POLYTECHNIC UNIVERSITY OF TURIN

Master of Engineering and Management

Master's degree Thesis

Challenges high-tech companies face when seeking financing and the answer by financial institutions.

Theoretical literature and empirical evidences.

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1. INTRODUCTION

At this particular moment in time, all the industrialized countries are called upon to sustain the national growth of their economic systems. Such context is characterised by the market globalisation and the acceleration of the competitive dynamics; the geographic borders of competitions are enlarging, competitive parameters are always changing and, therefore, the overall competitive scenario is extremely complex in every industry.

Furthermore, the recent financial and economic crisis must be taken into account, as it concerned all the industrialized countries and led them to define a new industrial policy based on knowledge and innovation. Such innovation as to be intended in a broader sense that includes the innovation of product, process, organization and institution. Knowledge and innovation are considered the competitiveness' drivers of firms on international markets and input of the process of modernisation of economic systems.

It follows from this that a crucial role in the implementation of such changes is played by those industries that are *knowledge intensive* and that can be distinguished by traditional industries thanks to some distinctive features, as the long-term period in which productive services are developed, the need of elevated investments in research and development and the high entrepreneurial and financial risk associated to such investments. The importance took on by such sectors in the national economic system led me to deeply analyse such high-tech context characterised by decisional complexity, uncertainty, dynamism and high levels of knowledge.

In particular, I examined the impact that such peculiarities have on the access to innovation financing. As a matter of fact, even though innovation is on the basis of the competiveness on the current economic world, the entrepreneur's

capability to allocate resources strongly depends on the credit availability and, in general, on the chances to access to finance.

Under such circumstances, the adoption of dedicated formulas of financing is crucial. Among them, the most important are:

- the Venture Capital or the investment company;
- new financial instruments that recognize Intellectual Property as collateral;
- Crowdfunding

Therefore, what emerges is the fact that such distinctive high-tech firms' characteristics together with their problems (uncertainty and asymmetric information) make the Modigliani Miller Theorem inapplicable. Indeed, it is not true that there is indifference between the use of equity and debt in terms of cost of capital and value of the firm. Instead, the approach preferred is the one that sustains the presence of a hierarchy of the financing sources.

My thesis is divided into eight chapters. The second one reviews the main theories regarding the firms' financial structure. It is demonstrated that if such theories are individually analysed they can lead to significantly different decisions and results. In the second chapter, moreover, empirical evidence is provided for the expounded theories with the aim to better understand how firms actually choose their equity-to-debt ratio and which are the main determining factors for such choice.

In the third chapter, a deeper analysis about the capital market imperfections is provided in order to perceive the main features of capital markets and high-tech investments. For this purpose, the Panunzi model is exposed.

In the fourth chapter numbers and comparisons between Europe and USA define an overview of the current high-tech industry. A special glance is given at the Italian market.

The fifth chapter discusses the role of IP-based finance and the logic behind the main policy options that have been proposed or tried so far. However, we are currently seeing patents being used as an offensive weapon against competitors, rather than being used to protect rights and increase innovation, as they were intended. This is the reason why also the danger and the benefit of using IP as weapons are discussed in the third chapter.

In the sixth chapter a deep analysis about how the financial institutions react to the innovation financing is provided. The private equity is the first source of financing examined through the angel finance and the venture capital markets. For the latter one, the efficiency of the instrument is both measured on a sample of Italian firms and by comparing the American market with the European one. Successively, the public equity, the role played by banks and the Italian mini-bond are considered.

The seventh chapter takes into account a new topic for the innovation financing: the crowdfunding. Indeed, such instrument as always been considered for social purposes and never for innovation.

Finally, in chapter eight overall conclusions about the presented thesis are drawn.

2. THE CAPITAL STRUCTURE

2.1 The Capital Structure: Definition And Determinants Of The Financing Choice

The selection of the optimal financial structure for a firm is a current issue, both for the theoretical and the empirical research.
Nevertheless, this is not a new subject for theoretical studies.
The reason why this subject is ongoing nowadays lies into the fact that some aspects of these studies still seem to be unclear. Moreover, some inconsistencies have been found between the different theories and the empirical evidences. Also, the selection of an optimal financial structure represents a critical topic as it is strongly related with the main important decisions a firm must take, like the search of the optimal levels of debt, the cost of equity capital and other financial policies.

First and foremost, the definition of *capital structure* must be settled.
The capital structure includes all the ways through which a firm finance its own investments. The means used vary among any combination of debt, equity or hybrid financial instruments. Therefore, the capital structure consists in the set of the different bonds issued by a firm and the different financial resources used.
The definition of the financial needs and the research of an appropriate equilibrium between debt and equity are the main challenges a firm must face from its earliest stages. Nonetheless, these decisions vary according to the phase of the life cycle the firm is experiencing and they represent the result of the strategic choices taken by the firm itself.

The capital structure is undoubtedly influenced by the following factors:

- the sales growth rate;
- the competitive structure of the industry;
- the control system of the firm and the behaviour towards the risk taken by owners and management;
- the creditors' behaviour towards the firm and the industry.

Nevertheless, the main determinants of the capital structure are:

- the agency costs;
- the asymmetric information;
- the firm's market value
- the choice between a cost leadership strategy and an innovation one.

2.2 Economic Theories: From The Modigliani – Miller Theorem To The Market Timing Theory

Different theories have been developed in relation to each of the above-mentioned factors, with the aim of finding a solution to two of the main issues concerning the financial structure that are:

- the research of the optimal combination of securities that allows the firm to maximize its value and to minimize the cost of capital at the same time;
- the determination of the optimal debt-to-equity ratio.

The first scholars to study in a meticulous and scientific way such topics were Modigliani and Miller. As a matter of fact, their theories, elaborated in the 1958, represented a real revolution in finance.

With the Proposition 1 and 2, Modigliani and Miller drew the conclusion that the capital structure is irrelevant both for the determination of the value of a firm and for the estimation of the cost of capital. It must be taken into account, however, that these results are based on simplified hypothesis that are detached from reality. For this reason, if even one of such hypotheses is removed, Proposition 1 and 2 result to be invalid.

This is the reason why two different variations to the original theory were developed:

- the *trade-off theory*, according to which every firm can find its optimal capital structure;
- the *pecking-order theory* that removes the perfect information hypothesis from the Modigliani-Miller theory and states that, in presence of asymmetric information between the management and the market, firms find more convenient to resort to sources of funding that less affect the value of the firm.

Moreover, a further theoretical research based on the behavioural finance results has been developed. This new theory refers to the *market timing* hypothesis which states that firms select the more convenient source of funding in a certain moment taking into account the irrational preferences made by investors; therefore, firms issue their shares when their market price is greater than their rational value and, vice versa, they use the debt when their shares are underestimated.

Since most of the Modigliani and Miller's hypothesis are violated in the reality, it can be declared that no theory fully reflects the firms' reality, although the empirical cases result to be a combination of the different effects highlighted by different theories.

2.2.1 The Modigliani – Miller Theorem

During the 1950s, Franco Modigliani and Merton Miller were the first two economists to study the relation between the value of the firm and its financial structure. After having conceptualized and developed their researches, they gave birth to the Modigliani – Miller Theorem. Consequently, they wrote "The Cost of Capital, Corporation Finance and the Theory of Investment", which was published in the American Economic Review in the 1958.

The innovation of the theorem lies into the fact that, until then, the financial studies were only used to describe the institutions and the methods applied into

the financial system. With this theorem, instead, the modern thinking on theoretical economics sprouts up. Its main goal is to show the current relations between the characteristics of the financial markets and the investment funds, basing the results on the investors' rationality and the market equilibrium.

In order to explain the Modigliani and Miller theorem, two firms, which are identical except for their financial structures, have to be taken into account. If the first firm (Firm U) is unlevered - that is, it is financed by equity only - and the other one (Firm L) is levered - it is financed partly by equity, and partly by debt-, then, according to MM theorem, the value of the two firms is the same.
Merton Miller provides an example to explain the concept behind the theory, in his book "Financial Innovations and Market Volatility" using the following analogy:
"*Think of the firm as a gigantic tub of whole milk. The farmer can sell the whole milk as is. Or he can separate out the cream and sell it at a considerably higher price than the whole milk would bring.*
But, of course, what the farmer would have left would be skim milk with low butterfat content and that would sell for much less than whole milk. That corresponds to the levered equity. The M and M proposition says that if there were no costs of separation (and, of course, no government dairy-support programs), the cream plus the skim milk would bring the same price as the whole milk."

However, there are some hypotheses that must be respected in order to make the theorem effective. They are:

- the capital market is perfect. It means that it is competitive, the transaction costs are null and there is no asymmetric information;
- There is no cost of debt. The financial distress costs are also absent;
- Both firms and individual investors are able to borrow the same amount with the same interest rate;
- Taxes on both investors' and firms' incomes are absent;
- The expected operating profits are constant and equal to the current operating profits;
- Investors are rational agents who maximize their utility function.

- The firms issue only 2 kinds of securities, that are risk-free bonds (debt) and shares;
- All the firms are in the same risk class;
- Managers maximize the function of wealth for the shareholders. Therefore, costs of agency are absent because there is no divergence between the two targets of control and ownership. Shareholders, in turn, do not take actions aimed at damaging the creditors' interests.
- The potential firm's bankruptcy does not lead to costs of bankruptcy or settlement. Therefore, if the firm goes bankrupt, it is sufficient to sell the firm's assets in order to settle the debt.

Hence, according to what has been said above, if these hypotheses were valid, it would be impossible to identify the pros and cons related to the use of debt. This would lead to casual and highly variable debt-to-equity ratios.

Based on these hypotheses, Modigliani and Miller formulated two propositions.

2.2.1.1. Modigliani And Miller Theorem- Proposition I

A firm cannot change the total value of its outstanding securities by changing the proportions of its capital structure.

Thus,

$$V_U = V_L$$

where V_U is the value of an unlevered firm and V_L is the value of a levered firm.

In order to verify this proposition, it can be assumed that an investor is considering buying one of the two firms, U or L. Instead of purchasing the shares of the levered firm L, the investor could purchase the firm U's shares and borrow the same amount of money B that firm L does. The eventual returns to both investments have to be the same. Therefore, the price of L must be equal to the price of U minus the money borrowed B, which is the value of L's debt.

This discussion also clarifies the role of some of the theorem's assumptions. We have implicitly assumed that the cost of borrowing a determined amount burdens in the same way both on the investor and on the firm.

