we can say that these results confirm what we said above: low leverage portfolios

generate higher excess return (alpha) than high leverage portfolios. This is true for all sectors excluding the Industrials small size portfolios. As a consequence, they refute our expectations from the research objective that highly leveraged stocks outperform portfolios of low leveraged stocks. In fact, it is the reverse: **portfolios of low leveraged stocks achieve better results than portfolios of high leveraged stocks**.

Concerning the big alphas, it means that we made a return far more important than the theoretical model predicted by the three-factor model. It signifies that we did not pay enough for these stocks. They were cheap as the market was attributing them too big risk premiums[14]. Either it is due to an irrational fear or it reflects a non-reflected risk in our model (for example the distress risk factor not taken into account by HML but taken into account by investors).

From these big alphas, a significant premium brings out for the 6 portfolios of the sector Healthcare and Technology which are really higher than for all the other sectors.

5.3.2.2 Risk-adjusted returns according to systematic risk model: Fama & French's three factors

We checked whether the coefficients of the explanatory variables from low leverage portfolios are more exposed (have a higher coefficient) to risk factors than high leverage portfolios. We started by analysing the significance of all coefficients and we ruled out all non-significant figures.

Below, you can find the Table 5.15 summing up our analysis.

Before sharing our conclusions, **we give our expectations** on the results in terms of loadings for the three factors.

Theoretically, stocks and portfolios the most leveraged will have a higher loading for the **market beta**.

Suppose we have two similar companies except that company A has 100 of equity and company B has 50 of equity and 50 of debt. If their firm value takes 10%, they both will be worth at 110. In absolute amounts, shareholders in both companies will earn 10 but expressed in relative amounts, company B' shareholders will earn 20% as they have a greater exposure to risk due to the leverage effect. B has a beta twice bigger than A after

[14]When the risk increases, the risk premium increases too and it makes a high discount rate which in turn gives a low price mathematically.

# Sectors	$R_m - R_f$	SMB	HML
1, 9, 10	Higher loadings for small size portfolios	/	No big difference
2, 3	Mixed results	/	Higher loadings for high leverage portfolios
4	/	/	/
6, 8	Higher loadings for low leverage portfolios	Higher loadings for small size portfolios	Higher loadings for high leverage portfolios
7	Higher loadings for high leverage portfolios	/	Loadings slightly higher for high leverage portfolios than medium leverage portfolios
All sectors	Higher loadings for high leverage portfolios	Higher loadings for small size portfolios	Higher loadings for high leverage portfolios

Table 5.15: Coefficients' exposure by sector

CAPM because of the leverage effect, all other things being equal.

As for **SMB**, there are two reasons whereby we expect to see higher loadings for portfolios 1, 4 and 7 (small market values) than for portfolios 3, 6 and 9 (high market values).

The first reason is that size factor is already a selection criterion for the portfolios formation.

The second reason is that small firms are in a more unstable situation than larger firms with regard to taking out a loan and financing itself. Perez-Quiros and Timmermann (2000) indeed say that small firms have not as much collateral as bigger firms do have and will not as easily get a loan. As a consequence, in period of recession and credit crunch where the informational asymmetry between lenders and firms is greater than during a period of expansion, small firms will be more impacted and a flight to quality will be observed. Erel, Julio, Kim, and Weisbach (2012) explain the flight to quality as a situation in times of economic uncertainty where investors become more risk averse and move their capital away from riskier investments to safer bets such as larger firms with a better capital intensity.

With regard to **HML**. We expect to see positive coefficients for high leveraged companies as after Fama and French (1996) theory this factor is a proxy **for financial distress**. If we observe a negative coefficient, it would mean that growth stocks yield more than value stocks. We remind that stocks valuation are based on the prospective cash flows. To give an approximate estimation, we would say that on a 10-year time scale all future cash flows of a value stock lie between 1 and 3 years whereas they lie between 6 to 10 years for a growth stock. Growth stocks are also more flexible than a value stock from a balance sheet perspective; they can decide to change projects without putting the company's situation at risk.

From our analysis, it appears that low leverage portfolios have higher loadings (coefficients) for SMB than high leverage portfolios which means that they are more exposed to this factor.

Also, we see that high leverage portfolios have higher loadings for HML than low leverage portfolios. For $R_m - R_f$, we have no meaningful differences among portfolios. This suggests that the 6 portfolios are exposed on a similar way to market risk.

