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Impact of capital structure on firm's performance: Evaluating the contribution of Tax-shields, financial distress costs and information asymmetric across industries

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Abstract

The relationship between capital structure and firm's performance has been intensively explored in corporate finances. Though traditional capital structure theories provide foundational insights, they usually fail to consider how industries attributes, internal resources and information asymmetric moderate this relationship. This thesis aims to achieve two keys objectives: firstly investigating whether the effects of debt on firm performance varies depending on industry characteristics and are considerably altered when debt is decomposed into debt maturity (long term debt vs short term debt) and capital mix (Mix between Equity and debt). Secondly, demonstrating that these effects considerably differs depending on information asymmetry (firm size used as proxy) and financial slack (proxied by liquidity/preferred financial order). By leveraging on the **Global Industry Classification Standard (GICS),** we explore a panel data extending across 04 sectors: Capital intensive, Pharmaceutical, Technology and Mature and Stable industries. We used Fixed effects (FE) models including dummy variables for financial slack and information asymmetry as well as interaction terms between debt variables and those dummy variables in order to find the optimal debt thresholds through the non-linear relationship between debt and return. Our empirical results show that maturity structure matters. Short term debt stands as a transitional tool in the pharma industry and distress signal in the tech sector. Conversely, liquidity (financial slack) is an amplifier increasing debt's effectiveness (pecking order theory) in both sectors. Also, Large firms(low information asymmetry) benefit from debt advantage while smaller (high information asymmetric) firms are penalized by the markets for issuing debt in all industries except capital intensive industry. We also found there exist a debt threshold in capital intensive and pharma industries (both industries are underleveraged) while there is no optimal debt level in the two other sector.

Keywords: *Capital Structure, Firm Performance, Debt Maturity, Financing Mix, Information Asymmetry, Financial Slack, GICS Sector, optimal debt.*

Zusammenfassung

Die Beziehung zwischen Kapitalstruktur und Unternehmensperformance ist ein intensiv untersuchtes Thema der Finance. Obwohl traditionelle Kapitalstrukturtheorien grundlegende Einblicke bieten, vernachlässigen sie häufig, wie Branchenmerkmale, interne Ressourcen und Informationsasymmetrien diese Beziehung moderieren. Die vorliegende Thesis verfolgt zwei Hauptziele: Erstens wird untersucht, ob die Auswirkungen von Verschuldung auf die Unternehmensperformance je nach Branchencharakteristika variieren und ob sie sich erheblich verändern, wenn die Verschuldung in Fristigkeit (langfristige vs. kurzfristige Schulden) und Kapitalmix (Eigen- und Fremdkapital) unterteilt wird. Zweitens soll aufgezeigt werden, dass diese Effekte in Abhängigkeit von Informationsasymmetrien (mit der Unternehmensgröße als Proxy) und finanzieller Flexibilität bzw. Financial Slack (Liquidität) erheblich divergieren. Unter Verwendung des Global Industry Classification Standard (GICS) analysieren wir Paneldaten aus vier Sektoren: kapitalintensive, Pharmazeutik, Technologie sowie reife und stabile Industrien. Wir verwenden Fixed-Effects-Modelle (FE) unter Einbeziehung von Dummy-Variablen für Financial Slack und Informationsasymmetrie sowie Interaktionsterme zwischen Verschuldungsvariablen und diesen Dummys. Ziel ist es, optimale Verschuldungsschwellenwerte über die nichtlineare Beziehung zwischen Verschuldung und Rendite zu ermitteln. Unsere empirischen Ergebnisse zeigen, dass die Fristigkeitsstruktur der Schulden von Bedeutung ist: Kurzfristige Schulden fungieren in der Pharmaindustrie als Übergangsinstrument, während sie im Technologiesektor als Krisensignal gewertet werden. Umgekehrt wirkt Liquidität (Financial Slack) als Verstärker, der die Effektivität der Verschuldung (gemäß der Pecking-Order-Theorie) in beiden Sektoren erhöht. Zudem profitieren große Unternehmen (geringe Informationsasymmetrie) von den Vorteilen der Verschuldung, während kleinere Unternehmen (hohe Informationsasymmetrie) in allen Branchen – mit Ausnahme der kapitalintensiven Industrie – vom Markt für die Aufnahme von Schulden bestraft werden. Wir konnten ferner nachweisen, dass in der kapitalintensiven Industrie sowie in der Pharmaindustrie Verschuldungsschwellenwerte existieren (beide Branchen sind unterverschuldet), während in den beiden anderen Sektoren kein optimales Verschuldungsniveau feststellbar ist.

Schlagwörter: *Kapitalstruktur, Unternehmensperformance, Fristigkeit der Verschuldung, Finanzierungsmix, Informationsasymmetrie, Financial Slack, GICS-Sektor, optimale Verschuldung.*

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I. Introduction and motivation

When it comes to corporate finance, the main issue for firms is not only to know which capital structure they should adopt, but also the appropriate debt maturity structure and financial mix. The main purpose is to attain the optimal capital and maturity structure where the cost of capital is kept at its minimum while the firm value or profitability is maximized (**Ezra Solomon**, 1963). Many scholars and practicians have tried to come up with an answer to this question. For instance, MM (Modigliani-Miller) suggests that if there are no taxes and capital markets are perfect, the market value of the company does not depend on its capital or maturity structure (**Modigliani-Miller**:1958). Nevertheless, In the presence of transaction costs, asymmetry of information and tax-sheltering, Modigliani-Miller 'theorem does no longer hold. According to **Kraus and Litzenberger (1973)**, the right capital and maturity structure should result from the tradeoff between tax rate and financial distress. As a matter of fact, interest payments are deducted from income before tax calculation. This consequently reduces taxable income. This reduction in taxes (due to interest payment) is therefore considered as a wealth transfer to investors from the government arising entirely from the capital structure choice of the firm (**Kraus and Litzenberger, 1973**).

There are also other subsequent and popular theories based on asymmetric information that arose. One of the prominent among them is the Agency Theory proposed by **Jensen and Meckling (1976).** As reported by them, the use of leverage is an useful and disciplinary tool to reduce agency costs that arise between shareholders (principals) and managers (agents). In other words, a (higher) level of debt would induce a constant payment of interest, therefore putting more financial pressure on the company. This in turn would discourage managers for making irresponsible financial decisions and encourage them to prioritize investments with positive net present value. In addition to this theory, the **Pecking Order Theory (Myers & Majluf**, 1984) was also developed. It outlines the company prefer a certain order of financing. Companies would prefer first to use internal or retained funds, then debt financing and as last resort Equity issuance.

While literature has done a remarkable job regarding advantages of indebtedness on firms financial performances, there exists a lacuna of knowledge regarding benefits of indebtedness on firms performances across different industries. As a matter of fact, different industries operate under distinct economic, technological, and competitive environments, which accordingly shape their

financing needs and risk profiles (**Hong and Tongtong**, 2025). For instance, a capital-intensive firm would probably take advantage of a higher leverage due to tax shield benefit provided by debt, whereas a high-growth technology company with high earnings instability and nonphysical assets would find internal funds and Equity financing more appropriate in order to secure financial flexibility and escape from the pressure arising from interest payments. On the other hand, a retail business would presumably give priority to a moderate and stable indebtedness level. Consequently, the aggregation in capital structures research may overlook inter-industry differences and specificities leading to a capital structure's homogenization. Some scholars such as **Boru Lei** (2025) have tried to address this issue. He carried out a study on the impact of capital structure on financial performances of firms across the real estate, manufacturing, retail, technology, and pharmaceutical industries in Hong-Kong. He found out for instance that real estate and manufacturing firms are strongly attracted by long term debts and this therefore improves their performances.

The main purpose of our research is to empirically assess how capital structure, maturity structure and financial mix leverage decisions affect companies profitability but also to assess how impactful these 03 parameters are on firm performances across different industries when asymmetry information and liquidity are taken into account. In order to achieve this, we would use a sample of 240 European non-financial firms. Observations run from 2020 to 2024 and firms are divided into 04 industries:

- **Capital-Intensive Industries** (e.g., Manufacturing, Utilities)
- **High-Growth & Technology/Knowledge-Based Industries** (e.g., Software, Biotechnology)
- **Service Industries** (e.g., Consulting, Professional Services)
- **Mature/Stable Industries** (e.g., Consumer Staples, Traditional Retail)

It is also important to highlight the fact that we are not only interested in assessing how debt impacts on firm's profitability. We are also interested in assessing how debt maturity structure (the mix of short term and long term debt) and financial (the mix of financial sources such as debt and Equity) across the 04 different industries we just highlighted above would change in the presence of information asymmetric and liquidity. Therefore, our study would revolve around those 03 debt aspects since they all measure leverage but convey different information on debt:

- **Debt size** (It measures the debt level of the firm with respect to the size of the firm)
- **The maturity structure of debt** (It measures the debt level with respect to its maturity: Short and long term debt)
- **The mix of financing sources** (This is about how much debt and how Equity financing is the firm using?)

II. Research Question and sub questions

Different prominent theories have emerged to explain the relationship between capital structure and corporate performance and each of them revolves around different factors. Those factors include: perfect market conditions (Modigliani-Miller theorem), information asymmetric (the Pecking order theory and Agency theory), the tax-shield and financial distress risk or costs (the trade-off theory). Our research encompasses all these factors in an attempt to assess how capital structure affects firm's performance. Given this, we formulated the following research question:

How does distinct capital structure dimensions (debt rate, debt maturity and mix financing) affect firm performance (ROA and ROE) and how does that effect change across different industries when considering the tax-shield benefits, financial distress risk (costs) and information asymmetry?

In order to answer this question, we would subdivide it into 03 other sub-questions related to leverage, maturity, mix financing, information asymmetric, financial distress costs and liquidity ratio.

SQ1:How does maturity structure of debt (long term debt and short term debt) impacts on firm performance ?

The purpose here is to find out how debt maturity structure impacts firm performance in different industries. We would also investigate how effects on firm performance of the combination between "tax-shield and debt" vary when associated with short and long term debts. We therefore formulated the following hypothesis:

H1: The general impact of debt on firm performance is industry specific: it is beneficial to heavy and physical asset industry (Capital intensive and mature industry) but damaging for non-physical asset industry (pharma and technology industry).

We want here to broadly assess the impact of overall debt on firm performance without taking account maturity and mix financing.

H2: The impact of short term debt on firm performance across each industry is more pronounced (stronger) than the impact of long term debt mainly due to liquidity and debt roll over risks.

The purpose of this hypothesis is to find out whether the fact a firm needs to roll over (short) term debt every time makes it to hurt performance more than long term debt. This means long term debt puts less pressure on firm performance than short term debt.

H3: The influence of debt maturity structure on performance is sector-specific: In mature and high tangible industries (Mature and stable and capital intensive industries), both long and short term debt enhances performance due to tax-shield while they deteriorate performance in less tangible asset industries (Tech and pharma industries) due to information asymmetric and abundant liquidity.

Through this hypothesis, we want to find out whether in high intangible assets industries (tech and pharma) where liquidity ratio is high, long term debt is a trap for firms (because of very high proportion of non-physical assets and market's penalty from issuing debt and further long term debt). Whereas in high physical assets industries (Capital intensive and mature and stable industries), long term debt is advantageous due to tax-shield lock and high asset tangibility.

SQ2: Is there an optimal capital structure that maximizes performance for each sector and how does that optimal capital structure change in presence of different levels of information asymmetric and asset tangibility?

The purpose here is to find out whether the non-linear inverted relationship (Inverted U-shape) between firm value and leverage as highlighted by the trade-off theory would displays distinct optimal leverage ratios for each industry. That means indebtedness is not necessarily a good or bad thing in itself, but the purpose is to show that up to a certain level, financial distress

cost start being more important than tax-shield benefits. As for the previous sub-question, the 02 following hypothesis were proposed:

H4: There exists a non-linear relationship between leverage and firm performance (Inverted U-shape) and the optimal leverage ratio (D*) is higher in tangible asset industries (Capital intensive and mature and stable industry) than in less tangible asset industries (tech/pharma industries).

The purpose of this hypothesis is to prove that debt is not necessarily advantageous or disadvantageous. But there exists an optimal debt level which maximizes tax-shield benefits and beyond it, performance starts decreasing. We also want through this hypothesis demonstrates that optimal debt is linked to asset tangibility as well as demonstrating that certain sectors and consequently certain firms are underleveraged or overleveraged.

H5: Liquidity stands out as a positive multiplier that raises a firm's optimal debt threshold level by offsetting bankruptcy risk (cost).

This fifth hypothesis seeks to show that optimal debt level can be increased or decreased depending on certain factors among which liquidity. So we want to find out whether firms with high level of liquidity have a higher optimal debt compared to firm with low level of liquidity. Liquidity then emerges as an insurance or a buffer.

SQ3: **How does the type of financing (preference order of financing among internal funds, debt and Equity) privileged by firms in industries conveys information asymmetry and to which extent that information asymmetric affects profitability?**

The purpose here is to investigate whether the fact that a firm has a preference order for the types of financing it would use sends a (positive or negative) signal to the market. This in turn would positively order negatively impact performance. Firms with high information asymmetric and high liquidity would probably be hurt more by debt issuance.