In order to express formulaically the Proposition I, two firms with the same operating income but with two different financial structures are taken into account.
Modigliani and Miller define the value of a firm as the sum of the market value of its shares plus the market value of its debts. Hence:

$$V_i = D_i + E_i$$

where

- V_i is the total market value for the i-th firm;
- $D_i$is the market value of debt for the i-th firm;
- E_i is the market value of outstanding shares for the i-th firm.
- X_i are the expected profits before interests for the i-th firm.

According to the theorem, V_i is equal to the discounted value of the expected profits before interests of the firm, provided that the discount rate used to discount the profits is equal to the rate of return on shares for firms belonging to the same risk class of the firm taken into account.
Hence, the value of the firm is determined both by the discount rate and the profits coming from the real activities of the firm. Moreover, the value is independent from the composition of the liabilities adopted in order to fund these activities.

Let us take into account two firms, U and L, with $X_U = X_L = X$.
The firm U funds its investments only by issuing new shares, while the firm L funds its investments by using both shares and debt. According to Modigliani and Miller, $V_U = V_L$. In order to understand this result, a reductio ad absurdum can be used.

Let us suppose that under the conditions previously listed, $V_U < V_L$. It means that the value of a firm is greater if it choses to resort to debt.
The share price for a generic investor *j* who owns an amount a_L of the total stock of the firm L will be:

$$e_L = \alpha_L * E_L$$

The profit for the investor will be:

$$Y_L = \alpha_L * (X - r * D_L)$$

that means that it is equal to the expected profit minus the cost of capital gathered by issuing the debt.
If the investor decided to sell its shares on the firm L and to buy new shares that cost e_U from the unlevered firm U, this new purchase would have a market value equal to

$$e_U = \alpha_L * (E_L + D_L)$$

Hence, the investor *j* buys its shares of the unlevered firm at a cost that is equal to the shares value for the levered firm L plus the amount $\alpha_L * D_L$ that the investor obtains through the loan.
The amount of shares of the firm U that the investor *j* owns is equal to

$$\alpha_U = \frac{e_U}{E_U} = \frac{\alpha_L * (E_L + D_L)}{E_U}$$

that provides a net profit equal to

$$Y_U = \frac{\alpha_L * (E_L + D_L)}{E_U} * X - r * \alpha_L * D_L$$

This is true only under the hypothesis of perfect markets, where individuals and firms borrow at the same interest rate *r*. In particular, it can be observed that, by buying the shares from the unlevered firm and by getting into debt in turn, the

investor *j* replays the portfolio composition that has been supposed to be the optimal one (because it is $V_U < V_L$) but at a cost that is lower than its market value. By doing so, the investor j obtains an arbitrage profit.

Since this opportunity is valid for the investor until the levered firm's value is greater than the unlevered firm's one, the investor would have a means through which he could earn money indefinitely. Evidently, this is not compatible with equilibrium.

As a matter of fact, in equilibrium that means in presence of perfect financial markets, the investors' concurrent behaviour deletes the opportunities of arbitrage.

This can be analytically demonstrated by observing that, given that $V_i = D_i + E_i$, the value of the firms can be expressed as follows:

$$V_U = E_U$$
$$V_L = E_L + D_L$$

By substituting in the net profit expression for the investor Y_U the value V_L:

$$Y_U = \frac{\alpha_L * V_L}{V_U} * X - r * \alpha_L * D_L = \alpha_L * (\frac{V_L}{V_U} * X - r * D_L)$$

Given the initial hypothesis $V_U < V_L$, it can be stated that Y_U is greater that Y_L. Therefore, the investor will prefer to sell the shares from the levered firm and to buy the ones from the unlevered firm. By doing so, he decreases e_L (by increasing e_U) and consequently he also decreases V_L. That leads to the conclusion that $V_U < V_L$ does not represent an equilibrium: the market value of a levered firm cannot be greater than the market value of an unlevered firm because this would lead the investor to always be able to replay the combination of debt and shares provided by the levered firm.

In the same way, it can be demonstrated that $V_U > V_L$ is not an equilibrium. Now, it has to be considered that the investor *j* owns a certain amount of shares of the unlevered firm; the market value for such shares is $e_U = \alpha_U * E_U$ and the profit provided is $Y_U = \alpha_U * X$.

If the investor decides to sell such shares and to buy from a levered firm both new shares at a price equal to e_L and debts at a price equal to *d*, he obtains the total value

$$e_U = e_L + d$$

Another hypothesis is that the investor would replay the financial structure of the firm L. Hence,

$$e_L = \left(\frac{E_L}{V_L}\right) * \ e_U$$

$$d = \left(\frac{D_L}{V_L}\right) * e_U$$

The investments in the levered firm generate a profit equal to

$$Y_L = \frac{e_L}{E_L} * (X - r * D_L) + r * d$$

By substituting the expressions of e_L and *d*, the profit becomes

$$Y_L = \frac{e_U}{V_L} * (X - r * D_L) + r * \frac{D_L}{V_L} * e_U = \left(\frac{e_U}{V_L}\right) * X$$

By operating two other substitutions, that are $e_U = a_U * E_U$ and $V_U = E_U$, the final expression for the net profit becomes

$$Y_L = \left(\frac{\alpha_U * V_U}{V_L}\right) * X$$

From this expression we can conclude that, if $V_U > V_L$, then $Y_U < Y_L$. Thus, the investor will prefer to sell the shares from the unlevered firm in order to buy capital from the levered firm. By doing so, the investor decreases e_U (by increasing e_L) and consequently he also decreases V_U. That leads to the conclusion that $V_U > V_L$ does not represent a condition of equilibrium.

All in all, if an equilibrium do exist, it will be $V_U = V_L$. This is the proof of the irrelevance of the financial structure in determining a firm's market value.

2.2.1.2. Modigliani And Miller Theorem - Proposition II

- ***The expected rate of return on the common stock of a levered firm increases in proportion to the debt-to-equity ratio (D/E).***

- ***The firm's overall cost of capital (WACC) is unaffected by its capital structure.***

This means that a higher debt-to-equity ratio causes a higher return on equity. As a matter of fact, equity-holders take a higher risk in a levered company. Moreover, the growth rate depends on the spread between the expected return on a portfolio made up by all the securities a firm has and the expected return on the debt.
However, it must be taken into account that, in Proposition 2, it has been implicitly assumed that no transaction costs exist and individuals and corporations borrow at the same rates.
Hence,

$$r_E = r_0 + \frac{D}{E_L}(r_0 - r_D)$$

where

- r_E is the expected rate of return on levered equity, or cost of equity.
- r_0 is the expected rate of return on unlevered equity, or cost of capital.
- r_D is the expected rate of return on borrowings, or cost of debt.
- $\frac{D}{E_L}$ is the debt-to-equity ratio.

An important implication of this formula is that any attempt made in order to increase the value of the firm through an issuance of debt will be balanced with a greater cost of capital. This can be demonstrated by observing the Weighted Average Cost of Capital's expression:

$$WACC = r_A = r_E * \left(\frac{E}{D+E}\right) + r_D * (\frac{D}{D+E})$$

By keeping constant the interest rate on debt r_D, shareholders will require a return on shares characterized by an upward trend. Hence, increasing the leverage ratio leads to a change in the financial risk distribution between shareholders and creditors. Nevertheless, the risk associated to the firm in its entirety does not change. Thus, no additional value is created.

It must be pointed out that the Proposition II of the Modigliani-Miller theorem assumes that the expected return on equity has an upward trend in accordance with the debt-to-equity ratio only until the debt level is low and the firm's bonds are risk-free. As the firm runs more into debts with the aim to increase its interest rates, shareholders require a return rate that will increase more slowly, since the risk moves from the shareholders to the bondholders.

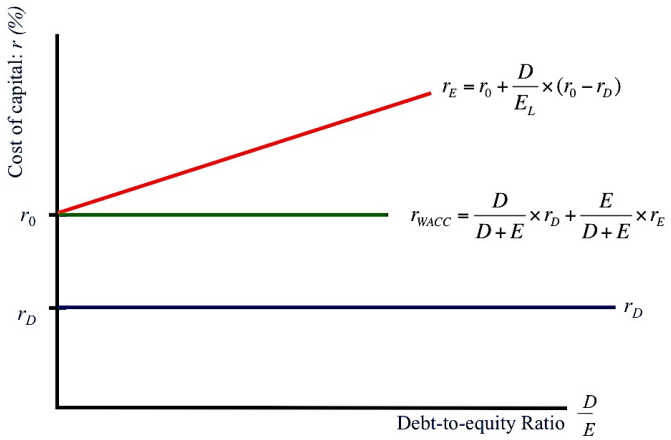

Figure 1. The Cost of Equity, the Cost of Debt, and the Weighted Average Cost of Capital: Modigliani-Miller's Proposition II with No Corporate Taxes and No Bankruptcy Costs.

2.2.1.3. Financial Structure With Corporate Taxes

According to the two Modigliani-Miller Propositions, the choices concerning the composition of the financing resources and the decisions upon the investments are independent from the financial structure.

However, if one observes the reality, he can conclude that the financial policies are important because, without them, the debt-to-equity ratios would tend to vary in a casual way in every firm and in every industry. It can be observed that several firms operating in capital-intensive industries tend to use the debt, while pharmaceutical firms and advertising firms are mostly financed by equity. This happens because there are some important factors that must be taken into account.

First of all, the corporate taxes must be considered.

As a matter of fact, in the 1963, Modigliani and Miller corrected the analysis of their theorem by evaluating the impact of taxes on the capital structure.

More precisely, they stated that the market value of firms belonging to the same risk class is both function of the corporate taxes rate and the leverage level.

In other words, two firms with similar cash flows will pay different taxes if their capital structure is different. Thus, a levered firm will have a higher after-taxes income if it is compared with an unlevered firm. This happens because the interest the levered firm pays on the debt financing is a cost deductible for tax purposes. Consequently, the fiscal benefit that comes from debt determines that the greater the total cash flows for the financiers (shareholders and creditors), the greater the debt in the financial structure. Also, the market value of the levered firm will be greater than the market value of the unlevered one.

The difference between the two firms will be given by the debt multiplied by the firm's tax rate, as it is stated by the following formula:

$$V_L = V_U + t_c * D$$

where

- t_c is the marginal tax rate applied on the firms' income;
- $t_c * D$ is the actual value of the tax benefit brought by the debt, under the hypothesis that the debt is permanent.