5.3.3 Conclusion

We can draw as conclusion that after having adjusted for all systematic risk-factors (Rm-Rf, SMB, HML), if low leverage companies outperform, it means that investors either **underestimate the opportunity of being underleveraged** (e.g. freedom to lever up a lot of debt for a new opportunity, included opportunity of M&A/buy & build etc) **or** they **underestimate the risk of debt overhang**.

5.4 Net debt on EBITDA

PTF #	Portfolio name	Return	Excess return
1	Small size/Low Net Debt/EBITDA	25,2%	21,7%
2	Small size/Medium Net Debt/EBITDA	21,4%	18,0%
3	Small size/High Net Debt/EBITDA	14,7%	11,3%
4	Big size/Low Net Debt/EBITDA	25,2%	21,8%
5	Big size/Medium Net Debt/EBITDA	16,5%	13,0%
6	Big size/High Net Debt/EBITDA	14,4%	10,9%

Table 5.16: Portfolios returns classified by Net Debt/EBITDA and Market value

After our results (see Tables 5.16 and 5.1), we can conclude that the returns are almost identical which lead us to think that leveraged companies are companies which have relatively high net debt to EBITDA ratios.

6 Statistical work

Here are the different steps through which we will analyse the relevance of our regressions.

First and foremost, we wanted to test for endogeneity between our independent variables and the error term/the residuals.

We estimate that testing endogeneity in our sample is important for the following reason. In order to make up 6 portfolios, we used as selection criteria the size (market capitalization) and we obtained two groups of small and big market capitalization. Then, we regressed the returns of these portfolios (y, the dependent variable) by taking into account the size factor SMB (x, one of our 3 independent variables). We had a doubt to have SMB in both sides of the equation.

All the following steps are performed with the SPSS software.

Secondly, we look at the R^2 and R^2 adjusted. The difference between both measures is that when we add an explanatory variable to the model, the R^2 increases automatically. However, with the R^2 adjusted measure, when we load an extra independent variable in the model, R^2 adjusted will only increase if the variables we add are significant. In this respect, we estimate that the second measure, R^2 adjusted is more reliable. Nevertheless, we used the R^2 in our regressions above as the differences between our R^2 and R^2 adjusted are not that large.

Thirdly, we perform with SPSS a global analysis of the model. An F-test (Fisher test) is the test statistic that we use to compare a big model with a small model.

$$\begin{cases} H_0 : \beta_1 = \beta_2 = \beta 3 = 0 & \text{then } Y_S = \beta_0 + U. \\ H_1 : \beta_1 \neq \beta_2 \neq \beta 3 \neq 0 & \text{then } Y_B = \beta_0 + (\beta_1 \times x_1) + (\beta_2 \times x_2) + (\beta_3 \times x_3)\,. \end{cases}$$

(with S = small model and B = big model).

Fourthly, we perform an individual analysis of the input of each explanatory variable on the dependent variable y. The test statistic used here is the t-test (Student test).

Fifthly, we carry out a multicollinearity test between our explanatory variables to check the existence of a linear relation between these variables. Collinearity is the fact that two

variables (or more) give the same information to the dependent variable.

Sixthly, we perform a test to check the autocorrelation of error terms with the independent variables. If we have autocorrelation, it means that our model is incorrectly specified, that an explanatory variable is missing or that data are not independent.

Seventhly, we check whether the sign of the coefficients make sense from an economic point of view.

Finally, we perform a residuals analysis.

Note that in this chapter only Portfolio 1 is used as dependent variable. In the Appendix G we displayed the same outcomes of the tests we carried out for Portfolios 2, 3, 4, 5 and 6.

6.1 Endogeneity

We verified the existence of endogeneity with the Hausman test on Excel with the *Data Analysis* button.

We followed the procedure known as Hausman test[1]. First we computed the residuals for the entire model with the return of the portfolio [2] as dependent variable and $R_m - R_f$, SMB and HML as independent variables. Secondly we took one of the explanatory variables as ordinate/dependent variable, for example $R_m - R_f$, and we used the two other explanatory variables SMB and HML as well as residuals as the right hand-side of the equation. We repeated the operation three times for our three independent variables. We always obtained a t-stat for residuals of almost 0 which means that we accept the null hypothesis H_0 of no correlation between the explanatory variable and the error term.