H6 (Asymmetry: Size): Leverage decreases firm performance more in smaller firms (High information asymmetric) than in lager firms (Low information asymmetric).

Using firm size as proxy for information asymmetric, (large firm are more scrutinized by governments and analysts and more information are available on them contrary to smaller firms)

we want to find out whether smaller firms are heavily penalized by the market for taking debt because of the lack of information (the firm is seen by the market as going through financial difficulties and quickly need financial support) While larger firms are less penalized (or rewarded) by the market for taking debt.

III. Introduction of the 04 different Industries

The industry in which a firm operates surely defines both its capital structure and its financial performance. There also exists a lot of industries and different criteria of classifications. Our own classification would be based on past studies, literature and from using **Global Industry Classification Standard** (GICS). For instance **Degryse, de Goeij, and Kappert (2012)** argued that the type of industry a firm operates in would determine its debt ratio. **Anzi Yao (2023),** differentiates between retail industry and real estate industry while **Boru lei (2005)** in his study on Hong-Kong firms came up with the following 04 industries: **real estate, manufacturing, retail, technology, and pharmaceutical industries.** On the other hand, **Rajeev Jain, Apurva Bhatnagar, Santosh Mishra (2025)** enumerated 04 industries in their study namely manufacturing, technology sector, financial sector and the retail sector.

Regarding empirical findings, **Rajan and Zingales (1995)** analyzed the capital structure determinants of firms from G7 countries. They found that due to variations in asset tangibility and growth, capital structure determinants largely vary across countries and industries. Similarly, **Abor** (2005) found varying impacts of capital structure on the profitability of Ghanaian firms across different sectors. Further studies in emerging markets, carried by **Chen and Strange** (2005) in China and **Nguyen and Jo (2018)** in Vietnam, resulted to the significant role of industry-specific characteristics. Building upon these previous findings and by examining contemporary data across multiple industries, we would try to find the optimal strategies and capital structure for firms across different industries.

On the other hand, the North American Industry Classification System (NAICS) classified industries into 05 categories: **Capital-Intensive Industries** (e.g., Manufacturing, Utilities, Airlines, Real Estate), **High-Growth & Technology/Knowledge-Based Industries** (e.g., Software, Biotechnology, E-commerce), **Service Industries** (e.g., Consulting, Professional

Services, Advertising), **Mature/Stable Industries** (e.g., Consumer Staples, Traditional Retail, Established Healthcare Services) and **Financial Services Industries** (e.g., Banking, Insurance).

Taking into account all of these information, we can definitely see that the sectors of **capital-intensive industries (manufacturing), the mature and stable industry (retail industry) and the technology sectors** always occur in the literature and empirical studies. We had the choice of adding to the list the **pharmaceutical** or the service sector. We preferred the former one because of the configuration and availability of the data.

A. Capital-Intensive Industries (e.g., Manufacturing, Utilities):

Firms in this industry require a lot of heavy investments in physical assets such as property and equipment. This information significantly influences their capital structure and they have to rely a lot on external funds (**Chen & Strange, 2005**; **Boru Lei, 2025**). Regarding their investment cycle, it is a very long one and they accordingly require to rely on long term investments and long term debt (Myers, 1977; Solomon, 1963). However, the reliance on heavy and long term debt makes also those firms to face a financial distress risk due to market changes (**Solomon,** 1963, **Titman, S**.1984). Firms operating in this industry usually invest a lot in illiquid and less redeployable assets. All of those characteristics make them to rely a lot on debt. In other words, they have a very high debt ratio and less Equity. For instance, real estate companies need very heavy finances to invest acquisition and development of properties. Similarly manufacturing companies rely a lot on debt than retail compagnies (**Degryse, de Goeij, & Kappert, 2012**).

B. The mature and stable industry (retail industry)

the capital configuration of mature and stable industry firms is characterized by the high proportion of tangible assets and the shortness of their investment cycles (**Almeida & Campello**, 2007). Since they do not depend on fixed capital investment as capital-intensive industries and given parameters such as the low capital requirement and reliability on market demand and operational flexibility, this type of firms are characterized by moderate leverage **(Boru Lei, 2005).** Mature and stable

industry firms (retail industry) do necessitate a lot of heavy fixed investment in facilities and heavy equipment but not as much as capital intensive industry's needs. This makes long term debt appealing for them and make them less risk adverse as far as borrowing is concerned. Their need for long term debt is far less than the one of capital intensive industries. According to **Boru Lei (2005),** those types of firms depend a lot on day-to-day activity and demand; This makes the market very unpredictable (volatile) and forces them, in consequence, to avoid very high leverage in order to reply to markets fast movements and changes in consumer behaviors (A high moderate debt level is preferred). This type of industry is very sensitive to macroeconomic factors and changes in consumer behaviors and preferences (**Bender, R., & Ward, K,**2008**)**. For example, in economic expansions seasons it is easy for firms to have access to loan and stimulate demands; However in recession periods the liquidity became scarce and firms may perform less.

C. High-Growth & Technology/Knowledge-Based Industries

In contrast to capital intensive industries, technology firms rely very little on debt. The difference between technology and mature and stable industry is that high-Growth & Technology/Knowledge-Based Industries rely less on debt than mature and stable industry. This industry is characterized by a heavy dependence on internal and Equity financing and this is attributed to their particular asset configuration and expansion opportunities; Their asset profile is made of very intangible assets such as software, talent, research and development as well as copy rights and patents and very low need of equipment and tangible assets (**Kedzior, M., Grabinska, B., Grabinski, K., & Kedzior, D**. 2020).. This asset profile generates different financing requirements than any other sector or industry; According to **Hogan & Hutson (2005)** and **Castro et al. (2015),** it is difficult for high tech companies to be granted loans because of the high intangibility of their assets and information asymmetry in the industry. Technologies companies at the beginning of their cycle would always rely on Equity financing to keep flexibility and to avoid pressure from debtholders during market volatility seasons. As a matter of fact, that industry is one of the most volatile **(Minola, T., Cassia, L & Criaco, G, 2004).** According to, **Timan and Wessels (1988),** one of the reasons for depending a lot on equity financing throughout the life

cycle of the firm is the fact that managers are not willing to send a bad signal to the market by issuing debt.

D. Pharmaceutical industry

Investment cycles in the pharmaceutical industry is very long and firms need to make a lot clinical trials and get regulatory approval (**Grabowski & Vernon**, 1994). They accordingly need huge level of capital to sustain research and development (R&D) and infrastructures and it actually takes 10 years or more for a drug to be tested and to be approved by regulators (**DiMasi, J.A., Grabowski, H.G., & Hansen, R.W: 2016**). As demonstrated by **Grabowski & Vernon**, (1994)**,** the long cycle investment period of pharma firms requires them to have huge upfront investments and return of investment generally start arising at the end of the trial phase. This then exposes them to significant risks including investment risks and potential absence of returns. The choice of the capital structure depends on 03 key factors:

the high proportion of non-physical of assets: The main assets in a pharma and healthcare firm are intangible and made of intellectual property and patents (**Grabowski & Vernon**, 1994). Those assets are not easily redeployable and it does not incentivize banks to grant them loans. Equity is then privileged compared to debt financing (**Shleifer, A., and Vishny, R. W.** 1992).

Long cycle of research and development (R&D): As stated by **Dimasi** (2016), from the start of the investment cycle to the regulatory approval, it may take up to 10 years or more. If they issue debts, they would have to pay periodic interests regardless if the drug is ready or still in clinical trials. The only solution left is then to rely on Equity financing to sustain their long term cycle investments.

The firm drug portfolio: The age of the firm matters. Highly aged and already possess a huge drug portfolio while young firms portfolio is made of less medicine or treatment. The old ones would generally have easier access to debt because of their track records while new ones would rely more on Equity (**Akinola, N., Apps**, R. 2025).

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IV. Literature review and empirical studies

There exists different theories linking capital structure, maturity structure, financial leverage and profitability. The purpose of this section is to present those theories and empirical results. We will also create a bridge between them and our study . We will start first with the Modigliani-Miller theorem, then we would explain the asymmetric information related theories: The trade-off theory, the pecking-order theory and the agency theory.

A. The Modigliani-Miller theorem

In 1958, **Franco Modigliani and Merton Miller** In their seminal paper titled *The Cost of Capital, Corporation Finance and the Theory of Investment* laid the foundations of the modern capital structure theory. They suggested that in perfect capital market settings, capital structure and as well as maturity and financial leverage are irrelevant. In other words, a firm value is independent of its capital structure (the mix of equity and debt to finance its investments) (Modigliani-Miller, 1958). It is based on the following assumptions:

- **No Taxes:** corporate or personal income taxes do not exist.
- **No Bankruptcy Costs:** No legal or administrative costs.
- **Symmetric Information:** There is no Adverse selection or moral hazard.
- **Efficient Markets:** No transaction costs, and investors can borrow/lend at the same risk-free rate as corporations.

The main issue with this theory is that it is not applicable in the real word. That is the reason why in attempt to address this issue, **Modigliani and Miller** released in **1963** a revision of the former theory titled *Corporate Income Taxes and the Cost of Capital*. That revision is commonly known as **the tax shield.** Based on the fact that interests are tax-deductible, there accordingly exists a tax advantage from using debt financing (**Modigliani and Miller**, 1963**)**. In other words, the market firm value of the firm is increased when the firm uses debt financing because of the present value of the tax shield.

The tax shield from debt can be expressed as:

$$\text{Tax Shield} = \text{Interest Expense} \times \text{Corporate Tax Rate}$$

1. Hypothesis

The issue with this theory is that it is not applicable to real world. Many scholars have already demonstrated that indebtedness indeed impacts on firm value and profitability. For example, **Graham** (2000) showed in his landmark empirical paper that tax shield is economically significant. Likely, **Dhaliwal et al**. (2006) in their seminal paper titled *"Taxes, Leverage, and the Cost of Equity Capital* argued that when a firm increases its debt, this in turn increases shareholders risk (the leverage risk premium). This in turn also increases the cost of capital and consequently decreases the profitability. One of the most famous authors who assessed the impact of debt on firm profitability is **Joshua Abor** (2005). In his seminal paper titled *"The effect of capital structure on profitability: an empirical analysis of listed firms in Ghana",* he found out that debt and especially short term debt positively impacts non-financial firms ROA in Ghana. That is the reason why we formulated the following hypothesis:

H1: The general impact of debt is industry specific: it is beneficial to heavy and tangible asset industry (Capital intensive industry and mature industry) but negative for intangible asset industry (pharma and technology industry).

H2: The impact of short term debt is more pronounced than the impact of long term debt across each industry due to liquidity risk and debt roll over risk

2. Measurement

Joshua Abor (2005) in his paper used a very simple panel regression including ROA as independent variable and Short and Long term debt ratios as dependent variables. We would just replicate the same model using Fixed effect model regression and interchange the dependant variables based on what we want to measure, Here is Joshua Abord basic regression model:

$$\mathbf{ROE_{it}\ or\ ROE_{it} = \beta_0 + \beta_1(Debt\ Ratio)_{i,t-1} + \beta_2(Size)_{i,t} + \beta_3(GDP\ growth)_{i,t} + \beta_4(Firmsize)_{i,t} + \beta_4(Liquidity)_{i,t} \epsilon_{i,t}}$$

Firstly, to prove that Modigliani-Miller (MM) theorem does not hold (testing the first hypothesis H1), we would run the above model and if the debt coefficient or estimate is significant, that would

imply that debt has an impact on firm performance. In other words, the Modigliani-Miller would not hold in case the debt estimate is significant.

If β1 is significant, MM theory does not hold.

We would after run Fixed effect Model (FEM) using Return on Equity (ROE) and (ROA) as dependent variables. Tests would be run for each industry separately. The independent variables would be the debt ratio (DR), the debt to equity ratio (D/E), the Long term debt rate (LTDR) and the short term debt rate (STDR) and would be interchanged. Control variables are liquidity, firm size, GDP growth rate.