Thus, the introduction of one of the pros of debt modifies the Proposition I, determining an upward trend both on the value of the firm and on the wealth of shareholder, as long as D increases.
However, the extreme consequence would be that, in absence of constraints to require debt, the firm would have a financial structure made of the 100% of debts.
As far as it concerns the Proposition II, the corporate taxes modify the expected rate of return asked from the shareholders.
As a matter of fact, some of the increase in equity risk and return is offset by interest tax shield:

$$r_E = r_0 + (1 - t_c) * (r_0 - r_D) * \frac{D}{E}$$

The cost of equity capital of the levered firm increases, even if it increases differently from the r_E determined without taxes because, even though $(1 - t_c)$ tends to decrease the value, the equity E is inferior to the one that would result from the absence of taxes on the firm's income.
The cost of equity that firms can use in order to discount a risky project will not include taxes:

$$WACC = r_D * (1 - t_c) * \left(\frac{D}{D + E}\right) + r_E * \left(\frac{E}{D + E}\right)$$

Moreover, it can be noticed that the firm's overall cost of capital constantly decreases as the debt-to-equity ratio increases, disobeying the Modigliani-Miller theorem that stated the independence of WACC from the financial structure. It is interesting to notice, in fact, that $WACC = r_A$ if $t_c = 0$ and $WACC < r_A$ if $t_c > 0$.

The extreme implications of the two MM models examined - that are the irrelevance of the capital structure for the first and a structure made by 100% of

debt for the second - provoked different reactions among the scholars for some important reasons:

- it is impossible to think that a generic firm would resort to a fixed and permanent amount of debt (because the debt varies with the profitability and the value of the firm);
- it is necessary to have a taxable income that is sufficiently big if one wants to take advantage from the tax shield. In addition to that, it is not easy to predict a firm's future trend;
- there could be some constraints to the amount of debt from which taxes can be deduct.

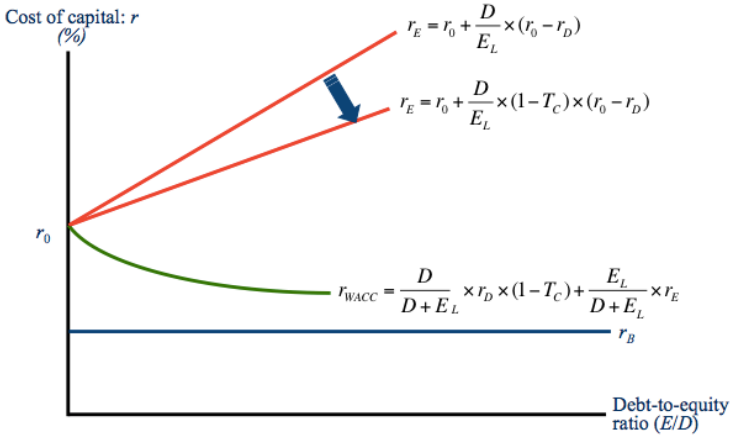

Figure 2. The Effect of Financial Leverage on the Cost of Debt and Equity Capital with Corporate Taxes

2.2.1.4. Financial Structure With Corporate Taxes And Bankruptcy Costs

Another reason why the MM's theorem seems not to be in line with real business life is the lack of bankruptcy costs in their model.

As discussed above, as long as bankruptcy costs are not introduced, risky debt has no effect on the value of the firm. Therefore, the value of the firm is equal to the value of the discounted cash flows from investment. In this case, the division of these cash flows between risky debt and risky equity is not important. However, when bankruptcy costs are considered, this does not stand anymore. Costs associated with bankruptcy may take different forms.

Specifically, the bankruptcy costs can be divided into:

- *financial distress*, that is a condition where a company cannot meet or has difficulty paying off its financial obligations to its creditors. However, most firms that experience financial distress do not ultimately file for bankruptcy;
- *direct bankruptcy costs* represented by legal, administrative and advisory fees paid by the firm. These costs cause bondholders to incur additional losses;
- *indirect bankruptcy costs*, that arise with the fear of incurring a bankruptcy. In particular, these costs include a loss in the assets value - as management spends time worrying about avoiding bankruptcy instead of running the business – and the loss of sales, valuable employees, ext. that causes the interruption of several operations.

Therefore, the value of the firm becomes

$$V_L = V_u + T_c * D - BC$$

where BC is the present value of the costs of financial distress which depends on the probability of distress and the magnitude of these costs if financial distress takes place.

Risk associated with the market value of the firm's assets can be divided into business risk and financial risk. Business risk refers to the variability and uncertainty of operating earnings before interest and tax (EBIT). Therefore, it depends on the nature of the industry in which the firm operates and it is influenced by several factors such as the variability of sales, selling costs and selling prices, and the existence of market power. Although the existence of business risk is crucial to the capital structure decisions, this type of risk exists irrespective of the extent to which firms rely on debt financing. However, financial risk arises from financial leverage, which, since it is a fixed cost source of fund, increases both the variability of earnings per share (EPS) and the probability of bankruptcy. In particular, bankruptcy is often caused by the fact that a firm is unable to fulfill its contractual financial obligations.

Moreover, this analysis implies that the relationship between the probability of bankruptcy and leverage may not be linear. When the level of leverage is low, an increase in the reliance on debt financing may not exert a significant effect on the likelihood of bankruptcy. However, the probability of bankruptcy starts to rise at an increasing rate as leverage increases beyond some threshold.

This effect results in a "U-shaped" WACC curve. Therefore, an optimal capital structure has to be found where the optimal leverage is attained, that is when WACC is minimized. This optimal leverage ratio maximizes the value of the firm and equates the marginal gain from leverage to the marginal expected loss from bankruptcy costs.

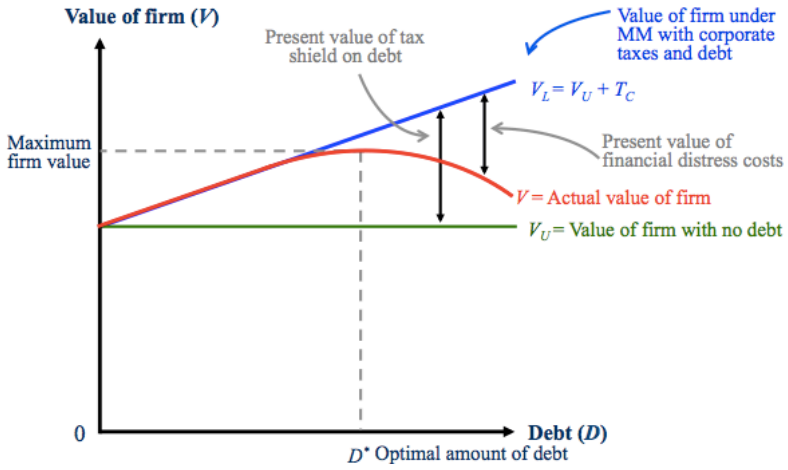

Figure 3. Integration of tax effects and bankruptcy costs in the MM theorem: the trade-off.

2.2.3. The Trade-Off Theory: The Agency Models

As Proposition 1 and 2 are valid only under the conditions listed above, variations to the original theory were developed. Among them, one can find the trade-off theory, according to which every firm can find its optimal capital structure.

Among the trade-off theories, it can be observed the presence of a sub-class of theories that employs the agency models in order to identify an optimal capital structure.

The problem arisen by the agency costs derives from the elimination of another hypothesis from the Modigliani-Miller Theorem: the symmetric and perfect information among all the actors in the market.

The first studies upon the asymmetric information emerged during the 1970s. They state that the presence of asymmetric information between two individuals (*principal* and *agent*) makes compulsory the control of the managerial behaviour throughout the different stage of the contractual relation: before the drafting of the contract (*screening activity*), during the contractual relation (*monitoring activity*) or after the expiration of the contract (*auditing activity*).

If these activities do not take place, the following critical situations appear:

- *adverse selection*: the manager can handle more information about the projects' future profitability than shareholders and potential external investors do. From one hand, the manager encounters difficulties in convincing them; from the other hand the investors suspect the manager will take advantage from the situation;
- *moral hazard*: the manager encounter difficulties in demonstrating his efforts to shareholders. But, at the same time, the manager can hide his efforts and his actions to shareholders.
- *incomplete contracts*: the information is known both by the management and by the investors, but it cannot be legitimately verified.

The theories based on the agency costs are based on the moral hazard problems that generally arise because of an interest conflict between the ones delegated to perform a given action (agents) and the ones that bear the consequences deriving from such action (principal).

Therefore, agency costs materialize when the firm's actors (shareholders, managers, creditors) have divergent interests.

The agency costs can be distinguished in:

- The *agency costs of outside financing*. They can be further classified into:
  - Agency costs of equity;
  - Agency costs of debt;
- The *agency costs between manager and shareholders*.

The agency costs of equity, deeply studied by Jensen and Meckling in the 1976, arise when the firm issues new shares. The two scholars analysed the

effects on the agency costs caused by an issuance of shares. For this purpose, they compared the behaviour of a manager owning the 100% of the residual rights of control with the behaviour that the same manager assumes when he sells a part of these rights or benefits to external investors.

In this latter case, the divergence of interests between the manager and the other investors creates some agency costs that lead the manager to behave in a way that badly influence the firm's value. As a matter of fact, the manager tends to appropriate the benefits coming from the firm's resources in order to maximize his own utility. The benefits stolen to the firm represent the agency costs of equity. To this kind of costs, there is the need to sum the monitoring costs supported by the shareholders in order to ensure that the management is operating in their interests.

A similar circumstance can be observed when manager do not own firm's shares. Therefore, they do not own any residual right of control on the firm. In this case, every effort made by the manager in order to increase the firm's income would only bring advantages to the shareholders, although the managers sustain the main effort. Similarly, the divergence of interests generates a monitoring cost that reduces the firm's value.

All these issues could be mitigated both by paying an incentive and increasing the equity's percentage owned by the manager in the firm, in order to align his interests to the firm's ones. But this could be not enough. As a matter of fact, the investments should be funded with a greater amount of debt, since the debt creates the commitment for the firm to pay the interests and reduces the unused cash flow that managers could employ in order to take advantage of the above-mentioned benefits.

Moreover, if the bankruptcy results to be rather expensive for mangers because of the loss of control's and reputation's benefits, then the debt can also be for them an incentive to work hard, to take minor advantages, to take better decisions regarding the investments, making, thus, decrease the probability of bankruptcy.

Therefore, in presence of agency costs of equity, the debt financing represents an effective means that weakens the conflicts between shareholders and managers.