6.2 R^2 and R^2 adjusted

In SPSS, for Portfolio 1, we obtained an R^2 of 0,522 and an R^2 adjusted of 0,454.

	Sum of squares	**df**	**Mean Square**	**F**	**Sig.**
Regression	6 584,819	3	2 194,940	7,645	0,001
Residual	6 029,511	21	287,120		
Total	12 614,329	24			

Table 6.1: ANOVA on the Excess return of Portfolio 1

6.3 Fisher test

Based on these results, we can conclude that the model is good as the p-value of 0,001 is lower than 0,05.

6.4 Student test

	Unst^{zed} Coefficients		St^{zed} Coef.			95% Conf. Interval		Collinear-ity Statistics	
	B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Toler-ance	VIF
(Constant)	24,183	4,050		5,972	0,000	15,761	32,604		
$R_m - R_f$	1,844	0,803	0,347	2,297	0,032	0,174	3,514	0,994	1,006
SMB	2,147	0,527	0,648	4,071	0,001	1,050	3,244	0,899	1,113
HML	−0,565	0,227	−0,397	−2,489	0,021	−1,036	−0,093	0,894	1,119

Table 6.2: Student test on the Excess return of Portfolio 1

The outcomes of this table is that all variables are significant as their p-value are lower than 0,05[3].

6.5 Multicollinearity: Variance Inflation Factor (VIF)

We tested multicollinearity with SPSS above in the right-part of the table, and in the Appendix F with Excel. We see that we obtained exactly the same VIFs. The variance inflation factor (VIF) of each variable is markedly below 10. We can conclude with not a too a big chance to make a mistake that our model does not suffer from multicollinearity. As a consequence, our variables are linearly independent.

[1] Ogunc and Carter Hill (2008).
[2] We only did our statistical tests for Portfolio 1.
[3] We allow ourselves to remind that the intercept – (Constant) in the Table – is not a variable.

6.6 Economic sense

Do the signs of the coefficients make sense from an economic point of view?

When we look at the table of the coefficients above and with respect to what we explained at the end of Chapter 5.3.5, these coefficients make sense from an economic point of view.

6.7 Autocorrelation

Sum of squares	df	Mean Square	F	Sig.
0,723	0,522	0,454	16,945%	1,954

$N = 25$, k (number of parameters: 1 y and 3 x) $= 4$.

Table 6.3: Autocorrelation test on the Excess return of Portfolio 1

The test is DW $= 2 \times (1 - r)$ with $-1 \leq r \leq 1$.

DW varies between 0 (positive autocorrelation) and 4 (negative autocorrelation).

In our table, we see we have a DW of almost 2 which means that we do not have correlation between the residuals.

6.8 Normality analysis

6.8.1 Residuals analysis

From this chart, we can say that the 3 conditions that define normality of residuals are verified: firstly, that the scatter plot has no particular pattern and has a random distribution. Secondly, that the positive residuals components offset the negative residuals components such that the sum of the residuals makes 0. Lastly, 95% of the standardized residuals are located in the range of values $[-2; 2]$.

Our residuals follow a normal distribution and our model is valid[4].

So we can state that our model is validated and that the residuals follow a normal distribution.

[4]It is not an issue to have a sample of 25 but having a sample of less than 20 or not the normality would have complicated the analysis. Indeed, in these two cases Student and Fisher test cannot be used as they suppose a normal distribution. We should have then used non-parametric tests like the Breusch-Pagan test.