Table 1: List of dependent variables

Dependant variables	Independent variables	Control variables
ROA and ROE	Debt ratio, Debt to equity ratio, Long term debt rate and short term debt rate	Liquidity ratio (Quick ratio), firm size (log of revenue), GDP growth rate

Model 1: Measuring the impact of debt on firm profitability.

$$\mathbf{ROE_{it}\ or\ ROE_{it} = \beta_0 + \beta_1(Debt\ Ratio)_{i,t-1} + \beta_2(Size)_{i,t} + \beta_3(GDP\ growth)_{i,t} + \beta_4(Firmsize)_{i,t} + \beta_4(Liquidity)_{i,t} + n_i + €_{i,t}}$$

Model 2: Measuring the impact of debt maturity on firm profitability

$$\mathbf{ROE_{it}\ or\ ROE_{it} = \beta_0 + \beta_1(Short\ term\ debt\ rate)_{i,t-1} + \beta_2(Long\ term\ debt\ rate)_{i,t-1} + \beta_3(Size)_{i,t} + \beta_4(GDP\ growth)_{i,t} + \beta_5(Firmsize)_{i,t} + \beta_4(Liquidity)_{i,t} + n_i + €_{i,t}}$$

Model 3: Measuring the impact of mix of financing on firm profitability

$$\mathbf{ROE_{it}\ or\ ROE_{it} = \beta_0 + \beta_1(Debt\text{-}Equity\text{-}Ratio)_{i,t-1} + \beta_2(Size)_{i,t} + \beta_3(GDP\ growth)_{i,t} + \beta_4(Liquidity)_{i,t} + n_i + €_{i,t}}$$

B. Trade-Off Theory

The trade-off theory was developed by **Kraus and Litzenberger** (1973) and stood as an answer to the limitations of the Modigliani-Miller irrelevance theorem(1958). While Modigliani-Miller explained the advantage of debt on firm's value through tax-shield, the optimal debt ratio in his theory is (however close to) 100%. This is actually impossible in the real-world and The trade-off theory was developed to address this issue. **Kraus and Litzenberger** (1973) introduced a new parameter: the financial distress cost. As proposed by them, optimal capital structure of a firm should result from the trade-off between the benefits of debt financing resulting from tax-shield and the cost of that debt commonly known as financial distress. There are different cost (risk) associated with indebtedness for a firm :financial distress cost and the agency cost.

1. Optimal debt level across industries in trade-off theory

Financial distress costs are made of direct and indirect financial costs. Direct costs consist of legal, administrative and accounting fees incurred while indirect costs consist of the loss of customers , suppliers ; and "fire sales" of assets (**Edward Altman**, 1984). Agency costs traditionally arise when there is conflict between shareholders (principal) and managers (agent) and this commonly known as the agency theory. Managers are tempted to take on high risky projects and go on empire building (**Jensen & Meckling**, 1976). There is a risk of underinvestment that then arises. According to **Dalci** (2018) ,there exists an inverted non-linear relationship between debt level and firm value (profitability). He demonstrated, that every firm and industry has "an optimal debt level". At a low debt level, the benefits of debts outweigh the cost of debts (risk of financial distress), but when the firm reaches the peak (optimal debt level), the costs of debt outweigh the benefits of debt (Tax-shield). Nonetheless, this optimal debt level differentiates according to the industry in which a firm operates. It also heavily depends on the firm and sector asset tangibility, profitability and business risk.

For instance, **high growth and technology** firms have very low tangible assets and rely then more on retained earnings and Equity financing than debt. They have a very low level of debt and consequently have a very low debt peak (low optimal debt level) (**Anzi Yao**, 2022). The optimum debt level (the peak) would be reach early in The inverted debt curve (the non-linear relationship

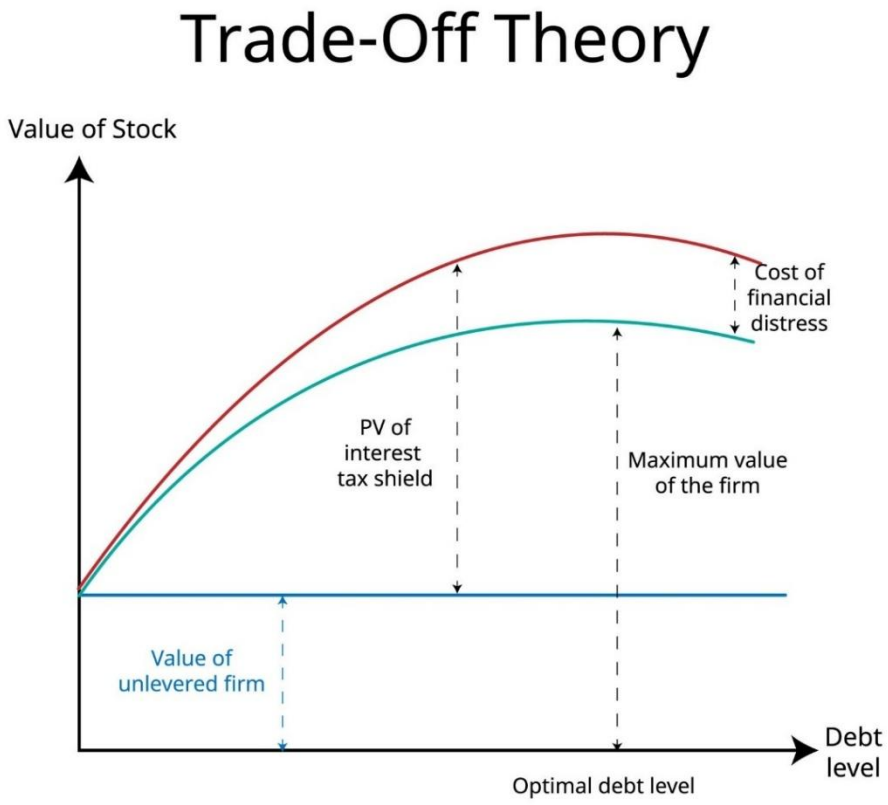
between debt and profitability). In other words, with even a low amount of debt financial distress is even high (**Titman, 1984**). In this industry, firms do not take advantage of tax shields benefits because they have very low debt ratio (**Graham, 2000**).

Regarding **mature and stable industry**, they have stable cash flows and profitability as well as moderate tangible and liquid assets. This allows them to take advantage of tax shields optimally (Miller, 1977), however due to low profitability ratio though stable, financial distress generally occurs at a moderate level of debt but the curve has a father top and peaks latter than technology industry (**Altman**,1984). In other words, the optimal debt level is higher in this industry.

In the **capital intensive industry**, collateral are highly tangible and activity cycles are very long. collateral such as buildings and power plants can be requested and seized by lenders in case of default of repayment. They accordingly have very easy access to high amount of long term debt and maximize considerable tax shield benefits. Due to that asset backing, optimal debt level is even higher than the 02 previous industries and the curve peaks very late (father right) (**Bradley, Jarrell, and Kim, 1984**).

Pharmaceutical industries also rely a lot on R&D and have considerable tangible assets but less than capital intensive industries. Since benefits arise very late in this type of industry, they rely more on long term debts and can also take advantage of tax shield benefits (**Titman and Wessels**, 1988). Distress cost are high but happen very late (generally during the trial phase which takes place after years hence the reliance on long term financings). The optimal debt level is also higher than mature and stable industry optimal debt.

Figure 1: Figure 1:The static trade-off theory of optimal capital structure (Shyam Sunder and Myers 1999)



2. Hypothesis formulation

Margarethis and Psillaki (2010) and **Berger and Bonaccorsi di Patti (2006)** are two of the most famous authors who empirically demonstrated the impact of debt on profitability using the tradeoff theory. Contrarily to the Modigliani-Miller theorem that states that there is a linear relationship between debt and firm values, they proved there in fact exists a nonlinear inverted U- Shape relationship between debt and firm profitability. Based on their empirical results, the following hypothesis were proposed:

H3: The influence of debt maturity on performance is sector-specific: In mature and high tangible industries (Mature and stable and capital intensive industries), long term debt enhances

performance due to tax-shield while they deteriorate performance in less tangible asset industries (Tech and pharma industries) due to information asymmetric and abundant liquidity.

H4: there exist a non-linear relationship between leverage and firm performance (Inverted U-shape) and the optimal leverage ratio (D*) is higher in high tangible asset industries (Capital intensive and mature and stable industry) than in less tangible asset industries (tech/pharma industries).

H5: Liquidity stands out as a positive amplifier that raises a firm's threshold debt level by offsetting financial distress risk (cost).

3. Measurement (Quadratic regression models)

In other to find the optimal debt for every industry individually, we would just replicate the quadratic regression model used by **Margarethis and Psillaki (2010)** and **Berger and Bonaccorsi di Patti (2006)** in their seminal papers. The model consists in regressing the performance or profitability variable (ROA or ROE) against two main dependent variables: leverage (Lev) and leverage square (Lev^2). Here is the model:

$$\mathbf{ROE_{it}\ or\ ROE_{it} = \beta_0 + \beta_1 (Lev)_{i,t-1} + \beta_2 (Leverage^2)_{i,t-1} + \sum X_{i,t} + n_i + €_{i,t}}$$

Where :

- $\mathbf{(Leverage)_{i,t-1}}$: Total debt ratio (or Debt-to-Equity-ratio or Long term debt and short term debt ratio) of last year
- $\mathbf{(Leverage^2)_{i,t-1}}$: The quadratic term used to capture the concavity of the relationship.
- **X**: The control variables (Liquidity, firm size, GDP growth)
- **n**: firms and years fixed effects
- **€**: The error term

The rationale behind this equation is that at the beginning through $\beta_1 > 0$, the increase of profitability related to the increase of debt outweigh the cost of bankruptcy arising from the increase of debt. However, $\beta_2 < 0$ (the square term) signifies the point at which the curve is dragging down and profitability increase resulting from increase of the debt starts becoming lower than costs resulting from the increase of the debt.

Based on the equation above, the optimal debt level (D*) can then be found by simply calculating the point where derivative is equal to Zero and we get the final answer:

$$(D)^* = \frac{\beta 1}{2\beta 2}$$

It is important to notice that in the base equation up here, we would just interchange the leverage parameter to identify the optimal long term debt and optimal debt to equity ratio for every industry.

C. Pecking Order Theory

On one hand, the tradeoff theory focuses on bankruptcy costs and taxes and the Pecking order theory on the other hand is driven by Asymmetric information. It was developed by **Myers & Majluf (1984).** This theory focuses on explaining how firms prioritize the order of financing. External shareholders and managers do not have the same level of information about profits and risks (Information Asymmetric). In following of that gap of information between the market and managers, the market could misprice the firm shares value. In that case, Equity is not prioritized by managers as principal sources of financing. Firms would then follow a certain order in choosing financing traditionally known as "the pecking order".

1. The Order of financing

Since there is a gap of information between managers and the market, the type of financing the firms prefers stands out as a signaling tool in the eyes of the market **(Myers and Majluf, 1984).**

- **Internal financing**:

Firms would always choose firstly internal funds or retained earnings because it is not associated to any transaction or asymmetric information costs. Through this signal, firm value is either not affected or increased (**Myers & Majluf**, 1984).

- **Debt financing**

Considering that internal funds are not enough, firms would prefer to issue debt. The reason behind this is that debt is less sensitive to asymmetric information than equity. The preference would be

given to short term debt financing than to long term debt financing. The market perceives it as a safer signal than Equity financing and the firm value is slightly affected.

- **Equity financing**

This type of financing is considered as the last resort. Issuing new stocks would send a signal to the market that the firm is overvalued. The stock price could therefore decrease. Because of this, managers use this financing method only as last resort **(Leland & Pyle**, 1977).

2. Cost of Asymmetric Information across industries

In **the technology and pharma industries**, the balance sheet structure is mostly made of very intangible asset such as R&D, software pattern, intellectual property, etc. and this does not convey a lot of information to the market (**Frank & Goyal** ,2003). For instance, only managers in a pharma firm know whether a medicine or a new treatment would work. Asymmetric of information in both industries is very high. Consequently, if those firms issue debt or equity, the market would severely penalizes them.

Regarding **Capital intensive industry**, the balance sheet is made mostly of very physical assets such as production units and machinery. This is easily valuable by both external actors and the market. In other words, the amount of information held by managers is not considerable and this makes asymmetric information very low. Accordingly, firms operating in this sector would be slightly penalized (or not penalized) by the market when issuing new debt or new Equity. This in turn gives them the room to operate under high leverage ratios.

For **stable and mature industry** (retail industry), balance sheet tangibility is moderate (inventory and brand), however future profitability depends on consumer and economic trends. It is important to notice that cash flows and profitability are stable in this industry. They also have enough internal funds and rely more on short term debts. The issuance of debt is also penalized by investors but less than for the technology and pharma industry.

Hypothesis formulation

Rajan and Zingales (1995) in their paper *What Do We Know about Capital Structure? Some Evidence from International Data*, used "firm-size" as proxy for asymmetric information. The rationale behind this is that large firms have disclosure obligations and these convey more information to the market and then less asymmetric of information. On the other side, small firms do not have those obligations and analysts show more interest in large firms. Consequently, this firms exhibit very high asymmetric of information. Similarly, there is another parameter conveying the level of asymmetric of information: "the financial slack" which is measured in this thesis by the liquidity ratio. Firms with higher liquidity would prioritize internal funds as first source of financing and those with lower liquidity would prioritize debt or Equity as first source of financing (**Stewart C. Myers, 1984**). High liquidity implies issuing less debt and less penalty from the market while low liquidity implies issuing a lot of debts and more penalty from the market. So the following hypothesis is proposed:

H6 (Asymmetry: Size): Leverage decreases firm performance more in smaller firms (High information asymmetric) than in lager firms (Low information asymmetric).