Nevertheless, this consideration cannot lead firms to have a financial structure entirely composed of debts because, as it has been mentioned before, also debt generates agency costs related to the conflict of interest between the shareholders and the creditors of a firm. The main factors of this kind of conflicts are:

- The fact that the debt securities' yield is determined under the assumption that the firm keeps constant its dividend policy. Therefore, unexpected increases in dividends or increases in debts could reduces the securities' value;
- The asset substitution problem, which represents the most important issue regarding the agency costs. It means that if the firm undertakes riskier projects instead of project characterised by a lower risk, the shares value increases while the debt insurances' value is reduced;
- The underinvestment.

2.2.3.1. The Asset Substitution Problem

In the 1976, Jensen and Meckling studied the issue concerning the "*activity substitution*" that arises when the firm, after having resorted to debt in order to carry out a low-risk investment, decides to invest in a sub-optimal way, that is the firm decides to invest in risker investments with a NPV characterised by a downward trend. By doing so, two different scenarios are likely to come up. In case of success, shareholders would take the most of the return. While, if the project fails, thanks to the limited liability, the firm will not bear costs that result to be higher than the initial investment. Consequently, the risk of bankruptcy would entirely burden on creditors and the owners of the residual rights of control would acquire the creditors' wealth.

In order to clarify the asset substitution problem (also known as *risk shifting*), one should consider the previous firm's formula $V = D + E$ and suppose that the firm only issues zero coupon bonds, with face value equal to *F* at the end of a certain period *T*; if at that time the firm's value V_T was greater than *F*, then the

creditors would get *F*, while the shareholders would own shares at a price equal to the residual value $V_T - F$. Instead, if the firm's value were minor than *F*, the creditors would get V_T, while the shareholders would not own anything,

Therefore, owning the firm's shares means having the right to buy the firm by paying the debt's face value *F* to creditors at the expiring date.

Thus, the shares' present value E_T, at the generic time *t*, is equal to a call option's value on the future firm's value V_T , with a price equal to F.

The value E_T, could be willingly augmented at the creditors' expenses by increasing the volatility σ or the firm's income variance σ^2. As a matter of fact, a greater variance makes more likely to have a very high or a very low firm's value at the time *T*. However, it must be taken into account that shareholders earn only if $V_T > F$. The expected value for V_T will thus be greater in presence of high variances than for low ones. This can be expressed as follows:

$$\frac{\delta E_t}{\delta \sigma^2} > 0$$

Therefore, besides V_T, E_t grows with σ^2 as well.

Based on these considerations, one can suppose a shareholder who has to choose between two projects P_1 (sure) and P_2 (risky). The casual playoff is equal to X_J and the yields' variance is such that $\sigma_1^2 < \square_2^2$.

One can now assume that X* is the credit's amount and V is the total market value in both cases (he chooses P_1 / he chooses P_2). According to what has been said before, the total playoff for creditors is equal to

$$R_J = X^* \quad \text{if } \square_j > X^*$$
$$R_J = X_j \quad \text{if } X_j < X^*$$

When the variance increases, the shares' value increases too. In addition, given that $\sigma_1^2 < \sigma_2^2$, the value of the share E_1 will be minor than the value of the share E_2. As a result, whereas $D_1 = V - E_1$ and $D_2 = V - E_2$, then $D_1 > D_2$.

If the manager/owner can sell the debt securities at the nominal value X^* believing that he will invest in a safer project, then he will receive a greater price

from creditors, that is D_1. After having sold the securities, his shares will be worth E_1.

Nevertheless, since $E_2 > E_1$, the manager would be in a more advantageous condition if he invested in the high risk project because in this case he would transfer the wealth from creditors to himself.

If creditors could not prevent the manager from editing the investment plan and if they understood that the manager has the chance and the intention to invest in a riskier project, then they would pay the securities worthing X* at a price equal to D_2. By doing so, the creditors would impede the wealth's transfer to the shareholders and they will also allow the agency cost of debt (that will burden on stockholders) to increase.

On the basis of the described example, it is possible to express formulaically this agency cost, also called *overinvestment cost*. Since the project P_1 is less risky than the project P_2, the expected value of its playoff will be greater:

$$E(X_1) > E(X_2)$$

This implies that $V_1 > V_2$. Moreover, if the difference

$$V_1 - V_2 = (E_1 - E_2) + (D_1 - D_2)$$

is small enough, the shares' value increases. The difference between the shares' value for the two kind of investment can be expressed as:

$$E_2 - E_1 = (D_1 - D_2) - (V_1 - V_2)$$

where $D_1 - D_2$ stands for the amount of wealth transferred to the shareholders and $V_1 - V_2$ is the reduction of the firm's value if the manager takes a riskier project. Indeed, $V_1 - V_2$ is exactly the agency cost caused by the issue of debt.

2.2.3.2. Solutions To The Conflict Between Creditors And Shareholders And Trade-Off Among The Agency Costs

The conflict between shareholders and creditors could be limited by including in the debt contracts some clauses that modify the playoff for the debt's owner: this is the case of the convertible debt that gives to bondholders the right to exchange their bonds with other firm's financial instruments in the ways and in the times specified in the contract. This would reduce the incentive for shareholders to expropriate the creditors, since if it happens, then the creditors transform their wealth in the firm's shares.

Jensen and Meckling concluded their dissertation about the agency problems by illustrating how the optimal capital structure is also the result of the trade-off between the agency costs of debt and the agency costs of equity.

As it can be observed by the figure 4, the total agency costs are given by the sum of the two kinds of costs and the optimal financial structure is the one that that minimizes the total costs.

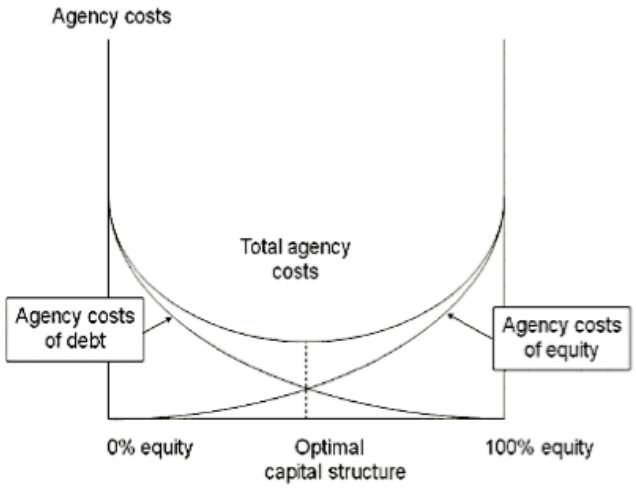

Figure 4. Agency costs of debt and equity

2.2.4. The Pecking Order Theory: The Myers And Majluf Model And The Implication For The Financial Structure

The pecking order theory removes the hypothesis of perfect information from the Modigliani-Miller model.

One of the duties for the manager/owner is to select the investment's projects and it is obvious that he has greater information than investors about the projects themselves (i.e. the expected return) or about the firm's value. Moreover, the management could propose to investors to buy a firm's good that has some characteristics that are hard to be proved: in similar conditions of asymmetric information, the adverse selection can roll out.

The introduction of the explicit design of the imperfect information's subject allowed the generation of different approaches that explain the capital structure. Some authors describe the chosen financial structure as a useful instrument for the mitigation of the inefficiencies caused both by some investment decisions and by the asymmetric information among parties; some other authors consider the financial structure as a means through which one could point out to the external investors the information the firm provides.

The branch of literature that faces the firm's financial structure choice in a context distinguished by the adverse selection arises in the 1984 with Mysers and Majluf. As a matter of fact, the two scholars showed that, if the management really knows the actual value related to the balance sheet activities but this information seems to be imprecise for both the investors and the market, then the market likely underestimates the business capital.

Therefore, if the firms are obliged to fund their new investment projects through the issue of new shares, the *underpricing* could be so high that the new investors earn much more than the actual project's NPV. By doing so, the current stockholders are affected by a net loss that will lead to the rejection of the project, even though it presented a positive NPV.

The rejection of investments could be avoided by appealing firstly from the cash flows generated by the firm and secondly from the low-risk debt. The issue of new shares has to be taken into account only if the other two alternatives result to be unavailable.

This finding shows that firms will always prefer to resort to the investment means that are less affected by the asymmetric information, even though this minimizes the informative advantage of the information's owner.

It is possible to illustrate the intuition that lies on the Myers and Majluf's study by comparing the issue of debt with the issue of equity.
The debt financing allows proceeding with the investment and, if it has success, the creditors obtain a fixed payment. Therefore the greater the investment yield, the greater the shareholders' profit.
Conversely, in the case of equity financing, new shareholders will earn from the investments in proportion to the shares bought. Therefore, the profit for the prior shareholders will be less.
It follows that only the firms that do not forecast a high return for their investments will issue new shares, because otherwise the current shareholders would have to share considerable profits with the new shareholders. This is what happens from a firm's point of view.
By looking at the market, the line of reasoning does not change. The issue of new share is interpreted as a signal that the expected return of the investment is not reassuring.
Indeed, it is empirically verified that the common shares' price decreases whenever the issue of new equity is announced.
This is the Myers and Majluf's reasoning viewed by theoretical terms. However, the same reasoning can be formulaically expressed.
One can suppose to have two different firms in the same market. Their activities are worth respectively *H* and *L* (with L<H). For example, H=200 and L=100.
Initially, only managers know the nature of the firm and their objective is to maximize the actual value of the residual right of control of all the shareholders.
One can hypothesize, moreover, that external investors will evaluate that the firm is of the kind H with probability *p* and that it is of the kind L with probability *1-p*. Both the firms have access to a new project that requires an investment I, i.e., 50, that will generated a given profit, equal to 75. By hypothesizing a null discount rate, the NPV for the investment will be positive and equal to 25.
If the firms' management accepted the project, then it would have to be funded by an issue of equity. However, the firm of type H will reject the project and will

not issue new shares, while the firm of type L will accept the project and will issue new shares at a price equal to the investment's value, that is I.
The investors will interpret the issue as a signal that the firm belongs to the type L.
By referring to the Theory of Games, it can be affirmed that a Nash equilibrium with imperfect information exists and that this equilibrium is characterised by:

- the probabilities with which the investors evaluate the firms of the different kinds, that can be expressed as

$$p = \mathrm{P}\left(V = \frac{H}{Issuing\ of\ shares}\right) = 0$$
$$1 - p = \mathrm{P}\left(V = \frac{L}{Issuing\ of\ shares}\right) = 1$$

- the strategies such that:

V = H = 200 → do not issue new shares
V = L = 100 → issue new shares

The set of these strategies and probabilities is a Nash equilibrium if no firm has the incentive to divert from the defined strategy. Therefore, equilibrium must be verified.
First of all, the type L firms will have to issue an amount of new shares *a* that can fund the entire investment I. Therefore it will be such that

$$a * (V_L + VAN + I) = I$$

By substituting the numerical values hypothesised it is obtained that *a*=(50/175)=0,29. A firm of type L could divert from its equilibrium strategy by not investing. But, by doing so, the profit for the current shareholders would be equal to 100, that means that it would be inferior than the profit they get by investing that is given by

$$(1 - a) * (VL + VAN + I) = 0{,}71 * (100 + 25 + 50) = 124$$

As far as it concerns the firm of type H, it can be affirmed that the firm can divert from the equilibrium strategy and invest by issuing new shares that would be underestimated from the market as if they were issued by the firm of type L. As it is considered to be a firm of type L, then the firm is obliged to issue an amount of new shares equal to 0,29. By doing so, the current shareholders would get a profit equal to

$$(1-a)*(VL+VAN+I)=0{,}71*(200+25+50)=195$$

that is minor than the one the firm would get by rejecting the investment.
Ultimately, at equilibrium, only the firms of type L (that is only the “not good” firms) will accept the project with a positive NPV.
The obtained equilibrium describes a priority order for the sources of funding that is exactly the pecking order: firms rank the funding choices on the basis both of the discipline the market dictates to them and of their risk exposure related to the asymmetric information.
This ranking can be summed-up in the following points:

- firms prefer the internal financing;
- firms adapt their payout ratios to their opportunities of investment, by searching at the same time to avoid unexpected variation of dividends;
- as far as management cash flows are influenced by the dividend policies, by the fluctuations of profitability and by the investment opportunities, they can be greater or minor than the investments’ expenses. In the former case, the additional cash flow it is used to refund the debt or to invest in negotiable securities. In the latter case, the firm would employ the cash flow or it would sell its negotiable securities;
- if a cash imbalance situation would arise, that means that the internal financial resources are not sufficient to cover the expenses due to investments and remuneration of risk capital, then the firm would be obliged to resort to the external financing. Previously, it would issue debt securities (that are safer), then hybrid securities (convertible bonds) and in the end, only as an extreme solution, the firm would issue new shares.

The pecking order theory is in contrast with the trade-off theory because it does not consider the existence of an optimal debt-to-equity ratio. Therefore, from this theory it can be deduced that:

- the leverage ratio for each firm reflects its needs of external financing;
- the more profitable firms employ few debt capital;
- firms prefer the financial slack. It means that they search interesting projects for the future and they gather cash flow in order not to address to the external financing as soon as the chance to fund a new project comes out.

2.2.5. The Market Timing Theories

In the 2002, Baker and Wurgler developed new theory that is completely different from the ones analysed until now.

These theories are based on the hypothesis that the market can give an inefficient or irrational evaluation of a firm's shares or debt.

One can suppose that, at a given point in time, the market give an extremely positive evaluation for a generic firm's shares and that the same firm has an investment project that needs to be funded by the issue of new shares or debt.

Obviously, the great value assigned from the market to the shares leads the firm to choose the first alternative. Since the new shares will have an elevated (and irrational) evaluation, it will be sufficient to issue a reduced amount of shares in order to gather the investment's fund. By doing so, the current stockholders would not share high profits with the new shareholders.

A similar line of reasoning could be followed if the market evaluates in an elevated and irrational way the debt securities.

Ultimately, the market timing theories conclude that the choice of the optimal financial structure is not motivated neither by consideration about the optimal conditions (trade-off theory), nor by the concern about the information that a determined choice of financing would reveal to the investors (pecking order theory). But rather, the decisions could be driven from what the market prefers, not necessarily for rational reasons, in a given point of time.

2.2.6. The Empirical Evidence Of The Economic Theories: Which Is The Actual Financial Behaviour Of Firms?

Many empirical researches have subjected the trade-off and pecking order theories to several tests, while the market timing theory only has preliminary results due to its recent formulation.

The empirical tests for the theories regarding the capital structure have two different aims:

- the evaluation of the theory's consistency with empirical data;
- making sure that the theory can explain a firms' behaviour that, according to alternative theories, is unjustifiable.

This second aim derives from the observation that each of the three theories examined starts with the rejection of some hypothesis of the original Modigliani – Miller theorem. As a matter of fact, the trade-off theory hypothesises the presences of taxes and costs of agency; the pecking order theory is based on the existence of the asymmetric information between firms and external investors; the market timing theory assumes that the evaluation of the market regarding the stocks could diverge from their rational value. Nevertheless, in the reality it is common to find more hypotheses violated at the same time.

Normally, an empirical test on the capital structure theories is a statistical analysis on the data related to the financing choice taken by a sample of firms. Through the econometric instruments, the test studies the data registered in the balance sheet and their leverage by trying to find a link with the variables described in the various theories. If the results on a sample of firms are close to the ones forecasted by a determined theory with an elevated significance level, approving evidence to the theory is found. If not, the evidence is considered inconsistent with the theory.

In this regard, it has to be pointed out that, at the moment, the empirical research has not managed to find a model among the ones illustrated before that can be considered entirely correct. As a matter of fact, different theories are able to explain different aspects of the financial behaviour taken by the firms, as

it has already been clarified in the comparison between the trade-off theory and the pecking order theory.

2.2.6.1. The Tax Benefit Coming From Debt

Graham (2000) studies the Modigliani-Miller theorem that states that a firm derives a tax advantage from the debt, since the interests are deductible. According to this line of reasoning, firms should increase their debt until the marginal benefit from debt is null – that is, until the benefit generated by an additional dollar of debt is completely balanced by the increase of the expected insolvency costs, so that the firm cannot take any advantage from debt any longer.

Graham calculated the marginal benefit generated by debt. He estimates this value with a simulation method based on the Miller's expression for the fiscal benefit of debt. By doing so, Graham obtains a marginal benefit of debt curve for any firm.

The typical curve is initially flat: for modest debt levels, the advantage coming from an increase of debt is constant. When a certain debt level is reached, the marginal benefit of debt decreases, as the expected insolvency costs becomes more relevant.

According to the Modigliani –Miller Theorem, firms should run into debts until the marginal benefit of debt curve starts to decrease. Until then, in fact, an increase of debt brings value to the firm. However, Graham spotted that most of the firms of his sample have level of debt critically inferior.

A possible conclusion is that the Modigliani – Miller thesis is wrong and that there are further costs of debts that were not taken into account and that make optimal a lower level of debt than the one forecasted by the Miller's expression.

An alternative solution is that Graham did not take into account some balance sheet items that, even though they are not debt, have the same function the debt has.

This is the case of *stock options* in favour of the employees, that represent a passivity for firms.

Graham and Harvey (2004) demonstrate that, if this item is considered, the debt level is much more closer to the one forecasted by Modigliani and Miller.

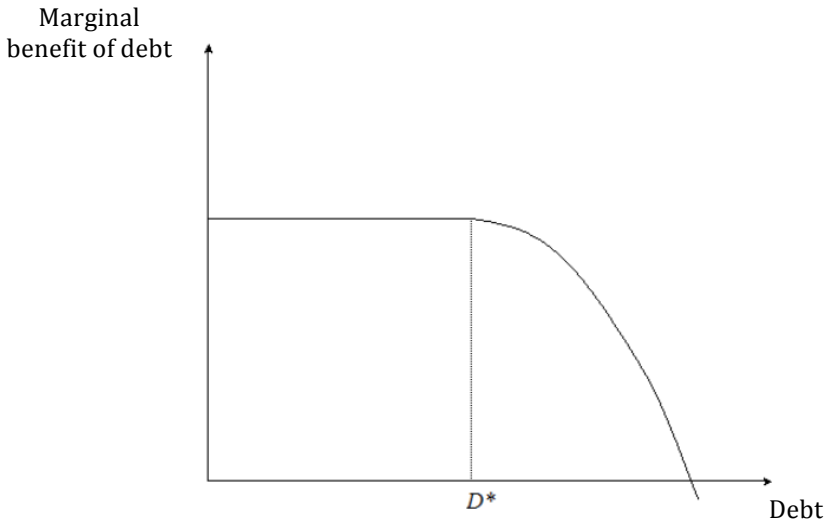

Figure 5. Marginal benefit of debt curves estimated with the Graham's simulation method and based on the Miller's formula.

2.2.6.2. Tests on the trade-off theory and pecking order theory.

Several studies opened the still ongoing debate about whether the profound effects of operating and market performance on firms' financing decisions are due to trade-off or to pecking order financing behavior. Therefore, the analysis of some empirical studies about this subject follows.

As it has been said before, traditional corporate finance models suggest that firms select optimal capital structures by trading off various tax and incentive benefits of debt financing against financial distress costs.

Hovakimian, Opler and Titman (2001) tested whether a firm's history may influence the determination of its capital structure. According to this line of reasoning, highly profitable firms often pay down debt through their earnings. Consequently, these firms result to be less levered than their less profitable counterparts. In addition, firms tend to issue equity following an increase in stock prices, implying that firms that perform well subsequently reduce their leverage.

Nevertheless, several authors have noticed that the negative correlation

between profits and leverage is in line with the pecking order theory. Thus, firms passively gather earnings, becoming less levered when they are profitable and gather debt, becoming more levered when they are unprofitable.

Consequently, the scholars tested the hypothesis that firms tend to move toward a target debt ratio when they either raise new capital or retire or repurchase existing capital.

Following Myers and Majluf, the test recognizes that firms consist of both assets in place and growth opportunities. Moreover, the test argues that target ratios are likely to be determined by comparing the relative weights of these two components of value. In particular, firms should use relatively more debt to finance assets in place and relatively more equity to finance growth opportunities. As a result, firms may choose to issue equity rather than debt in response to an increase in their value, when such increase is caused by a greater perceived value of their growth opportunities.

In order to prove their hypotheses, Hovakimian, Opler and Titman employed a two-stage estimation procedure. In the first stage, they estimated target debt ratios by regressing observed debt ratios on many of the variables used in earlier studies. In the second stage, they used the predicted debt ratio resulted from the first stage as a proxy for the firm's target or its long-run optimal debt/assets ratio. The difference between a firm's predicted debt/assets ratio and its actual ratio is then included in the second stage regressions as a predictor of whether the firm issues debt or equity. The second stage regressions include additional variables that may also proxy for deviation between the firm's current and target debt ratio.