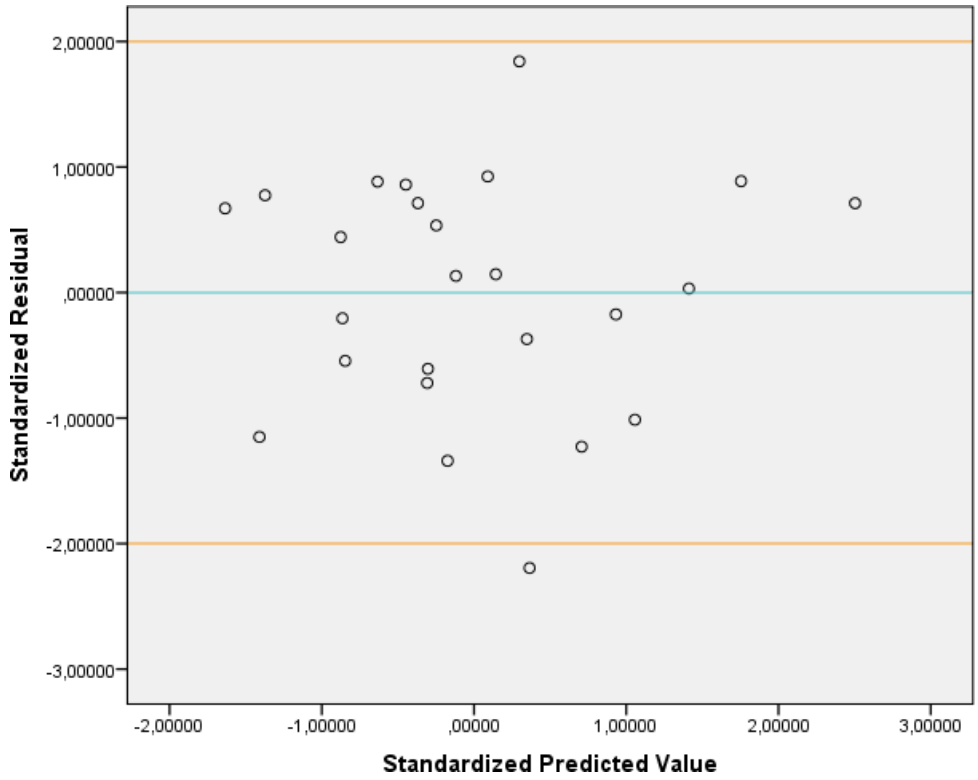

Figure 6.1: Residuals analysis for Portfolio 1

6.8.2 Visual tool and Normality test

The normal probability plot (or "*droite de Henry*" in French), which belongs to the family of the Q-Q plot, is a visual tool that allows to see easily if the distribution follows a Gaussian distribution. Here, as the majority of the points are on the 45 degrees' line, we can consider to have normality.

As the normal probability plot does not have the scientific rigour of a statistical test, we use the Shapiro-Wilk or Kolmogorov-Smirnov test to test the normality of standardized residuals.

	Kolmogorov-Smirnov[5]			**Shapiro-Wilk**		
	Statistic	**df**	**Sig.**	**Statistic**	**df**	**Sig.**
Standardized residual	0,123	25	0,200[6]	0,962	25	0,455

Table 6.4: Normality test

The null hypothesis H_0 says that we have normality and here as we have a high p-value (higher than 0,05), it means that we accept the null hypothesis[7].

[7] H_0: normality. H_0 is accepted if p-value $>$ 0,05. We draw attention on the fact that here it is not the same case than significance tests where p-values must be smaller than 0,05 to affirm that variables are significant. For Jarque-Bera and other tests that test normality, p-values must be greater than 0,05 to conclude that the data follow a Gaussian distribution.