Measurement

Proxy and threshold definition

We would use "firm size" as a proxy for asymmetry information and the other important notice is the use of Lag-1 of debt. The rationale using the Lag variable is to see how due to asymmetric information, the issuing of debt from last year has caused the performance to decrease. In other words, we assess how Debtt-1 has an impact on ROE or ROA because of asymmetric information (firm size). In order to measure the level of asymmetric information through firm size, we would calculate the firm size median (Me) for each industry and it would serve as threshold.

- If Firm size$_{i,t}$ > Median (Me), firm is considered as large firm = **Low asymmetric information.**
- If Firm size$_{i,t}$ < Median (Me), firm is considered as small firm = **High asymmetric information.**

We create a dummy variable (D_{ASym}) to take into account the size of the firm which serves as proxy for asymmetric information level of the firm. Analyses would be run separately for each industry.

High Asymmetry (D_{ASym} = 1): Small firms (below the industry median size). They have less public disclosure.

Low Asymmetry (D_{ASym} = 0): Large firms (above the industry median size). They are more transparent to investors.

We create also another dummy variable to take into account the "financial slack parameter". Firms with high liquidity level would prefer internal financing and almost no debt (No penalty from the market and increase in the performance). A firm with low liquidity level would issue more debt and Equity and would be heavily penalized by the market.

- If Firm liquidity > Median (Me), firm is considered as having high financial slack = No penalty from the market.
- If Firm liquidity <= Median (Me), firm is considered as having low financial slack = High penalty from the market.

High financial slack (D_{slack} = 1) : if $liquidity_{i,t} > Me_{liq}$

Low financial slack (D_{slack} = 0) : if $liquidity_{i,t} <= Me_{liq}$

$$\mathbf{ROE_{it}\ or\ ROE_{it} = \beta_0 + \beta_1(Leverage)_{i,t-1} + \beta_2(Leverage * D_{AS})_{i,t-1} + \beta_3(Leverage * D_{Slack})_{i,t-1} + X_{i,t} + n_i + \epsilon_{i,t}}$$

- **$(Leverage)_{i,t-1}$** : Total debt ratio (or Debt-to-Equity-ratio or Long term debt and short term debt ratio) of last year
- **$(Leverage * D_{AS})_{i,t-1}$:** Information Asymmetry penalty (Interaction of last year leverage with size dummy)
- **$(Leverage * D_{Slack})_{i,t-1}$:** Financial slack reward (interaction between last year leverage with liquidity slack dummy)
- **X**: The control variables vector (Liquidity, firmsize, GDP growth)
- **n**: firms and years fixed effects

- **€**: The error term

In the course of running econometrical analysis, different debt parameters would be interchanged (Debt ratio, short and long term debt and debt to Equity ratio).

V. The other determinants of profitability and Empirical studies

There are different factors influencing firm performance. These are the following factors: size, , asset tangibility, liquidity, inflation (sanding for GDP growth) and industry characteristics. There are many more other factors but we would focus only on those previously enumerated.

A. Size

Used as a substitute or proxy for capital market access, firm's size takes into account the diversification and asymmetric information parameters. According **to Rajan and Zingales (1995)** due to their size, it is much more difficult for smaller firms to get credits from institutions. Larger firms would generally get much more better conditions when issuing securities. For **Warner (1977),** larger firms cash flows and investment are less unstable and that reduces the bankruptcy risk . This is due to their wide diversification with respect to products and regions. In the field of information asymmetric, Larger firms failure is considered as too important for economic stability. Consequently they are under stricter and bigger surveillance by experts and markets observers and that considerably diminishes information asymmetric. This gives them the opportunity to raise Equity and issue debt at cheaper price than small firms and with less transaction costs **(Marsh ,1982 Fama and French (2002),** in their study *"Testing Trade-Off and Pecking Order Predictions* also found that there exist a negative relationship between level of indebtedness und financial returns. As a matter of fact, large companies make a lot of profits and that allows them to count on earnings and less on leverage. On contrary, small firms, due to the low amount of cash generated, they rely more on debt.

B. Asset Tangibility

A firm asset is a key determinant is assessing the borrowing capacity of a firm and consequently its profitability. According to **Harris & Raviv (1991**), The tangibility of a firm asset stand as the key factor when talking about collateral because they can be used as collateral; Non-physical assets (brand equity, intellectual property, human capital) are context-specific and go through severe value decrease during financial distress (**Harris & Raviv, 1991**). On the other hand, physical assets such as Property, Plant, and Equipment (PPE) can be pledged as collateral. The greater the portion of tangible in total asset is, the higher is the chance for a firm to be trusted by financial institutions**. Myers (1977)** came up with the conclusion that collateralized debt backed by physical assets reduces the agency conflicts by preventing managers from selling the collateral to fund speculative projects. Regarding the industry specific characteristics, **Frank and Goyal (2009),** found that tangibility is a credible factor having a positive influence on leverage. This is then significant for firm industry type. For instance, manufacturing firms have a high portion of tangible assets and are expected to have a higher leverage that high technology firms that have a small portion of physical assets.

C. Liquidity

Since liquidity reveals the firm capacity to meet its short term payments, it is a very critical parameter driving both the level of capital structure of a firm and its profitability. There are two opposing theories as far as liquidity is concerned as driver of a firm capital structure and profitability. On one side, we have the pecking order theory developed by **Myers and Majluf (1984).** As reported by this theory, firms give priority to the use of internal funds to finance its activities.. On the other hand, we have the trade-off theory suggesting that firms with a high amount of internal would consequently see its indebtedness capacity increase. According to **Shleifer & Vishny (1992**), a firm with a high amount of internal funds has a better financial stability and can easily repay its short term debts. This allows the firm to issue securities at better conditions because of the good signal its financial stability sends to the market. It is also important to notice that liquid assets are more easy to sale on financial markets in case of bankruptcy. This parameter makes it easier for firms with high liquidity level to have easier access to credit market.

The reality is that the pecking order theory is the one that proves to get the consensus of practicians. For instance **Ozkan (2001),** in his study on UK firms found that there exists an inverse relationship between liquidity level and debt ratio. According to his report, firms with significant levels of reserves use it as primary source of funding and this decreases accordingly the level of indebtedness. Like Ozkan in 2001, **Antoniou et al**. (2008) carried out a similar study on G5 countries and found the same results regardless the industry in which the firm operates.

D. Industry type

The industry in which a firms is located is definitely considered as the most important factor that drives performance. **Frank and Goyal (2009),** strengthened the view that median debt ratio in an industry stands as a reference point for a firm when choosing its financial structure. This parameter matters more than its growth rate or profitability. As far as the industry parameter is concerned, there are 03 main factors that matter most: The asset tangibility, the information asymmetric and the optimal debt level. Though debt provides a tax shied advantage, the capacity to take profit from that tax advantage considerably depends on how tangible the assets are in the industry **(Bradley, Jarrell and Kim; 1984).**

VI. 4. Methodology, data and variables definition

The purpose of this section is to provide insights into data, the sources of data, the methodology used and to define variables as well as the period of analyst.

A. Methodology

There are generally 02 motivations why firms use debt. Either to finance its investments. In this case the financial needs for taking on investments are more than the available funds. The second reason is to take advantage of the tax-shield. Most of the factors and parameters used in this study derived from other studies and literature. There is a list of variables influencing directly order indirectly profitability (return of equity and return of asset as dependent variables) that we have found. There are industry specific characteristics, **the size, the firm age, the growth opportunity,**

the firm scale, the level of liquidity and macroeconomic conditions as independent variables. It is important to note that all of those independent variables somehow influence the profitability.

In our cases, our study is focused on firms in Europe and especially firms in the EU area. The method of analysis we use in this study in order to find the relationship (causality) between the financial performance of firms and choice of capital structure in the EU area across different industries is the FE model in order to capture Years and Firms effects. We would use the software R-Studio and statistic aggregates from Excel.

We would accordingly run the following tests in this study:

- **Model selection Test**:.
- **The Hausmann Test** (FE vs RE)
- **Autocorrelation test** (Breusch -Pagan Test and modified Wald test for FE)
- **Multicollinearity test**

  To check whether independent variables are correlated using VIF (Variance Inflation Factor)

B. Data

For this study, we focus on firms within the EU Area and all those firms are sectored in 04 industries (See the criteria for industry classification above). We focused on 240 firms from 2020 to 2024. In other words, for each firm we have 300 observations over the 05 years. This implies 1200 observations over the 05 years. We excluded financial firms such as banks in our study due to their financial configuration and behaviors. We collected our data both from the financial databank investing.com (Atos Stock Price Today | EPA: ATOS Live - Investing.com) and from the own websites of the listed companies in this study (balance sheets and income statements). Also notice that we selected 60 firms for each of the 04 industries.

1. Variables definition

Keeping in mind that the purpose of this study is to find the relationship between firms financial performance and choice of capital structure across different industries, the choice of variable was

made based on past literature; They were listed in the previous chapter. We namely have dependent and independent variables.

dependent variables

We have chosen dependent variables based on past researches and literature; For instance, **Rohit Kamble1, Mahesh Mahankal, Yogesh Jojare (2025)** set ROE, ROA, EBITA and EPS as dependent variables in their study on the impact of capital structure on financial performance of Hong-Kong firms. But we selected only two out of the four due to data availability.

- **Return on Assets (ROA):** Calculated as Net Income / Total Assets.
- **Return on Equity (ROE):** Calculated as Net Income / Shareholder Equity.

Dependent variables	Method of calculation
Return of Equity	Net income/ Equity
Return of Asset	Net Income/Total Asset

Independent and control variables

There exists a lot of factors driving a firm financial performance. However, we would focus only on some of them and we would also add an error term and some control variables. We would also use a certain number of variables resulting from studies carried out by Brailsford et al. (2002), Fazlzadeh (2011), Kayo and Kimura (2011), Gurcharan (2010), Chakraborty (2010), Huang and Song (2006) and Pandey (2001).

Independent and dummy variables (Capital Structure):

- **Debt-to-Equity Ratio (D/E):** Total Debt / Total Shareholder Equity.
- **Total Debt-to-Assets Ratio (D/A):** Total Debt / Total Assets.

- **Long-Term Debt Ratio (LTD/A):** Long-Term Debt / Total Assets.
- **The Dummy variable** for asymmetric information (1 for high asymmetric information and 0 for low asymmetric information).

Control Variables:

- **Firm Size:** Natural logarithm of Total revenue. .
- **Liquidity (Quick-ratio):** Current Assets / Current Liabilities.
- **Macroeconomic Conditions:** Annual GDP Growth Rate or interest rates, to account for economy-wide effects

Table 2: List of independent and control variables

Independent/ Control variables	**Method of calculation**
Debt-to-Equity Ratio (DE)	Total Debt / Total Shareholder Equity
Total Debt-to-Assets Ratio (DA):	Total Debt / Total Assets.
Long-Term Debt Ratio (LTD/A):.	Long-Term Debt / Total Assets
Short term debt ratio	Short term debt/ Total Assets
Firm Size	Natural logarithm of Total Asset
Liquidity	Current Assets / Current Liabilities
Macroeconomic Conditions:	Annual GDP Growth Rate or interest rates, to account for economy-wide effects

Hypothesis summarize

Here is the summarize of all the hypothesis

H1: The general impact of debt is industry specific: it is beneficial to heavy and tangible asset industry (Capital intensive industry and mature industry) but negative for intangible asset industry (pharma and technology industry).

H2: The impact of short term debt is more pronounced than the impact of long term debt across each industry due to liquidity risk and debt roll over risk.

H3: The influence of debt maturity on performance is sector-specific: In mature and high tangible industries (Mature and stable and capital intensive industries), long term debt enhances performance due to tax-shield lock while it deteriorates performance in less tangible asset industries (Tech and pharma industries) due to information asymmetric and abundant liquidity.

H4: there exist a non-linear relationship between leverage and firm performance (Inverted U-shape) and the optimal leverage ratio (D*) is higher in high tangible asset industries (Capital intensive and mature and stable industry) than in less tangible asset industries (tech/pharma industries).

H5: Liquidity stands out as a positive amplifier that raises a firm's threshold debt level by offsetting financial distress risk (cost).

H6 (Asymmetry: Size): Leverage decreases firm performance more in smaller firms (High information asymmetric) than in lager firms (Low information asymmetric).

VII. Descriptive statistics

Table 3: Descriptive statistics for the overall sample

General sample's descriptive statistics					
	Mean	**Median**	**Min**	**Max**	**Standard deviation**
DE	0,726	0,653	0	2,080	0,474
DR	0,265	0,269	0	0,667	0,136
ROA	0,0427	0,0419	-0,6766	0,214	0,071
STDR	0,080	0,066	0	0,292	0,057
LTDR	0,1875	0,1785	0	0,63	0,126
ROE	0,108	0,1054	-0,2809	0,473	0,121
GDPR	0,009	0,0105	-0,112	0,151	0,04
firm size	1,967	1,4084	-1,602	5,801	1,851
Liquidity	1,530	1,2857	0,031	6,780	0,853

- **ROE (Mean: 0.108):** Per unit of Equity invested, shareholders have an average return of 10,8% which is close the median return of 10,54%. The distribution may be symmetric.

- **Debt Ratio (DR) (Mean: 0.265):** 26;5% of total capital is financed by debt in the overall sample.