As a result, it is observed that, although past profits are an important predictor of observed debt ratios, when firms either raise or retire significant amounts of new capital, their choices move them toward the target capital structures suggested by the static tradeoff models, more often than offsetting the effects of accumulated profits and losses. These findings persist regardless of the maturity or the convertibility of the debt issued.

Moreover, the tendency of firms to make financial choices that move them toward a target debt ratio appears to be more important when they choose between equity repurchases and debt retirements than when they choose between equity and debt issuances.

Finally, their results suggest that stock prices play an important role in determining a firm's financing choice. As a matter of fact, firms with big increases in stock prices are more likely to issue equity and retire debt than firms with stock price declines.

Hovakimian and Tehranian (2004) follow another line of reasoning that focuses on the instances when firms issue both debt and equity.
The result obtained by this empirical study highlights that the importance of market-to-book ratio in corporate financing decisions is, at least partially, due to the negative relation between growth opportunities and target leverage predicted by trade-off theories. Indeed, high market-to-book firms have low target debt ratios and, therefore, tend more to issue equity and less to issue debt.
Moreover, Hovakimian and Tehranian pointed out that profitability has no effect on the firm's debt ratio. This is consistent with the dynamic trade-off hypothesis stating that the negative effect of profitability on observed debt ratios reflects the deviation from the target.
Thus, consistent with the findings of earlier studies, the probability of debt versus equity issuance increases with the firm's profitability.
Further analysis shows that, although the likelihood of equity issuance declines with profitability, the likelihood of debt issuance is not affected by profitability.
As a result, according to Hovakimian and Tehranian, neither the trade-off nor the pecking order hypothesis can fully explain all of their profitability results. However, the results are consistent with a hybrid hypothesis that firms have target debt ratios but also prefer internal financing to external funds.

The third empirical research analysed comes from Frank and Goyal (2007).
The two scholars considered publicly traded American firms over the period 1950 to 2003 with the aim to determine the critical factors that can be associated to leverage.
Therefore, they found the following six factors:

- firms that compete in industries with highly levered firms tend to have high leverage;
- most firms with a high market-to-book ratio have low levels of leverage;

- firms that have more tangible assets tend to have more leverage;
- firms that have more profits tend to have less leverage;
- larger firms tend to have high leverage;
- firms tend to have high leverage when inflation is expected to be high.

For these firms the evidence highlights the weaknesses present in both trade-off and pecking order theories.

The main empirical weakness of the tradeoff theory is found in the fact that firms tend to stock retained earnings (i.e. build up internal equity) before spending the money to build capacity. The process of retaining earnings would show up empirically as profits reducing leverage. Buying the physical capital involves spending money which thus increases leverage. Hence leverage is positively related to physical capital in the theory.

Pecking order theory, instead, does not directly predict the importance of industry. This is a crucial problem when profitability is already included in the model. In addition, the scholars state that factors regarding the roles of tangibility and the firm size are not easily derivable from the basic logic of the pecking order theory.

2.2.6.3. Further tests on the pecking order theory: the Event Study Technique

As it has been stated before, a conclusion drawn from the pecking-order analysis is that the announcement about the issue of new shares reveals to the market information related to the investments quality of firms that have to be funded with new equity. Particularly, this announcement makes the NPV of such investments lower. Hence, the issue of new shares determines the collapse in the share price. This result has been analysed by an econometric technique called event study. This technique also provided an explanation for the consequences on the share prices caused by the exchange offers (debt for equity and vice versa) and by the repurchase of shares.

As far as it concerns the issue of securities, it has been observed that:

- the irregular returns related to the announcement of the issue of common shares are more negative;

- the irregular returns related to the convertible bonds or to the issue of privileged and convertible shares are more negative than the ones related to the correspondent non-convertible securities;
- the irregular returns related to the issue of risk-free debt or of privileged shares are not, at a statistical level, significantly non-zero;
- the irregular returns associated to the issue of securities by a public firm are less negative than the ones associated to the same securities issued by industrial firms.

With regard to the exchange offers, Masulis (1983) demonstrated through the event study technique that the shares price increases when the firm offers the debt for equity exchange and decreases when the firm offers the equity for debt exchange. This could be due to a tax effect. As a matter of fact, if the firm had an inferior leverage than the optimal one, and if the interest tax shields were positive, then the debt for equity exchanges would bring the firm to the optimal capital structure. On the contrary, the opposite exchange would distance the firm from the optimal condition.

Thus, the evidence on the exchange offers tried to test the robustness of the trade-off theory to describe the financial behaviour, since the theory states that firms sometimes get in a lower position than the optimal condition and sometimes they get in a higher one.

The theory also states that in the former case, firms should opt for an equity for debts exchange and in the latter case, they should opt for a debt for equity exchange.

However, there is an important difference between the model and the reality: the former states that, in both cases, firms move toward the optimal condition, but actually only a kind of exchange represents a good news for the market.

As a matter of fact, Masulis states that the capability of a firm to exchange debt for equity could point out that its capability of debt is augmented. Consequently, only the debt for equity exchange will be positive for the firm.

In conclusion, several studies confirmed that the repurchase of shares, as it is counterposed to the issuance, will determine an increase in the shares price.

2.2.6.3. The Linear Regression Model Based On The Financial Deficit

Reclaiming the test on the pecking order theory, Myers and Shyam-Sunder proposed a more direct test then the event study. As a matter of fact, the two economists did not focus on the effects on the share price caused by the announcement of an issue of new equity. They observed, instead, that the pecking order theory states that, once the internal resources are over, firms resort mostly to debt in order to fund their projects.

Starting from this line of reasoning, Myers and Shyam-Sunder define the *financial deficit* as the difference between the investments the firm has made at a given year and the financial resources available to the firm. Therefore, if the Myers and Majluf's theory is correct, such difference has to be equal to the debt of a new issue made in the same period of time. This is the reason why, according to the scholars, the pecking order theory does not explain the debt level, but instead, the variation of debt.

Myers and Shyam-Sunder tested this statement through a linear regression model:

$$\Delta D_{it} = a + b * DEF_{it} + \varepsilon_{it}$$

where

- ΔD_{it} represents the issue of debt of the i-th firm in the year t
- DEF_{it} is the financial deficit

If the Myers and Majluf theory was correct, the statistics R^2 associated to this regression should be close to 100%. This means that the debt issued is entirely due to the financial deficit, with *a* and *b* respectively equal to 0 and 1.

In practise, the two scholars found statistics R^2 varying between 68% and 86%. Thus, the pecking order theory is partially valid, since there is a part of variability in the issuance of debt that is not explained.

2.2.6.4. The Test On The Market Timing Theory

The first empirical researches made about the market timing positively confirm the hypothesis made in the theory.

Baker and Wurgler (2002) highlight the fact that the capital structure of firms is explained by a variable called “external finance weighted-average” (EFWA).

Formulaically,

$$\left(\frac{M}{B}\right)_{EFWA,t} = \sum_{s=0}^{t} \frac{e_s + d_s}{\sum_{r=0}^{t} e_r + d_r} \left(\frac{M}{B}\right)_s$$

where

- e_s and d_s are the net issue of equity and debt;
- $\frac{M}{B}$ is the *Tobin’s q ratio* and represents the market book-value.

According to the Baker and Wurgler’s results, the EFWA statistically explains the equity-to-assets ratio.

The meaning of this result is that the historical evolution of the Tobin’s q ratio explains the current capital structure of a firm. In other terms, the firm’s capital is made up by a higher percentage of equity if the firm’s shares have always had a high market value. This proofs the validity of the market timing theory.

Elliott, Koëter-Kant and Warr made a different test in order to prove the effectiveness of the market timing theory.

In their study, the scholars attempted to separate market-timing effects (caused by irrational pricing) from the effects of growth options and adverse selection (due to asymmetric information). To examine the relative importance of growth options and mispricing, they decomposed book-to-market into a growth option component and a mispricing component and then directly examined the role that each plays in the security choice decision.

Elliott, Koëter-Kant and Warr conducted their tests on a sample of 3,781

public equity and 5,391 non-convertible debt issues.

Consistent with the market timing theory, they found that firms with overvalued equity are more likely to issue equity, while those that are fairly valued or undervalued, are more likely to issue debt.

These last findings resolve the dual interpretation of the results of Baker and Wurgler (2002). Substituting analyst forecast earnings for ex-post earnings leaves the results qualitatively unchanged. This can be interpreted as further evidence of market timing in general and in particular suggestive of investor irrationally. Finally we also find similar results when we use alternative valuation measures to estimate mispricing.

The scholars tested the market timing theory of capital structure in a framework that avoids the dual interpretation problem of book-to-market, in which book-to-market measures growth options, asymmetric information or irrational equity mispricing. As a matter of fact, they employed an earnings based valuation model (the residual income model) to directly measure the firm's intrinsic value. Using a sample of 9,172 security issuances the scholars found that firms whose equity is overvalued, (i.e. the market value exceeds the intrinsic value generated by the residual income model) are significantly more likely to issue equity. In order to differentiate between the impact of mispricing and growth options in the security issuance decision, it has been chosen to decompose book-to-market into two components; mispricing (value-to-price) and growth options (book-to-value). After controlling for growth options, we find that mispricing has significant incremental explanatory power.

Finally, Elliott, Koëter-Kant and Warr's results are robust to alternative valuation measures such as price-to earnings ratios, price-to-sales ratios and a measure of the stock price run-up. In conclusion, according to this study, mispricing of equity plays a major, if not dominant role, in the security choice decision.

2.2.6.5. The Managers' Behaviour In Practice

An alternative approach to the empirical studies presented above, is the one followed by Graham and Harvey (2001, 2002). The two scholars carried out a survey addressed to Chief Financial Officers of a sample of firms quoted in the US. The scope of the survey is to understand whether the economic theories are actually followed in practice.

The answers provided by CFOs demonstrate that they base their decisions on heuristic or informal criteria that barely respect the economic theory's rules.

Usually, their targets are the maintenance of a good financial flexibility (that is the possibility to vary the projects' size and to resort to alternative sources of financing) and the preservation of a good rating.

Moreover, despite the pecking order hypothesis, it has been found that managers are not worried about financial effects, as the asset substitution, the agency costs, the problems related to the taxes on shareholders or creditors and asymmetric information.

More likely, however, the effects of these problems are incorporated in the firm's shares prices and the debts, therefore they affect in any case the financial decisions taken by the management.