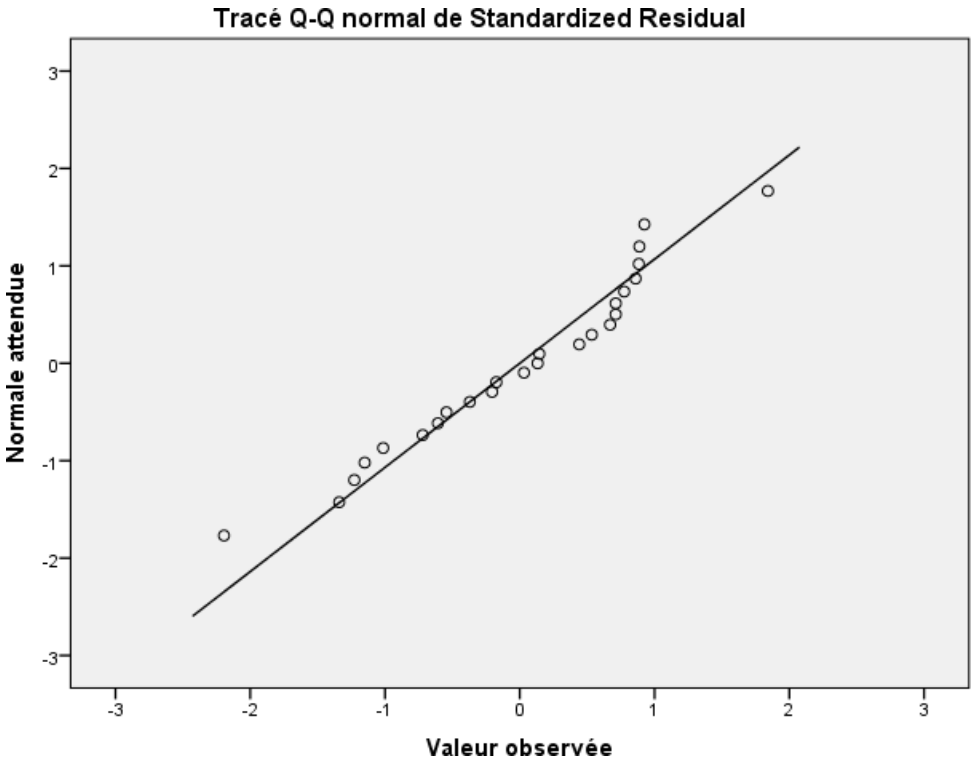

Figure 6.2: Q-Q plot for Portfolio 1

6.9 Comparison between regressions/sub-population: Chow test

In the Appendix H, we performed a Chow test to check the stability of parameters between two regressions. We compared Portfolio 1 with Portfolio 3 and Portfolio 4 with Portfolio 6. We obtained as results that there are no structural changes between the explanatory variables of the regressions compared which means that our portfolios' returns are statistically the same.

7 Limitations and Suggestions for future research

7.1 Limitations and weaknesses

Survivorship bias

The 1 506 stocks that have been retrieved from Datastream are stocks that were listed in May 2016 (the date they have been found). But if we look at the number of stocks that have a price at the beginning of the period of analysis – that is, in January 1990 –, only 625[1] firms do have a price. There are many reasons for that; companies who disappeared have been bought or may have declared bankruptcy or have been liquidated. The problem is that it makes our analysis a bit biased as rightly one of the objectives of this thesis was to invest in highly leveraged and distressed firms. And so if we invest in the high leveraged companies over the 26 years, we obtain a higher return that if we had invested in the companies who have been delisted.

Leverage filtered

We marked in the Excel files the negative leverage ratios by "NaN" (Not a Number) because it does not make any sense to have a negative leverage. Also, we set an arbitrary threshold to 20 to avoid that some outliers misrepresent the samples and computations. We did not choose a lower limit as it is conceivable from our opinion to have such ratios and being too constraining may lead to neglect potential highly leveraged companies.

Below, the Table 7.1 represents the differences of total average leverage ratio per sector when taking into account the threshold of 20 or not. We see that for some sectors, the difference is quite significant!

We see in the Table 7.2 below (for the year 2002) that all deciles change when introducing the threshold of 20.

We here explain the cases in which we can encounter a very high D/E ratio.

The only possible case is when shareholder equity is very small. The reasons that can lead to a very small shareholder equity are either that is it an accounting deferred loss: in this

[1] Without the financial sector companies, we have 516 firms.

Sectors	**Total average[2] leverage ratio**	
	With outliers	Without outliers
Basic Materials	1,08	0,98
Consumer Cyclicals	1,35	0,81
Consumer Non-Cyclicals	1,37	0,88
Energy	0,64	0,63
Healthcare	0,98	0,53
Industrials	0,98	0,72
Technology	1,23	0,37
Telecom + Utilities	1,47	1,40

Table 7.1: Difference when taking into account or not the threshold of 20

Without outliers > 20 **(2002)**	**With outliers (2002)**
0	0
0	0
0,05	0,05
0,20	**0,21**
0,35	0,35
0,52	0,53
0,69	0,70
0,97	**0,98**
1,36	1,40
2,05	2,16
18,78	3 096,64

Table 7.2: Impact of the threshold on the percentiles

case it is temporary and in a few months ahead it is getting back to normal, or it is a real loss that can lead to bankruptcy and will be recognised if we see "NaN" appear in the Excel tables. For example, a company has one million (1M) of debt and 1M of equity. If there is a deferred loss, then the negative result is brought to the liabilities side and is carried forward to a later year. Or there is an asset depreciation: a 1M worth patent is declared worthless. We will then have 1M of debt and 0 Equity (1M - 1M).

Debt remains always fixed but equity changes: shareholder equity does not change but is impacted by the accountant deferred loss or the real loss. Therefore, a very high D/E ratio is not a bug and is very likely according to the reasons mentioned above. We decided to withdraw these companies in order to not deform the average. Also, it is not a big deal as only a few companies are concerned by this matter. What we seek to do in this thesis is to confirm if investing in companies with a D/E ratio higher than the sector average yield a different or higher return than other companies. We do not try to verify if a few companies did bankrupt or are in a difficult situation.