- **Maturity Profile:** firms in general rely more on long term debt (mean: 0,1875) than on short term debt (mean: 0,080)

- **Debt-to-Equity (DE) (Mean: 0.726):** we can see that the maximum Debt to Equity ratio is 2,08 meaning that some firms in the sample are highly leveraged.

Table 4: Descriptive statistics for high growth and technology firms

Technology firms					
	Mean	**Median**	**Min**	**Max**	**Standard deviation**
DE	0,482	0,34	0	2	0,45
DR	0,169	0,15	0	0,667	0,145
ROA	0,03	0,041	-0,677	0,214	0,112
STDR	0,062	0,047	0	0,18	0,05
LTDR	0,182	0,096	0	2,538	0,38
ROE	0,102	0,115	-0,281	0,47	0,17
GDPR	0,009	0,009	-0,11	0,151	0,038
firm size	2,35	2,95	-1,60	4,87	1,756
Liquidity	2,23	1,86	0,031	6,78	1,217

This industry showcases the highest liquidity mean and median ratio: The median liquidity is 1,86 and the mean liquidity is 2,23 which are far higher than the ones for the overall sample. As expected those types of firms are very liquid and this sends a good signal to the market. We can also see that the maximum liquidity ratio is 6,78 meaning that some firms are having very high internal liquidity. This is in line with the pecking order theory (**Myers,** 1984) saying that tech firms have very high amount liquidity due to high assets intangibility and Research and development (R&D) strategy. Issuing debt would make the market to penalize them.

Capital Structure (Debt cautiones)

As predicted, the debt ratio mean (0,169) is low and lower than the overall sample debt ratio mean (0,265) and this is the same observation with debt to equity ratio (DE) mean (0,482 < 0,726). Concerning the Long term ratio median (0,096) , it is much lower than the overall sample long term debt ratio median (0,1785). We can also make the same observation concerning the short term debt ratio mean and median (0,047 < 0,066 and 0,062 < 0.08). This matches with the pecking order theory stating that debt has a negative impact on tech firms performance because of the bad signal it sent to the market.

ROE (Median: 0.115) is higher than the general median ROE (10,05%) while the debt ratios mean and medians are below the general ones. This may suggest that tech firms performance does not first derive from taking advantage of the tax shield but from operational efficiency.

Table 5:Mature and stable industry descriptive statistic

Mature and stable industry descriptive statistics					
	Mean	**Median**	**Min**	**Max**	**Standard deviation**
DE	0,83	0,74	0,116	1,97	0,414
DR	**0,29**	**0,28**	**0,085**	**0,512**	**0,089**
ROA	0,05	0,047	-0,054	0,160	0,049
STDR	0,135	0,12	0,013	0,292	0,063
LTDR	0,157	0,143	0	0,4062	0,09
ROE	0,123	0,12	-0,10	0,368	0,109
GDPR	0,008	0,009	-0,112	0,087	0,042
firm size	1,801	1,1	-0,853	5,17	1,598
Liquidity	1,25	1,162	0,67	2,38	0,415

Both the median and mean liquidity are much lower than technology firms liquidity median and mean (**1.162** < **1.86**) and (1.25 <2.23). This is due to the higher tangibility and stability of cash flows in mature and stable industry. That gives them an easy access to the capital market without necessarily being penalized. The debt ratio in this industry is much higher than debt ratio in the tech industry (0,29 > 0,169). As a matter of fact, all the debt parameters are higher for this industry and even much higher than the overall sample. This due to the cash flow stability serving as collateral (Trade-off theory). They take full advantage of the tax shield without risking a penalty from the market as tech firms (the pecking order theory).

Table 6: Capital intensive industry descriptive statistics

Capital intensive industry descriptive statistics					
	Mean	**Median**	**Min**	**Max**	**Standard deviation**
DE	1,010	0,9375	0,095	2,081	0,448
DR	0,337	0,359	0,038	0,622	0,121
ROA	0,031	0,03	-0,021	0,083	0,022
STDR	0,0624	0,059	0	0,2924	0,04
LTDR	0,2735	0,29	0,004	0,5315	0,11
ROE	0,086	0,083	-0,0482	0,215	0,057
GDPR	0,010	0,0125	-0,112	0,083	0,04
Firm size	1,886	0,765	-0,523	5,801	2,122
Liquidity	0,957	0,886	0,3621	2,34	0,249

We can see that this industry has the highest Debt ratio parameters off all sectors (eg: debt to Equity ratio mean: 1,010 >0,29 or 0,169 or 0,259) while they rely more on long term debt than on short term debt (0,2735 > 0,0624), they still perform very good. The preference for long term is due to the longevity of their investment cycle. This is in line with the trade-off theory suggesting that capital intensive firms take advantage of tax shield by having an easy access on the debt market because of asset tangibility .In contrast with tech firms, liquidity ratio in this industry is very low and below 1. This implies firms have low amount of internal funds and invest everything in the process .

Table7: Pharmaceutical industry descriptive statistics

Pharmaceutical industry descriptive statistics					
	Mean	**Median**	**Min**	**Max**	**Standard deviation**
DE	0,58	0,467	0	1,529	0,388
DR	0,259	0,248	0	0,589	0,12
ROA	0,058	0,0597	-0,226	0,19	0,065
STDR	0,061	0,0597	0	0,216	0,0347
LTDR	0,198	0,185	0	0,63	0,10
ROE	0,114	0,115	-0,13	0,366	0,116
GDPR	0,009	0,012	-0,112	0,087	0,039
Firm size	1,83	1,3277	-1,523	5,273	1,84
Liquidity	1,685	1,604	0,736	3	0,53

As expected, pharma and healthcare industry firms have the second highest liquidity ratio after the technology industry out of the 04 industries in the sample. This implies that they rely also a lot on internal financing due to the nature of their business. As seen above, they are characterized by high asymmetric information as tech firms, issuing debt would be penalizing for them because of the negative signal it sends to investors (pecking order theory).

We can also see that the debt and debt to equity ratios are the second lowest in the whole sample and that corroborates the fact they do not rely on debt. The maturity of debt is made mostly of long term debt because of the long cycle investment (it takes time for clinical trials and regulatory approval) and short term debt comes with liquidity risk. We could also see that the sector is very rentable as technology sector compared to other sectors and the general sample. It is important to highlight the fact that technology sector and pharma industries are the most volatile ones out of the 04 industry in the whole sample. This is due to the nature and riskiness of their activities. This pushes them to rely more on internal funding.

Table 8: Comparison table for the 04 industries

Variable	**Technology**	**Pharmaceutical**	**Mature & Stable**	**Capital Intensive**
Median Size D_{AS}	2.95	1.3277	1.1	0.765
Median Liquidity (D_{Slack})	1.86	1.604	1.162	0.886
Median Debt Ratio (D_R)	0.15	0.248	0.28	0.359
Median ROE	11.5%	11.5%	12.0%	8.3%
Dominant Theory	Pecking Order	Pecking Order	Trade-off	Trade-off

D_{ASym}: Dummy variable for asymmetric information

D_{Slack}: Dummy variable for financial slack or internal funding (liquidity)

Asymmetric of information: as we move from technology industry to capital intensive technology, the median liquidity ratio decreases and we see the inverse for debt ratio (it increases as we move from the technology sector to the capital intensive sector). This demonstrates the "financial slack" phenomenon. Technology and pharma industries have less tangible assets and due to the riskiness of their activity, they have to rely more of internal financings (issuing debt would be penalized by the market) in contrast with the mature and stable and capital intensive industries that have highly tangible assets and are not penalized by the market when they issue debts.

1. Model adjustment and tests

In order to prevent our estimates to be bias due to extreme observations, we used a statistic technique called "Winzorisation". It consists in removing large outliers variables and replace them with the upper and lower percentiles while the sample size is still preserved **(Tukey**, 1962). We chose this technique instead of removing observations because it is widely used in Econometrics and in finances. The purpose of it is to produce more robust and reliable estimates (**Barnett & Levis**, 1994). Many studies and scholars have used this method in order to adjust and tackle data

anomalies (eg: Fama and French, 1993; Kothari, Leone & Wasley, 2005). Variables such as profitability, leverage and growth were concerned by it. So our purpose is to make sure that results are not driven by abnormal dataset which are not indictive of firms performances.

Table 9: Correlation table

variables	DE	DR	ROA	STDR	LTDR	ROE	GDPR	SGR	firmsize	Liquidity
DE	1.00	0.785	−0.247	0.357	0.325	−0.096	−0.049	−0.031	−0.015	−0.497
DR	0.785	1.00	−0.174	0.425	0.481	−0.160	−0.024	−0.001	−0.141	−0.513
ROA	−0.247	−0.174	1.00	−0.085	−0.132	0.805	0.039	−0.032	0.033	0.114
STDR	0.357	0.425	−0.085	1.00	−0.086	−0.025	−0.040	0.032	0.110	−0.275
LTDR	0.325	0.481	−0.132	−0.086	1.00	−0.163	0.012	0.054	−0.066	−0.100
ROE	−0.096	−0.160	0.805	−0.025	−0.163	1.00	0.049	−0.007	−0.005	0.055
GDPR	−0.049	−0.024	0.039	−0.040	0.012	0.049	1.00	0.037	−0.038	0.002
SGR	−0.031	−0.001	−0.032	0.032	0.054	−0.007	0.037	1.00	0.068	0.004
Firm size	−0.015	−0.141	0.033	0.110	−0.066	−0.005	−0.038	0.068	1.00	−0.110
Liquidity	−0.497	−0.513	0.114	−0.275	−0.100	0.055	0.002	0.004	−0.110	1.00

One of the most striking correlation coefficient is the Liquidity debt correlation ratio (**the financial slack signal of the pecking order theory) :**

- Liquidity and Debt correlation Ratio (DR) = −0.513 and Liquidity and Debt-to-Equity correlation ratio (DE) = −0.497

Interpretation: As firms liquidity increases, their debt ratio decreases. As demonstrated above for the technology and pharma industries, using debt would give debt a penalty from the market and that would decrease performance. This also may imply that liquidity stands out as a substitute for debt.

The Negative correlation between debt and performance

- DR (Debt ratio) and ROE: −0.160 and DE (Debt Equity) and ROE: −0.096

Interpretation: This negative correlation between debt and financial performance may suggest that there is a "debt penalty" from the market to firms issuing debts. We would check it in coming econometric analyses.

positive correlation between liquidity and Performance

- Liquidity and ROE: 0.055 and Liquidity and ROA: 0.114

Interpretation: In our research, liquidity plays a crucial role of "**financial slack**". This positive correlation may imply firstly that the market rewards firms using less debt and more internal funds. The other conclusion it may imply is that, having enough liquidity gives the room to the firm to invest without feeling the burden of debt and Equity.

Table 11:Multicollinearity test (VIF)

Variable	VIF	Tolerance (1/VIF)	Status
Debt Ratio (DR)	1.437	0.696	No Issue
Firm Size (firm size)	1.078	0.928	No Issue
Liquidity	1.425	0.702	No Issue
GDP Growth (GDPR)	1.004	0.996	No Issue
Sales Growth (SGR)	1.007	0.993	No Issue

We can see from this multicollinearity test that all vif values are below 5 which is acceptable. There is no multicollinearity among independent variables.

Table 12: Hausman Test

This test would help us to know which model between the RE (Random effect Model) and FE (Fixed effect Model) is the most fitted model for our study.

Test Statistic	Value	(df)	P-value	Conclusion (α=0.05)	Preferred Model
Chi-squared (χ2)	16.035	4	0.02435	Reject H0	Fixed Effects (FE)

P-value = 0.02435 > 0.05, we reject the Null hypothesis (H0) and conclude that the Fixed effect model is adapted to our dataset.

Table 13:The Heteroskedasticity test (Breusch-Pagan Test)

Test	**T-Statistic (BP)**	**(df)**	**p-value**	**Result**
Studentized-Breusch-Pagan	22.972	4	0.0001282	Significant

We ran a Breusch-Pagan test to test for heteroskedasticity in our models. The test gave us a p-value of 0.0001282. This is far less than the standard 5% significance level, the null hypothesis of homoscedasticity is rejected. This signals us the presence of heteroskedasticity in our model. Consequently, we would use the Robust standard errors in the final regressions to ensure that our coefficients are reliable.

VIII. Results and interpretation

We are going to give results and interpretations following the hypothesis order.

1. Analysis of performance by maturity

H1 results: The broad impact of total debt differentiates across industries

Table 14: Fixed effect regression (with robust-standard) of performance (ROE and ROA) against debt ratio (DR) for the overall sample.