3. CAPITAL MARKET IMPERFECTIONS AND HIGH-TECH INVESTMENT

3.1. Why Capital Markets Are Different From All The Other Markets?

The financial crisis emerged in the autumn of 2008 has caused a worldwide contraction of the economic activity that has been compared to the one suffered during the Great Depression of the 1930s.

The so-called *credit crunch* is one of the main factors that contributed to the recession. In other words, the main driver of such crisis has been identified in the credit reduction that firms suffered from financial institutions and firstly from banks. More precisely, some firms experienced the *credit rationing* that is the incapability to get funds from banks even when firms are willing to pay higher interest rates for the loan.

The credit rationing differs from a goods rationing. In order to explain such difference, one can take into account the apples market. It is obvious to imagine what happens when an excess demand for apples occurs: the apples price grows, the demand decreases, the supply grows until the demand equals the supply. Therefore, there is no rationing in the apples market.

One of the fundamental differences has to be found in the presence of asymmetric information.

The following model, created by Fausto Panunzi (2009), mathematically explains what happens when a bank have to grant a loan to a firm willing to start a new project both in case of symmetric information (*first best*) and in case of asymmetric information (*second best*).

In order to decide whether to grant the loan, the bank has to consider the possibility that the entrepreneur will not be able to pay down such debt and, thus, the possibility that the project will fail.

The success factors for a project are numerous: the entrepreneur's skills, his commitment to the project, the market conditions, ext. For some of these factors, there is an information asymmetry between bank and entrepreneur.
Indeed, the entrepreneur can better know the market regarding both the product and the productive factors. The entrepreneur can also have a better knowledge about his own skills. Other factors, such as the commitment of the entrepreneur, are observable only by the entrepreneur. In the following chapters, I will try to explain how these factors can cause inefficiencies in the capital market that often turn into credit rationing.

3.1.1. Hidden Characteristics, Underinvestment And Overinvestment

Panunzi took into account an entrepreneur who is trying to fund a project. The fund needed to activate the project (i.e. the purchase of a machinery) is equal to 65. The entrepreneur has no financial resource that can be invested. Therefore, he is obliged to ask such amount to the bank. The entrepreneur has no other goods that can be taken as warranty (collateral).
The project has the same probability to fail and to succeed. If it succeeds, it generates a cash flow equal to 100. Meanwhile, if it fails, it generates a cash flow equal to 0. The probability of success depends on the entrepreneur's features. If the entrepreneur is talented, then the success probability is equal to 0.8. If he is not talented, instead, the success probability is equal to 0.4. In the first case, the entrepreneur belongs to the T type (where T stands for talent), meanwhile in the second case the entrepreneur belongs to the NT type. On one hand, the entrepreneur knows the type to which he belongs. On the other hand, the bank only knows that the probability that the entrepreneur belongs to the T type is equal to $\frac{1}{2}$.
Other assumptions are needed. The most important one is the limited responsibility for the entrepreneur: he can never be obliged to pay an amount that is greater than the cash flow generated by the project. Particularly, if the project fails, he does not pay down the debt, as the cash flow is equal to 0.

Under these conditions, the credit contract results to be very simple: the bank borrows 65 to the entrepreneur and, in turn, the entrepreneur promises to pay to the bank an amount D ($\leq$ 100) when the project succeeds.

Moreover, one can suppose that, for simplicity, the entrepreneur offers such contract to the bank that, in turn, can only accept it or deny it. The interest rate is equal to 0 and, therefore, the opportunity cost to borrow 65 to the entrepreneur is equal to 65. In other words, the bank is neutral to the risk, as it is interested only to the expected return. Therefore, the bank will accept to borrow 65 only when it is almost certain that the project will not fail.

First, the case of symmetric information is analysed. Therefore, the bank can observe the entrepreneur's type (*first best*). In this case, the T type entrepreneur can be funded. As a matter of fact, the expected cash flow is equal to

$$0.8 * 100 + 0.2 * 0 = 80 > 65.$$

In case of success, the T type could propose to the bank to pay down the amount D that makes the expected returns for the bank to be null. More precisely, the contract proposed by the T type should be able to satisfy the condition

$$0.8 * D + 0.2 * 0 = 65$$

and, therefore, $D = 81.25$. Then, the return expected by the T type will be

$$0.8 * (100 - 81.25) + 0.2 * 0 = 15.$$

It has to be noticed that 15 is the exact total return expected from the project (80-65).

If one now considers the NT type, he can easily notice that he would not be funded. As a matter of fact, the expected cash flow is only equal to

$$0.4 * 100 + 0.6 * 0 = 40$$

and, therefore, the entrepreneur is not able to totally pay back the bank. In other words, even if the NT type entrepreneur proposed to pay down D=100, the bank would refuse to grant the loan. Thus, in case of symmetric information (*first best*) only half entrepreneurs (the ones belonging to the T type) would be funded.

As far as it concerns the case of asymmetric information, instead, the bank cannot distinguish between the two types of entrepreneur. From its point of view, the entrepreneur can at most pay down

$$\frac{1}{2}[0.8 * 100 + 0.2 * 0] + \frac{1}{2}[0.4 * 100 + 0.6 * 0] = 60$$

that is the average between the amount that can be payed by the T type entrepreneur and the amount that can be payed by the NT type entrepreneur.
But, as 60<65, the bank does not grant the loan to the entrepreneur. In other words, even if the entrepreneur offers to pay D=100, the bank expects to suffer from losses for the granted loan. Thus, in this case, no entrepreneur gets the fund and an underinvestment phenomenon takes place.
However, this is not the only possible scenario. Let us suppose that the bank attributes a probability equal to 2/3 to the fact that the entrepreneur belongs to the T type. This implies that, for the bank, the expected clash flow is equal to

$$\frac{2}{3}[0.8 * 100 + 0.2 * 0] + \frac{1}{3}[0.4 * 100 + 0.6 * 0] \cong 66.7 > 65.$$

Now the bank is willing to grant the loan. Which is the lowest value for D that allows the bank to be willing to borrow financial resources to the entrepreneur? The following expression has to be valid:

$$\frac{2}{3} * [0.8 * D + 0.2 * 0] + \frac{1}{3} * [0.4 * D + 0.6 * 0] = 65$$

and, therefore, D=97.5.

In this case, both the T type entrepreneur and the NT type entrepreneur get the funds from the bank and, thus, a greater investment than the one required for the *first best* condition is needed.

Particularly, also the NT entrepreneur is funded, even if he generates a cash flow that is lower to the investment cost. This is another kind of capital market inefficiency caused by the asymmetric information. The bank, being unable to recognize the T type entrepreneur, funds all the entrepreneurs. It is easy to notice that the bank looses money only when the NT entrepreneur is funded. As a matter of fact, he averagely pays back

$$0.4 * 97.5 * 0.6 * 0 = 39$$

while he lends 65. Consequently, the T entrepreneur has to compensate the losses generated by the NT entrepreneur. Indeed, the T entrepreneur averagely pays

$$0.8 * 97.5 + 0.2 * 0 = 78.$$

Therefore, there is an implicit subsidy that goes from the T type to the NT type and that causes such overinvestment.

A crucial role is played by the limited responsibility of the entrepreneur. The NT entrepreneur is glad to lend, even if he knows that his project will generate a cash flow that will be insufficient to pay down the loan, because he does not have to stand the failure cost. When the project fails, he has a null payoff and the bank stands all the loss. But, in case of success, then he has a return equal to 100-97.5=2.5.

By summing up, it can be stated that the asymmetric information about the entrepreneur's features causes an inefficient level of investment in the capital market. The inefficiency can turns both into underinvestment or overinvestment if compared to the *first best* condition.

3.1.2. Moral Hazard And Capital Markets

Pannunzi also analyses the impact of moral hazard on capital markets. The model is mostly similar to the one analysed before. The main difference is the fact that the probability of success does not depend on the intrinsic entrepreneur's features, but on his level of effort.

For simplicity, one can suppose that the entrepreneur has the possibility to choose his effort level. In case of high effort, the probability of success is 0.8; meanwhile, in case of low effort, it is 0.4.

The underlying assumption is that at a higher effort corresponds a higher probability of success. But it is natural to assume that the entrepreneur does not like to exercise an effort and, consequently, has a disutility to work hard on the project. For this reason, it's assumed that, in case of high effort, the entrepreneur has an effort disutility equal to 10; meanwhile, in case of low effort, his disutility is equal to 0.

It can be noticed that, in case of high effort, the expected cash flow is equal to 80. By subtracting the effort disutility, 10, the cash flow becomes 70. Therefore, the resources generated with an high effort are greater than the investment cost, 65. Instead, if the entrepreneur chooses to apply a low effort, the expected cash flow is equal to 40 and, therefore, it is minor than the project cost. Thus, the bank is willing to fund the project only when the entrepreneur chooses a high effort. But the crucial assumption is that the actions taken by the entrepreneur are not observable by the bank (*moral hazard*). Hence, the funding contract has to induce the entrepreneur to choose the high effort.

The contract has the same features of the one analysed before: in case of project failure, the entrepreneur does not pay back the bank (limited responsibility); meanwhile, in case of success, the entrepreneur pays back D (≤ 100).

First, the values of D for which the entrepreneur is incentivised to provide a high effort have to be established. The condition is called *compatibility constraint* and it can be summed up as it follows:

$$0.8 * (100 - D) - 10 \geq 0.4 * (100 - D).$$

Thus, $D \leq 75$.

The condition has a simple interpretation: in order to preserve the entrepreneur's incentives to provide a high effort, the entrepreneur has to obtain at least 25 (100-25) in case of success.

If the condition $D \leq 75$ is satisfied and, hence, if the entrepreneur provides a high effort, the bank will be willing to fund the project only if it has no losses in the expected value, that is only if $0.8 * D \geq 65$. This condition is called bank's participation constraint.

Let us take the greatest value of D compatible with the participation constraint, that is D=75. It is easy to see that $0.8 * 65 = 60 < 65$ and, thus, in this example the two constraints (of incentives compatibility and of participation) are incompatible. This means that the entrepreneur will not be funded.

It is important to understand the reason why the entrepreneur does not get the fund. As the bank is not willing to borrow for D=75, the most obvious solution seems to be to increase D. For instance, it is easy to monitor that if D was equal to 81.25, we would have $0.8 * 81.25 = 65$. Why does not the entrepreneur propose this contract to the bank? Because if D=81.25, then the entrepreneur would choose the low effort and thus the probability of success would be 0.4. Therefore, the bank would expect to get $0.4 * 81.25 = 32.50$ and it would be not willing to grant the loan to the entrepreneur. Indeed, the credit rationing is created: an increase in the credit price does not manage to balance the market.