Annual return

We used annual returns but if we had used monthly returns, we would expect our regressions

to be more accurate and that our explanatory variables capture more 'uncertainty' and our R^2 and R^2 adjusted would be higher.

Also, as we have only 25 data, it obliges us to have fixed coefficients. When we regress our returns, Excel *(Data analysis button)* gives us only one coefficient per variable and we use this coefficient for computing the expected/theoretical returns each year. If we had used monthly returns, it would have allowed us to have different coefficients. We could have for example each month use a different beta coefficient by doing the average of the 36 preceding periods (months) but because of our lack of data, it was not doable. Nevertheless, as explained in Chapter 4.2.2. we managed to use a moving average for 10 of our 25 years.

7.2 Suggestions for future research

Instead of using annual returns, we could have used **monthly returns**. With monthly returns, we could have obtained more robust regressions as usually the more points you have, the more robust is your analysis, but we estimated that it is doable with only 25 points.

We decided to use the three-factor model of Fama & French but we could instead have used their five-factor model (which contain profitability and investment) and also include the momentum and low volatility factor.

We could have further decomposed our size portfolios into **more** leverage **decile groups**, of for example 20%. But it was our goal to have big portfolios so we did not do it.

We could have done a **weighted sum according to the size** of the companies when computing returns.

Conclusion

Our research objective was to verify whether portfolios of highly leveraged stocks outperform portfolios of low leveraged stocks. The results show that it is not true. Indeed, low D/E portfolios achieve really better results than high D/E portfolios.

In the first part, we made an overview of the principal theories of capital structure and their viewpoint about the existence of an optimal leverage ratio. After that, we talked about the pros and cons of the use of debt and the conflicts of interest that may arise between shareholders, debtholders and managers. We also treated about the consequences of having too much debt and its repercussions. This situation can create costs of financial distress and extremely lead to bankruptcy or liquidation. Then, we presented the issue of debt overhang. Debt overhang causes underinvestment problems as shareholders are not prone to invest in new positive NPV projects as most of the gains will be intended for debtholders. We have seen that if the company gets a very risky profile, lenders will in some ways claim the potential upside for themselves.

In the second part, after having presented our research objective, we explained the methodology we adopted in this master thesis. After having excluded financial companies which are irrelevant in this study, with our 1203 companies, we formed 6 portfolios sorted by size and leverage ratio in order to carry out two investment strategies which are to invest in the highest and the lowest leverage portfolio and to compare their respective return. We also divided our sample in 5 groups of sectors based on their level of fixed assets on market capitalization.

In the next chapter, we presented our results. We observed higher return for low leveraged companies whereas we expected to see higher return for more leveraged companies because the investor is supposed to be remunerated for the risk he bears and investing in companies with a higher leverage involves more risk; so this is the opposite of what we expected. Also, the sectors of Healthcare and Technology generated the highest return during our 25-year period of analysis while they have the lowest leverage ratio, whereas the sectors of Basic Materials, Utilities and Telecommunication Services had the lowest performance while they have the highest leverage ratio.

Besides, we also found that firms with low market capitalization have higher return than companies of bigger market capitalization all things being equal (with a same leverage ratio) which is in line with the size premium of the Fama & French theory. Identically, high leverage portfolios have more exposure to the value factor than low leverage portfolios which is consistent with the Fama & French value premium.

We then adjusted these returns for systematic risks on two manners. The first way was by computing the alphas and the second method by comparing the coefficients of our variables derived from our regressions using the three-factor model. Our results confirmed our initial findings that low leverage portfolios have a greater exposure to the SMB factor and that high leverage portfolios have a greater exposure to the HML factor. This means that the risk premiums associated with these factors are larger for these portfolios.

As future research, we suggest to use monthly returns. It would have allowed us to be more consistent when computing our coefficients necessary to calculate the expected return. Also, we propose to include more factors in our regression such as the momentum or low volatility factor in order to capture more variation in our stock returns and maybe to reduce the gap between the expected and realised return.

Finally, we performed some statistical tests to analyse the relevance of our regressions and to identify potential biases that could be present between our dependent and explanatory variables. No issues have been detected which suggest that our data are reliable.

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