Variable	ROE Coefficient	ROE Significance (P-value)	ROA Coefficient	ROA Significance (P-value)
Total Debt (DR)	−0.1505	∗∗ (0.0051)	−0.0818	. (0.0923)
Firm Size	0.0002	(0.9560)	−0.0003	ns (0.8617)
Liquidity	0.0217	(0.2334)	0.0174	∗ (0.0408)
GDP Growth (GDPR)	0.1203	∗ (0.0239)	0.0522	∗ (0.0377)

We can see from the table that Debt negatively impacts on Return on Equity and Return on Asset (MM does not hold). This implies as debt increases, the financial return to shareholders decreases (Pecking order theory). It is still early to conclude that the market penalizes firms taking on debt without carrying on sectorial analysis. We also see that liquidity positively affects the Return on Assets. This may imply that firms relying more on internal debt financing perform better. There is a striking contrast between performance negatively affected by debt while liquidity (proxy for internal funds) increases it. That is typical to a pecking order theory scenario where market penalizes borrowers. However it is still early to conclude so.

Table 15: Fixed effect regression (with robust-standard) performance (ROE and ROA) against Lag debt ratio (lag DR) in Capital intensive industry.

Variable	ROE (Lagged) Estimates and significance	ROA (Lagged) Estimates and significance
Lagged Debt (DRt−1)	0.4209∗∗	0.1766∗∗
Firm Size (information asymmetry)	0.1110∗∗∗	0.0266∗
Liquidity	0.0162	0.0057
GDP Growth (GDPR)	0.0836	−0.0222

Contrarily to the whole sample regression where debt negatively impacts on performance, last year debt positively impacts performance (ROE and ROA) of firm in the capital intensive industry. This means that last year debt is invest in tangible assets, which in turn increases operational and financial performances (tradeoff theory). We could also see that firm size has a positive impact on return. We believe that is due to the fact that those firms do not have high level asymmetric information because of the high tangibility of their assets. So when they issue debt, it is not penalized by the market and they have easier access to capital market. Size here stands as proxy for asymmetric information (pecking order theory).

Table 16: Fixed effect regression (with robust-standard) performance (ROE and ROA) against Lag debt ratio (lag DR) mature and stable industry

Variable	ROE Estimate	ROE Significance	ROA Estimate	ROA Significance
Lag_DR (Total Debt)	-0.48628	** (0.0060)	-0.23248	*** (0.0003)
Firm size	0.00881	Insignificant	0.00332	Insignificant
Liquidity	0.10503	** (0.0054)	0.05454	** (0.0053)
GDPR	0.09721	. (0.0921)	0.04488	. (0.0879)

This results are contradictory to what expected regarding mature and stable firms. Debt actually negatively impacts both on financial and operational performances while liquidity impacts positively. This aligns with **the pecking order theory** (firms are penalized from issuing debt so they keep huge amount of internal funds to finance operations: market perceives it as health criteria and firms are rewarded). However, it may also be that either those firms are overleveraged (debt saturation has already been reached) or they have very low margins. Retail industry especially in the food industry operate under very low margins when they become stable and mature indeed and that could explain this negative impact of debt. It may be possible that the cost of debt is far more important than the benefits of tax shields combined with margins (tradeoff theory). It is important to notice that the value of the estimates are far greater than the median and mean ROE and ROA in that sector (-0,48 is far more important than the ROE and ROA mean and median = 0,05 and 0,047) and it the same for the ROE (-0,23 is more important than 0,123 or 0,12). This implies the

cost of debt is too much important and the optimal debt ratio is reached too early (pecking order theory)

Table 16: Random effect regression model for Debt ratio (DR) in the technology sector

Variable	ROA Coefficient (Estimate)	ROE Coefficient (Estimate)
Lag_Debt Ratio (DR)	-0.1137 (*)	-0.1940 (***)
Firm Size	+0.0140	0.0024
Liquidity	+0.0150 (*)	0.0101
GDPR	+0.0789	0.1919

The most important things to highlight in this table are negative impact of debt on the financial performance (ROE) and the positive effect of liquidity (financial proxy for financial slack) but also the non-impact of firm size in that industry. That is a pecking order theory classic. Tech firms are penalized by the Market because issuing debt sends a bad signal of lack of internal funds and or an urgent need for financing. We can see that instead, they have much more internal fund (liquidity) than any other sector to finance their operations which in turn improves operational performance .

Table 17: Fixed effect regression (with robust-standard) performance (ROE and ROA) against lag Debt ratio in pharma industry

Variable	ROA (Within/FE)	ROE (Within/FE)	interpretation
Lagged Debt(DRt−1)	0.0649*	0.0907*	Debt has a positive impact on performance
Firm Size	0.0028	0.0049	Size (Asymmetry) does not matter
Liquidity	0.0380*	0.0421 (Marginally significant)	Financial Slack: crucial for transition during in R&D phases.
GDPR	0.0104	-0.0553	No impact

This result is totally contradictory to our expectations and common literature arguing that pharma firms do no rely on debt because investment cycle and regulatory compliance. We see clearly that debt positively and significantly impacts both operational and financial performance. This comply with the trade-off theory and not with the pecking order theory as expected. We can also see that asymmetric information factor (firm size) is not significant. In other words, this sector is not penalized by market when debt is issued though liquidity has a positive impact on performance. We believe that is due to the existence phase in which most of those companies are; **The average age of the 60 firms in our sample is 78 years old and the median age is 68 years and the age minimum is 9 years (close to 10 years).** These data are important because it shows that those pharma and healthcare firms are not new comers in the business. They proved to be profitable in the past and have good track records. Because of that, investors and market can trust them and they have easy access to the capital market without being penalized.

Table 18: H1 summarizing comparative table across industries

Industry	Coefficient (ROE)	Theory	Conclusion
Overall Sample	-0.1505**	Pecking Order	firms are globally penalized for taking on debt
Capital Intensive	0.4209**	Trade-Off	Debt fuels investment in long life assets which positively impacts performance
Pharma	0.0907*	Trade-Off	Debt is used to fund R&D (supported by positive track record and reputation)
Technology	-0.1940***	Pecking Order	Debt signals financial distress while liquidity signals good health to the market
Mature & Stable	-0.4862**	Pecking Order	Low margins and debt saturation decrease performance for every new unit of debt.

Table 19: Fixed effect regression (with robust-standard) performance (ROE and ROA) against Lag debt to Equity ratio (lag DE) in Capital intensive industry.

Variable	ROE (Lagged)	ROE (P-value)	ROA (Lagged)	ROA (P-value)
Lagged DE (DEt−1)	0.0295	(0.1516)	0.0195∗	(0.0131)
Firm Size	0.0942∗∗∗	(less than 0.001)	0.0202	(0.1095)
Liquidity	0.0333	(0.3826)	0.0135	(0.3941)
GDP Growth	0.0406	(0.6745)	−0.0352	(0.4102)

We can see that the Debt equity ratio (mix financing) only affects significantly ROA and not ROE as the debt ratio. This is a striking result and means that in the capital intensive sector, while the increase of debt improves both the operational and financial performances, the financial performance starts decreasing at a certain point when tax shield advantage becomes less important than financial distress costs (shareholder bear the new additional risk: trade-off theory). It is important to notice that ROA measures the operational performance while ROE measures financial performance.

H2 and H3 results: The impact of short and long term debts are sector contingent.

Table 20: Fixed effect regression (with robust-standard) performance (ROE and ROA) against lag LTDR and lag STDR in Capital intensive industry.

Variable	Coefficient	Significance (p-value)
Lag(STDR,1)	0.0269	0.7445
Lag(LTDR 1)	0.2119	0.0044 (**)
Firm Size	0.0253	0.0441 (*)
Liquidity	0.0051	0.6278
GDPR	-0.0274	0.5097

From this table we realized that Short term debt has no impact on firms in capital intensive industry while Long term has a strong positive impact. **This means that the impact of long term is more pronounced in this industry since short term debt does not even have an impact on performance** (**This result does not support H2**). This is normal because short term debt cannot

be used to finance long term assets used in the capital intensive industry in contrast with long term debt. This aligns with trade-off theory. Another remarkable element here is the positive and significant impact of size on performance. We use size throughout this research as proxy for asymmetric information. Large firms in this industry have less information asymmetric and this impacts on performance. The larger a capital intensive firm is, the more performing it is.

Table 21: Fixed effect regression (with robust-standard) performance (ROE and ROA) against lag LTDR and lag STDR in mature and stable industry.

Variables	ROE Estimates	Significance	ROA Estimates	Significance
Lag_LTDR	-0.48624	** (0.0076)	-0.23114	*** (0.0006)
Lag_STDR	-0.48641	** (0.0062)	-0.23711	*** (0.0003)
Firm size	0.00881	(0.2112)	0.00329	(0.2704)
Liquidity	0.10503	** (0.0055)	0.05445	** (0.0055)
GDPR	0.09721	. (0.0932)	0.04494	. (0.0886)

As with debt ratio, the result is even more striking and contradictory because both type of debt maturity are highly significant and almost have the same negative impact. It is either possible that market penalizes those firms from issuing debts (the pecking order theory) or they operate very high above their optimal debt levels (tradeoff theory). In this sector, market does not then care about the type of debt but about debt itself. Short term debt impact is slightly above long term debt (In terms of absolute value). We see that 0.48624 (LTDR) < 0.48641 (STDR) for ROE and 0.23114 (LTDR) < 0.23711 (STDR). Therefore, **H2 is then rejected**.

Table 22: Regression Results for Pharma ROA comparing 1-Year and 2-Year Time Lags with regard to LTDR and STDR

Variable	ROA (1-Year Lag)	ROA (2-Year Lag)	ROE (1-Year Lag)	ROE (2-Year Lag)
Lag_STDR	0.3061 *	0.2535 *	0.5302 *	0.3512 .
Lag_LTDR	0.0317	0.0857	0.0219	0.1610
Firm Size	0.0036	0.0009	0.0078	0.0023
Liquidity	0.0313 **	0.0325 *	0.0288	0.0113
GDPR	0.2293 *	0.1108	0.3354	0.3168

We see that the maturity of the debt matters, when we increase the lag time to 2, we realize that short term debt is the part of the debt that feeds the operational and financial performance growth in the pharma industry. We can also see the size does not matter while liquidity matter (pecking order theory). This means that, in contrast to common belief asymmetric information is not a key driver of performance in this sector. In this case STDR stands out as a bridge to finance different phases of the project and that is normal because most of their assets are intangible assets. **H3 is therefore supported based on our data.**

Table 23: Random effect regression model for debt maturity (STDR and LTDR) in the technology sector

Variables	ROA	ROE (P-value)
Lag_Long-Term Debt (LTDR)	-0.0422* (0.0183)	-0.0735*** (0.0170)
Lag_Short-Term Debt (STDR)	-0.3119 (0.2027)	-0.4297 . (0.2183)
Firm Size	0.0148* . (0.0089)	0.0039 *(0.0110)
Liquidity	0.0146* (0.0063)	0.0105* (0.0146)
GDPR	0.0796 (0.0910)	0.2013 (0.1728)

We can see that in this technology industry, the short term debt rate does not impact performance; Though the industry is penalized for taking debt, it is penalized for taking long term debt and not short term debt. We still see the positive impact of both liquidity (proxy for financial slack) and size (asymmetric information proxy) on operational performance (Pecking order theory). **Both H2 and H3 are not supported in this industry since Short term debt does not even have a significant impact while long term debt has a significant impact**.

Table 24: Comparison: Impact of maturity Structure on Performance across different industries.

Industry	Debt type	H1validation	Firm Size (Asymmetry Signal)	conclusion
Capital Intensive	LTDR (+)	No	Significant (+)	High tangible assets allows long-term debt to improve performance (tax-shield).
Technology	LTDR (-)	No	Significant (+)	Financial distress costs: due to assets intangibility and business model, long term debt is a burden.
Mature & Stable	Both (-)	No	Insignificant	The type of debt does not matter but debt itself matters.
Pharmaceutical	STDR (+)	Yes	Insignificant	Liquidity Bridge: Short-term debt stands as transitional tool for R&D maturation.

From this table we see that the impact of short term is more pronounced only in the pharmaceutical sector out of the 04 sectors. **So we reject H2** and this implies that for the 03 other industries, long term debt impacts more on firm performance than short term debt. This strongly aligns with the overall sample descriptive statistics where firms rely more on long term debt than on short term debt (0,080 < 0,1875).

Table 25: **H3 Comparison analysis by industry**

Sector	Industry	Maturity	Size(Asymmetry)	H2 Status	Conclusion
High Tangibility & Mature	Capital Intensive	LTDR (+)	Significant (+)	supported	Long term debt creates tax-shield.
High Tangibility & Mature	Mature industry	Both (-)	Insignificant	Not Supported	Debt type does not matter
Low Tangibility	Technology	LTDR (-)	Significant (+)	supported	Long term debt is a burden.
Low Tangibility	Pharma	STDR (+) and LTDR is not significant	Insignificant	supported	Short term debt is used as a transitional tool

H2 is supported for low tangibility asset industry (Pharma and technology industries) and the pecking order theory dominates there. We can see that long term debt has a negative impact or no impact on performance. While long term has a positive impact on performance in capital intensive industry and a negative impact in Mature and stable industry.

2. Optimal leverage level for each industry

Testing H4: The optimal debt level through the non-linear relationship between debt and return (Inverted U-Shape relationship)

The purpose of this section is to find if there exists a potential peak point where lies the optimal debt ratio for an industry (trade-off theory) and check if that optimal debt level increases when liquidity varies. If we prove that optimal debt ratio is different for each industry, this would imply that leverage differently impacts performance across different industry. Also, we want to answer the question of whether there is the perfect optimal maturity debt level. Increasing debt to take advantage of tax shield, but which type of debt maturity the firm should go for (Long term debt or short term debt?). As explained above, we need a nonlinear quadratic model.

Formula to calculate the optimal debt ratio (**Dalci**, 2018).

$$(D)^* = \frac{\beta 1}{2\beta 2}$$

Table 26: Quadratic Regression Results and Optimal Leverage Derivation for the Capital Intensive Industry

Variables	ROA	ROE
Lag_Linear Debt (β1)	0.1395**	0.3373*
Lag_Quadratic Debt (β2)	-0.1690*	-0.4156 .
Firm Size	-0.0019 .	-0.0012
Liquidity	0.0071	-0.0005
Optimal Debt Ratio (DR*)	41.27%	40.58%

Based on this result, we can see that as in the model without quadratic term, debt positively impacts financial and operational performance. However, now we integrated the optimal debt level which is around 41% and it is greater than both the mean and median of the whole industry 'capital

intensive industry. **We conclude that most firms in that sector are underleveraged**. The question now is to know what is the optimal debt to equity (DE) and optimal short-term and long-term debt ratios for the capital intensive sector?

Table 27: Quadratic Regression Results and Optimal Leverage (Debt to equity ratio) Derivation for the Capital Intensive Industry (ROA vs. ROE)

Variables	ROA	ROE
Lagged Debt to Equity Ratio (β1)	0.0342*	0.1093**
Squared Lagged Debt to Equity ratio (β2)	-0.0113 .	-0.0404**
Firm Size	0.0012	-0.0011
Liquidity	0.0050	0.0134
Optimal Debt to Equity Ratio (DE*)	1.51	1.35

We see here the same result with Debt to Equity ratio. Debt to equity ratio affects more ROE but the optimal Debt to Equity ratio is lower for the ROE. Both optimal ratios are still higher than the mean and median in the whole industries. This implies that firms in this sector are **underleveraged**.

Table 28: Quadratic Regression Results and Optimal Maturity debt Derivation for the Capital Intensive Industry (ROA vs. ROE)

Variables	ROA	ROE
(Linear Short term debt) STDR (β1)	-0.1061	0.1908
(Quadratic Short term debt) STDR²(β2)	0.8230	0.3589
(Linear Long term debt) LTDR (β3)	0.2491***	0.4938**
(Quadratic Long term debt) LTDR² (β4)	-0.3695**	-0.7014*
Firm Size	-0.0007	0.0026
Liquidity	0.0088	0.0145
Optimal Long term debt (LTDR*)	33.71%	35.20%
Optimal Short term debt (STDR*)	Not Significant	Not Significant

We can see that the only the long term debt matter in explaining performance while short term debt is used not as tool to increase performance but as fluctuating operational mean instead of a

performance driver. Something that is striking is that compared to long term ratio median and mean, the optimal long term debt leverage is still higher (33,7 > 0,29). This means that firms are **still underleveraged**. They should reduce short term debt and increase long term debt.

Table 29: Quadratic Regression Results and Optimal debt Derivation for the mature and stable industry (ROA vs. ROE)

Independent Variables	ROA	ROE
(Linear Debt ratio) $DR\_{t-1}(\beta 1)$	0.1101	-0.0401
(Quadratic debt ratio) DR^2_{t-1} ($\beta 2$)	-0.2129	-0.0282
Firm Size	0.0002	0.0012
Liquidity	0.0692***	0.1357***
Optimal Debt ratio (DR*)	Insignificant	Insignificant

Based on this result, we see that debt has no impact on firm performance in the mature and stable industry (Modigliani-Miller theorem). This could also fit with the pecking order theory since liquidity is the only significant variable in that industry (We had the same result with Debt to Equity ratio and long and short term debt). While other sectors such as Capital intensive industries use debt to take advantage of the tax-shield advantage, these firms are already maturer and have probably already reached their debt saturation level. Even size (asymmetric information proxy) has no impact implying that there is symmetric information in this industry. At this state, margins are kind of low (generally in the retail sector) and any additional unit of debt eats any additional cash flow. Consequently, they have rely more on internal funds than on debt or equity financing, hence liquidity is significant and positive.

Table 30: Quadratic Regression Results and Optimal debt Derivation for the technology industry (ROA vs. ROE)

Variables	ROA	ROE
(Linear Debt Ratio) DR_{t-1} (β1)	0.1179	-0.0494
(Quadratic Debt Ratio) DR^2_{t-1} (β2)	-0.4413	0.1526
Firm Size	0.0199***	0.0007
Liquidity	0.0247***	0.0216*
Optimal Debt Ratio (DR*)	Insignificant	Insignificant

The performance in this industry is no led first by debt but by size and liquidity. This means that asymmetric information plays a significant role in how those firms perform. For instance, size standing as proxy for asymmetric information (sign is positive) teaches us that the bigger a firm is, the more performing that firm would be because the asymmetric information level is low and that positively impacts on debt . When a firm in this sector becomes big enough, the market does not judge him according to the amount of debt it issued but based on transparency and track record (Modigliani Miller). The fact that liquidity is significant implies that they keep the traditional conservatism against debt which is typical to pecking order theory. It is also important to notice that debt coefficients in the simple regression model are negative.

Table 31: Impact of Total Debt (DR) on Pharmaceutical Performance (FE)

Variables	ROA	ROE
(Linear Debt ratio)DRt-1 (β1)	0.3393***	0.7227***
(Quadratic debt Ratio) DR^2t-1 (β2)	-0.4503**	-1.0717***
Firm Size	0.0030	0.0071
Liquidity	0.0286***	0.0218
Optimal Debt Ratio (DR*)	37.67%	33.72%

We can see that debt strongly and positively impacts on performance here(trade-off theory) while size and liquidity are not significant (possible absence of impact of asymmetric information). The optimal debt ratio is between 33,6% between to 37,72% which is under the mean and median of the whole sector. This implies that those firms are **underleveraged**.

Table 31: Quadratic Regression Results and Optimal debt maturity Derivation for the (ROA) for pharma industry

Variable	Coefficient (β)	P-value
(linear Short term debt)$STDR_{t-1}$	0.7623	0.0419(*)
(Quadratic short term debt) $STDR^2_{t-1}$	-29.873	0.1390
(Linear long term debt) $LTDR_{t-1}$	0.1218	0.4367
(Quadratic Long term debt) $LTDR^2\_{t-1}$	-0.2045	0.5055
Firm Size	0.0009	0.8009
Liquidity	0.0295	0.0092(***)

Only the short-term debt matters and not the long-term debt. Pharma Industries operate in phase and the investment cycle is 10 years. They need sometimes liquidity to fund and test projects during each step of the phase (liquidity ratio is significant and positive). Because of the length of the investment and the riskiness of the project (not sure if the product would work) market is not willing to grant long financing to pharma firms (this aligns with the pecking order theory where firms after internal fundings would prefer short term rate and then long term rate).

Table 32: Quadratic Regression Results and Optimal debt maturity Derivation for the (ROA) for pharma industry (Debt to Equity Ratio)

Variable	Coefficient (β)	P-value
(Linear Debt to Equity ratio)DE_{t-1}(β1)	0.0962(**)	0.0078
(Quadratic Debt to Equity ratio) DE^2_{t-1} (β2)	-0.0502(*)	0.0184
Firm Size	0.0030	0.3809
Liquidity	0.0324(**)	0.0035
Optimal Debt to Equity ratio (DE*)	0.959 (96%)	

Debt equity positively impacts performance. We can see that the optimal debt ratio is still under the threshold industry meaning those firms are underleveraged.

Table 33: Analysis comparison of optimal debt by industry

Industry	Optimal Debt ratio (DR*)	Optimal Debt toEquity (DE*)	Main Performance factors	Dominant Theory
Capital Intensive	41%	1.35 – 1.51	Long-Term Debt	Trade-Off Theory
Pharma	34% – 38%	0.96	Short-Term Debt and Liquidity	Trade-Off / Pecking Order)
Technology	Insignificant	Insignificant	Firm Size and Liquidity	Pecking Order / Modigliani-Miller
Mature & Stable	Insignificant	Insignificant	Liquidity (Internal Funds)	Modigliani-Miller

Optimal debt leverage is not universal and depends on factors such as asset tangibility, asymmetric information, liquidity and life cycle. **Hypothesis 4 is not supported (or it is partially supported).** In tangible asset sector (capital intensive industry) and pharma (It is partially tangible), there is effectively an optimal debt ratio. However, in low tangible industry (tech) and mature industry, debt is neutral and even decreases performance for each unity of debt.

Testing H4: the liquidity multiplier role

Table 34: Capital Intensive (With liquidity optimal debt multiplier Interaction term)

Variables	Coefficient (β)	P-value	Conclusion
Linear Debt (β1)	0.9506	0.008**	Initial Tax Shield profit
Quadratic Debt (β2)	−1.2525	0.000***	Debt Penalty peak
Liquidity (β3)	−0.0001	0.992	No significant
Interaction (β4)	0.2592	0.602	No significant
Firm Size (D_{Asym})	0.1130	0.000***	Information Asymmetry Proxy
New optimal debt ratio		60%	

The liquidity multiplier interaction term is not significant. This means that the presence of more

liquidity does not increase the effectiveness of debt. But the optimal debt ratio has increased from 41% to 60%. We also see that firm size term is positive and significative. This means that is size (proxy for asymmetry information) that matters more in this industry and amplifies optimal debt. **H5 is then not supported**.

Table 35: Technology industry (With liquidity optimal debt multiplier Interaction term)

Variables	Coefficient	Conclusion
(Linear debt ratio) Debt Ratio (DR)	−0.2392	There is no tax-shield advantage from debt.
(Quadratic debt ratio) Debt Squared (DR^2)	−0.3303	No peak (No optimal debt)
Liquidity Interaction	0.5423(*)	Liquidity is the main performance driver.
Firm Size	−0.0079	size does not reduce asymmetry in Tech.

In contrast to capital intensive industry, the liquidity interaction term is positive. That means liquidity is an optimal debt amplifier in this sector (However optimal debt does not change, that means there is a better use of debt when there is more liquidity). We also see that firm size is negative and non-significant. Debt is deadly only for firms with low liquidity in this sector. Liquidity is a greater signal in this industry than size (proxy for information asymmetric). **H5 is supported in this industry**

Table 36: mature and stable industry (With liquidity optimal debt multiplier Interaction term)

Variable	Coefficient	Conclusion
Linear Debt Ratio (DR)	0.1932	Insignificant
Quadratic Debt Squared (DR^2)	−0.1440	Insignificant
Liquidity	0.1127 (**)	Primary and key Driver
Interaction (Amplifier)	−0.2570	No Multiplier Effect
Firm Size	0.0036	No effect

The multiplier interaction term is not significant as well as all the other variables apart from liquidity. Mature firms generally have reached a debt saturation point where additional debt becomes deadly. **Therefore, H5 is rejected in mature ad stable industry**.

Table 37: pharma industry (With liquidity optimal debt multiplier Interaction term)

Variable	Coefficient	P-value	conclusion
Linear Debt (DR_lag)	0.6804	0.007**	Tax shield Benefit
Quadratic Debt (DR_lag_sq)²	−0.8382	0.010∗	Peak point for optima debt
Liquidity	0.0234	0.340	No effect
Interaction (Amplifier)	−0.1436	0.346	No effect
Firm Size	0.0096	0.038∗	Firm size reduces asymmetry disadvantages

Though debt has a positive impact (trade-off theory), the optimal debt amplifier interaction term is not significand this means liquidity does not increase optimal debt in pharma industry. Size standing for information asymmetric is the first driver. **H4 is not supported in this industry**.

Table 38: Summarizing table for optimal debt amplifier

Industry	Optimal Debt	Liquidity Amplifier	Key factor
Technology	No (Linear Neg)	YES and Significant	Financial slack (Liquidity)
Pharma	YES	No	Firm Size (Asymmetry)
Capital Intensive	YES	No	Both Tangibility of assets and firm Size
Mature and Stable	No (MM Neutral)	No	None

3. The impact of information asymmetry and liquidity on debt effectiveness (Testing H6)

The purpose of this part is to test the pecking order theory using dummies variables:

Table 39: Dummy variables

Variable	Meaning	interpretation	Interpretation
D_{Slack}	Financial Slack	1 if Liquidity > Threshold liquidity (industry median) me and 0 otherwise.	Liquidity Represents internal fund availability to prevent the Pecking Order penalty from the market.
D_{Asym}	Information Asymmetry	1 if size > threshold size (industry median) and 0 otherwise.	The size stands for the fact that a large firm would be highly scrutinized by analysts and external operators in contrast with a small firm.

The financial slack because the pecking order theory suggests that firms prefer internal funds instead of debts because issuing debt sends a bad signal to the market. The market then penalizes firms issuing debt or Equity and that is reflected in the financial and operational performance. We use liquidity (quick ratio) as proxy for financial slack or internal funds **(Myers and Majluf,1984).**

Regarding the use of size as asymmetric information proxy, many authors such as **Devereux and Schiantarelli (1990) or Petersen and Rajan (1994)**. The bigger and old a firm is, the better its reputation is. Analyst and regulators pay more attention to it and more information about that firm are available.

Table 40: Comprehensive Analysis of impact of information asymmetric and liquidity on debt performance – Capital Intensive (FE) and (ROA)

Variables	Coefficients	P-Value	Conclusion
DR_{t-1}	0.1821	0.019*	Debt provides Tax-Shield.
DR^2_{t-1}	-0.2222	0.037*	Optimal debt point exists
D_{Asym} (Size)	0.0293	0.003***	Large size decreases asymmetry and increases ROA.
D_{Slack} (Liq)	0.0043	0.310	Liquidity taken alone and by itself doesn't improve performance
Interaction (DR_D_{Asym}_int and DR_D_{Slack}_int)	Insignificant	> 0.70	No impact when taken together

The debt has a positive impact on firms in this sector and there exist an optimal debt ratio point **(0,41) as calculated above.** The interactions terms are not significant, this implies that in capital intensive industry, higher liquidity does not make debt more efficient in term of increasing performance. Consequently, H6 is rejected: Liquidity is not an amplifier in capital intensive industry.

We can also see that D_{Asym} (Size) which is asymmetric information proxy is positive and significant (0,0293). This means that large firms (low level of asymmetric information) in capital intensive industry see their performance increase because of low asymmetric information in contrast to small firms who see their performance decrease because of high information asymmetric. However, higher size (lower level of information asymmetric) does not make debt more productive since interactions terms are not significant (DR_DAsym_int). Consequently, **H6 is not supported in capital intensive industry.**

Table 41: Regression Results: Comprehensive Analysis of impact of information asymmetric and liquidty on debt performance – Mature and stable industry (FE) and (ROA): The aggregate mask

Variable	ROA (Estimate)	ROA (p-value)	ROE (Estimate)	ROE (p-value)
DR_lag1	-0.3336	0.2529	-0.4815	0.5001
(DR_lag1^2) (Quadratic)	0.2696	0.5163	0.4282	0.6736
D_{Asym} (Asymmetry Proxy)	-0.0084	0.7481	0.0069	0.9137
D_{Slack} (Financial Slack proxy)	0.0486	0.1136	0.0689	0.3591
$DR\_lag1:D_{Asym}$ (Interaction term)	0.0710	0.4045	0.0881	0.6729
$DR\_lag1:D_{Slack}$ (Interaction term)	-0.0742	0.4687	-0.0676	0.7876

We see from this table that no variable is significant but that is due to aggregation. As we would see in the following regressions, the market cares more about the composition and maturity of debt in this type of industry than on the aggregate debt itself.

Table 42: Regression Results: Impact of Leverage (Aggregate Debt to Equity ratio), Asymmetry, and Slack for mature and stable industry

Component	ROA	ROE	Statistical Significance
Linear Debt-Equity ratio	Negative (-0.16)	Negative (-0.30)	Significant (Debt is Initially Costly)
Quadratic DE^2	Positive (0.06)	Positive (0.13)	Significant (Threshold tax-shield benefit exists)
Size and asymmetry Interaction terms	Insignificant	Insignificant	Sized does not reduce Asymmetry
Liquidity (Slack) and asymmetry proxies	Not significant	Not significant	No impact

One is the most interesting results in this table is the U shaped relationship between performance and debt. In other words, at the beginning with low level of debt in this sector, the cost of financial distress outweigh tax shield advantages, but as the debt level increases, the tax shields benefits start outweighing financial distress costs. It is important to notice that the median and mean Debt to equity ratio in this sector are respectively 0,83 and 0,74 while **the optimal debt level at which debt advantages start outweighing financial distress is 1,15.** This implies that most of firms in that sector are actually underleveraged (Trade-off theory).

We can see that the asymmetric information and liquidity interactions terms are not significant. This implies that both H5 and H6 are accordingly not supported.

Table 43: Mature and Stable Industry: Combined Maturity (Short term and Long term debt) Model Summary in mature and stable industry

Variable Categories	Coefficients	ROA (Estimate)	ROE (Estimate)	Interpretation
Short-Term Debt	STDR_lag1	-0.4135	-0.3489	Non-significant
Quadratic Short term debt	(STDR_lag1²)	1.3028	2.8750	Non-significant
Long-Term Debt	LTDR_lag1	-0.0860	-0.2891	. Non-significant
Quadratic Long term debt	(LTDR_lag1²)	-0.1738	-0.0372	Non-significant.
Information asymmetric	D_{Asym}	0.0066	+0.0596	Size alone has no impact on performance it's how size mixes with debt.
Asymmetry interaction term	STDR:D_{Asym}	-0.2838 (.)	-1.1379 (**)	Significant Penalty: Large firms are penalized for taking ST debt.
Asymmetry interaction term	LTDR:D_{Asym}	0.1789 (.)	+0.4838 (*)	Significant Amplifier: Large firms are rewarded for taking LT debt.
Financial slack poxy	D_{Slack}	0.0455	+0.0564	Non-significant.
Interaction term	STDR:D_{Slack}	0.0950	+0.2640	Non-significant.
Interaction term	LTDR:D_{Slack}	-0.1461	-0.1450	Non-significant.

$STDR_{lag1}$:D_{Asym} (-1.137, p = 0.0034): We can see from here that firm with low asymmetric information in this industry (large firms) are penalized by the market for using short term debt because it sends a bad signal to the market. **(H6 is validated) for debt maturity**

$LTDR_{lag1}$:D_{Asym} (0.483, p = 0.0285): We can see those same large firms are highly rewarded by the markets when they issue long term debt. We can also notice that the structure of debt counts a lot. This results are contradictory to the pecking order theory supporting that short term debt should be prioritized by firms in the pecking financing order. **(H6 is validated)**

Table 44: : Regression Results: Impact of Leverage, Asymmetry, and Slack for technology industry

Variable Category	Coefficient	ROE	Conclusion
Liquidity Interaction (financial slack)	DR:D_{Slack}	0.293 (∗)	High liquidity in tech increases debt efficiency.
Size (asymmetric information) Interaction	LTDR:D_{Asym}	-0.424 (∗)	Penalty: Large tech firms are punished for taking long-term debt (the market sees it as possible financial distress).
Short-Term Debt	STDR_lag1	-1.101	Non-significant

We can notice from the table that the more liquid firms are in this sector, the more performing they are (Pecking order theory). High liquidity increases the impact of debt on performance. And large firms receive a penalty from issuing long term debt. This is typical pecking order theory.

We see that the liquidity interaction term is positive and this means that more liquidity improves the effectiveness of debt in capital intensive industry **(H5 is validated)** and long term debt interaction term with asymmetric information is negative. This means that firms with lower size (high asymmetric information) are penalized by the market when additional debt is issued **(H6 is validated)**

Table 45: pharma Industry: Debt Model Summary (ROA)

Variable Categories	Coefficient	Estimate	p-value	Conclusion
Short-Term Debt	STDR_lag1	4.361	0.008 (∗∗)	Shrot term debt impacts performance (Transitional tool)
Long-Term Debt	LTDR_lag1	-1.081	0.047 (∗)	Pharma firms are penalized for taking on long term debt
Size Interaction	(STDR:D_{Asym})	-3.649	0.025 (∗)	Penalty: Large firms suffer from using short term debt.
Size Interaction	(LTDR:D_{Asym})	1.193	0.026 (∗)	Premium: Large firms thrive on Long term debt.
Quadratic (STDR)	($STDR^2$)	-2.963	0.174	Not significant

In this table, we see that asymmetric information counts a lot in the pharma industry. short term debt highly and positively increases performance but not for large firms but only for small firms. As a matter of fact, large firms are penalized from taking on more short term debt and rewarded from taking on more long term debt. This is due to asymmetric information. For a large firm, issuing short term debt sends a negative signal to the market about their financial position. **(H6 is validated in this sector).**

Table 46: Summarizing industry comparison table **(H6)**

Industry	H6 (Size: Asymmetry)	Conclusion
Capital Intensive	Rejected	Physical asset make size to matter not
Mature/Stable	Validated	Large firms are rewarded by the market for taking Long term debt, and are penalized for taking short term debt.
Technology	Validated	Large firms are punished for taking Long term debt (financial distress situation).
Pharmaceutical	Validated	debt is more efficient for Large and old firms.

IX. CONCLUSION

The purpose of this research was to look into the impact of capital structure on firm performance across industries when tax-shield, asset tangibility and information asymmetric are considered. Through the interplay of those 03 factors, we were able to come up with the first conclusion that asset tangibility, business cycle and asymmetric information (proxied by firm size) are key factors determining how debt effectively affects firm performance across industries. We found out through our study that leverage impact is not universal:

The performance-enhancer: in capital intensive and pharma industries, debt stands out to be a value enhancer. Regarding pharmaceutical industry, performance's improvement by debt arises from the good reputation and track record those firms built from past years (the median firms age is 60 years). This past good reputation allows them to borrow in order to fund R&D, but they also use debt as a bridge mechanism from phase to phase throughout the long business cycle. Regarding capital intensive industry, the impact of debt on performance mainly results on the high tangibility of their assets. This asset tangibility is used as strong and sure collateral for issuing debt. They maximize tax-shield benefits.

The performance-drainer: On the other hand, technology and mature and stable industries are globally hurt by indebtedness. Regarding stable and mature industry, they have reached a debt saturation point. At that stage firms are stable and mature and margins are low. Every additional unit of marginal cost of debt outweigh every additional unit of marginal return. Technology industry suffers from the lack of tangible assets (they own mostly intangible assets such as patents and human resources) and high information asymmetric (market perception). This parameters have a negative impact on performance (They have to rely more on internal and Equity financing and issuing debt is penalized by the market).

Regarding the impact of maturity on firm performance, there exists a maturity alignment. In capital intensive industry, long term debt (LTD) is the key driver and that is in line with the long life of their tangible assets (manufacturing, equipment, machinery…). In Pharma and healthcare, short term debt is used as a bridge to jump in between phases of R&D. Alternatively, short term debt (as well as long term debt) is a "saturation' trap for firms in mature and stable industry. Regarding technology firms, debt and especially long term debt is deadly for performance (that is due to the

fact that those firms have high level of liquidity and market expect them to run more on internal financing and not on debt, especially long term debt).

We were also able to emerge with the fact the existence of optimal debt threshold is industry-contingent. We found out as there exists a non linear inverted U-shape relationship between debt and financial performance. We were able to find that optimal debt threshold in capital intensive was up to 41% (those firms are actually underleveraged) and 36% for pharma and healthcare industry (they are also underleveraged). This surely implies they are not fully taking advantage of tax-shield benefits. Conversely, there exists no optimal debt ratio in the technology industry since they rely more on internal financing and debt has a negative impact as showed above. For the mature and stable industry, the optimal debt threshold has been already overtaken. However, there exists an optimal debt to Equity ratio for firms in this industry (thought there is no optimal debt). When analysing the Debt to Equity ratio, we realized that optimal debt to Equity ratio is generally reached before the optimal debt ratio. we demonstrated that trade-off theory and pecking order theory are not necessarily incompatible with each other. They can complete each other to practically explain the behaviour of the impact of debt on firm performance across industries.

We also demonstrated that Firm size (Asymmetric of information) and liquidity ratio (financial slack) are not simply variables but they can play a debt performance multiplier role (However, it is an universal amplifier). In technology industry, asymmetric of information, proxied by firm size) and financial slack (proxied by liquidity ratio) play an amplifier role for debt performance while in the 03 other sectors, liquidity is not an amplifier and the amplification depends individually on other factors such as structural parameters.

Last but not least, we make the following 02 pillars recommendations to firm managers. There should be an alignment between maturity of debt and asset tangibility. Short term debts should not be used to fund long life assets because of the “roll-over” and liquidity risks.

X. Limitations and Suggestions for Future Research

As every empirical research, there are always limitations and these opens door for following researches and improvement.

We have first the theoretical and empirical research. Proxy limitations regarding firm size and internal funds. Though size and liquidity are generally recognized as proxy for information asymmetric and internal funds, there are many more other proxy. Other measures such as asset tangibility, R&D intensity, analyst coverage…. Would be taken into account for future researches.

We used Fixed effect model (FE) and Random effect Model (RE) for our estimates. However, we could have used Dynamic Panel GMM (Generalized Method of Moments) to help tackle possible endogeneity. Another limitation is that data could have been subject to macroeconomic volatility. The 2019 pandemic could have made cost of capital to skew and this affect tax-shield benefits.

Another limitation has to do with data availability. Our data go from 2020 to 2025 and run over 05 yeas while some firms have existed for more than 100 years. And we selected in total 240 firms. This is due to data availability. For Future Research, it would be interesting to research managerial decision and overconfidence to explain the underleverage of capital intensive and pharma industries.

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