It is worthy to return on this result once again. Why does not the entrepreneur get the credit even if, in case of high effort, the generated cash flow exceeds the costs? The problem is that not all the generated cash flow can be payed by the bank. A part of it has to be promised to the entrepreneur in order to preserve the incentives to provide a high effort. More precisely, the entrepreneur has to get 25 in case of success and, thus, in expected values, he has to get $0.8 * 25 + 0.2 * 0 = 20$. The expected cash flow generated in case of high effort is $0.8 * 100 + 0.2 * 0 = 80$. By subtracting the amount (20) that has to be given to the entrepreneur, the bank would get 60 and we know that this amount is not enough to pay down the loan of 65.

Until now, we have assumed that the entrepreneur does not own other financial resources. If one now supposes that he owns some financial resources equal to 5, he has to lend only 65-5=60. In this case, the entrepreneur gets the fund

because the amount that he can promise to the bank (the *pledgeable income*), that is 60, is exactly equal to the loan he needs.

In other words, two entrepreneurs willing to fund a project similar to the one described can be taken into account. The only difference between the two is that one of them has financial resources equal to 5 and the other has no financial resources. Therefore, the first one will be funded, meanwhile the second will not get the fund.

More generally, no entrepreneur can promise to pay down more than 60, nevertheless the expected cash flow is equal to 80. The difference, 20, is the price needed to solve the moral hazard problem and it is what generates the credit rationing.

3.2. Why High-Tech Funding Is Different From All The Other Fundings?

Innovation, intended as the creation of new ideas followed by their economic exploitation, is one of the main drivers of the economic growth.

Anyway, also firms, especially the ones operating in the high-tech industry, take advantage from innovation, as it constitutes an important competitive advantage in the market.

Thus, any obstacle to the technological evolution and to the enterprises' development is considered a missed chance to grow. However, it is widely known that the ability of innovation of an economic system is not only affected by its entrepreneurial skills, but also by the possibility to find adequate financing sources for new innovative projects. Several empirical studies demonstrated that the relation between high-tech firms and traditional financiers is very problematic. As a matter of fact, availability and cost of funds essentials to innovative processes are considered to be the main constraints to innovation.

The reasons behind the difficulty to find adequate funds are mostly related to the features owned by high tech firms that introduce new production methods (process innovation) or generate new products for final consumers or intermediate markets (product innovation).

If one takes into account the hierarchy of financing identified in the first chapter with the pecking order theory, it can be observed that in this context it is impossible to resort to the self-financing during the initial phases of innovative firms. As a matter of fact, these firms are not able to generate the cash flows needed to fulfil the payment duties.

As far as it concerns the external sources, instead, it can be proved that the evaluation of project by investors/financiers is characterised by an uncertainty level that is higher than the one owned by all the other enterprises that operate in traditional sectors and this causes screening activity carried out by outsiders to be particularly complex.

The reasons why it happens are:

- high technological uncertainty: researchers who work on innovative projects never have the certainty about the success and/or about the time-to-market of their invention;
- the firm is young and therefore its information problem cannot be consolidated by a track record. Consequently, it is hard to recognize the firm's quality and to distinguish between the good investments and the less profitable ones. This is the case of *lemon markets.* A solution to the asymmetric information problem could be to transmit all the information about the innovative project to the financier. However, by doing so, the entrepreneur looses his competitive advantage, as the transparency between insiders and outsiders determines a reduction in the projects' value;
- high competitive instability: it is not known whether the main concurrences will be firms belonging to the same industry;
- high investment costs and low variable costs: many high tech products need a high initial investment in order to develop the first units, but costs suddenly decrease once the production is launched;
- small life-cycle: most tech products need to be constantly up to date;
- difficulty to raise funds for high-risk projects.
- high-tech firms are not able to provide implicit and explicit warranties in order to lessen the creditor's risk: the implicit warranties are absent because, in the initial phases, firms are not able to generate positive net cash flows that could be used in order to pay the debt; meanwhile, the

explicit warranties are absent because these firms mostly own activities that are intangible and/or so *firm specific* that the risk of a potential financier is increased. As a matter of fact, the intangibleness of the assets and the specific knowledge limit the debt funding because of the absence of collaterals that could lessen bankruptcy costs faced by creditors.

In order to further analyse the critical aspects that characterise the financing of such enterprises, the economic value of the entrepreneurial initiative has to be studied. More specifically, risks related to an innovative project are distinguished between economical and financial risks.

Economical risks are:

- *Technological risks*, related to the probability of failure of the innovative process/product;
- *Temporal risks*, concerning the possibility of the innovation to be obsolete in the same time in which it is completed;
- *Market risks*, linked to the possibility of the innovation to fail once it enters the market;
- *Growth risks* that are the efficiencies and profitabilities of the management in presence of an increasing number of activities.

The financial risks, instead, take place once even one of the economical risks occurs. The consequence of this kind of risks is the difficulty to quantify, as the projects are hardly predictable and have a high variability.

A survey carried out by the Community Innovation Survey points out that, because of the examined problems, almost the 70% of the innovative firms states that an innovative project has been delayed, abandoned or renounced and more than a third of them faced financial difficulties. The same problem has been faced by the 40% of non-innovative firms.

As far as it concerns the information asymmetries, it is certain that estimating the value and the risk is a hard task for the potential financier, as the history and the balance sheet of the firm can rarely help. Even if the business plan could be useful in order to evaluate the expected dynamic of the firm's management, several difficulties may have to be faced because:

- The financier is not able to evaluate the adequacy of the hypothesis adopted for the Business Plan's drafting. This could lead to *moral hazard* phenomena. As a matter of fact, in this situation the manager could be tempted to increase the risk level of the project once he gets the new financial resources;
- The firm could decide not to spread detailed information regarding the future development plans.

Innovation, especially the technological one, is not a sporadic event, but it is a continuous process, as it represents a relevant resource of competitive advantage that is able to determine a reduction in the cost of a product or a differentiation in the products provided by the firm.

In the high-tech industry, such innovation has to result from the combination of both the incremental innovations and the radical ones. The former comes from tiny changes to the technology of the products/processes made in order to improve them; the latter comes from knowledge development that give often birth to new scientific principles by demolishing existing markets.

A very strong means able to promote the innovation in firms is the technological transfer that is represented by all the activities that evaluate, protect and commercialise technologies developed in projects carried out by Universities or Research Centres.

In particular, the technological transfer includes:

- the identification of new technologies and their industrial application;
- the protection of such technologies through the baking of patents, brands, models, designs and copyrights;
- the definition and the implementation of an effective strategy of marketing and the promotion of the results coming from the research;
- the technology transfer and the licensing to existing firms or the creation of new firms based on the same technology.

Such activities allow scientific centres and Universities to play a main role in the support of the industrial competitiveness through the knowledge's diffusion and promotion.

Moreover, the promotion process and the transfer of the technological and scientific results plays a main role in the economic development because it allows the transition from a manufactory system to the knowledge-based economy.

4. OVERVIEW OF THE HIGH-TECH INDUSTRY

In the context of economic globalisation, technology is a key factor in enhancing growth and competitiveness in business. High-tech industries are expanding most strongly in international trade and their dynamism helps to improve performance in other sectors.

Research, development, science and technology have been acknowledged as factors of growing competitiveness, better and better-paid jobs, greater social cohesion and a smart, sustainable and inclusive economy.

However, such phenomenon of expansion is not uniform, as United States remains the high-tech leader. In the next sections, an overview of the European and American high-tech industry will be provided. Finally, the reasons why a divergence between the two continents exists will be hypothesised.

4.1. The European industry in numbers

The European Union had almost 46 000 enterprises in high-tech manufacturing in 2014 (see Table 1), which represent 0.2 % of the total number of enterprises in the EU. Four countries — Germany, the United Kingdom (UK), Italy and Poland — together account for around 53 % of the high-tech sector in the EU-28. The UK has the most enterprises in the high-tech knowledge-intensive services sector (180 257 enterprises), followed by France (141 647) and Germany (112 570).

Research and development (R&D) spending in high-tech sectors by EU-28 businesses increased by an average of 4 % per year in 2005-2014, reaching

EUR 182 billion in 2014. Germany, France and the UK together accounted for more than half of all EU high-tech R&D spending in 2014. Germany had the highest spending in the high-tech manufacturing sector in 2013, at almost EUR 11.5 billion or 20 % of its total R&D expenditure.

Latest data coming from Eurostat clearly describe the overall employment situation Europe faced until 2015.

In 2015, 33.9 million people were employed in the manufacturing sector, a figure that represented 15.4 % of total employment. Of these, 2.4 million were employed in high-tech manufacturing, corresponding to 1.1 % of total employment. About three times as many were employed in high-tech knowledge intensive services, which accounted for 2.9 % of total employment.

As far as it concerns the high-tech sectors, figure 7 shows the evolution of the sold production of high-tech goods from 2007 to 2015 by type of product. There was a notable decrease in this period for electronics-telecommunications. The shares of scientific instruments and pharmacy grew by 4 % and 8 % respectively. In aerospace, non-electrical machinery and chemistry total sold production also increased between 2007 and 2015 while in electrical machinery and computer office machines total sold production decreased. Finally in armament sold production hardly changed.

	High-tech manufacturing				High-tech knowledge intensive services			
	Number of enterprises	Production value EUR million	Value added EUR million	Gross investment in tangible goods EUR million	Number of enterprises	Production value EUR million	Value added EUR million	Gross investment in tangible goods EUR million
EU	46.097 p	470.349 p	:	18.107 p	:	:	:	:
BE	566	18.553	7.527	830	28.617	33.931	14.709	3.234
B	414	:	:	:	9.919	3.571	1.863	389
CZ	3.339	11.695	1.735	335	31.561	11.127	5.122	601
DK	648	15.787	7.580	600	15.115	18.406	9.836	991
DE	8.827	110.528	42.906	4.281	112.570	180.334	109.54	12.193
EE	128	1.836	170	30	3.875	1.473	711	108
IE	:	:	:	:	:	:	:	:
EL	295	1.378	552	122	12.106	5.555	3.019	545
ES	2.668	16.234	6.230	598	50.116	53.443	30.047	2.497
FR	3.178	60.668	19.614	1.869	141.647	160.988	69.412	8.957
HR	544	1.051	447	94	5.383	2.919	1.452	199
IT	5.453	42.884	13.962	1.578	100.384	99.232	44.370	4.864
CY	:	:	:	:	866	1.030	560	151
LV	171	:	:	:	5.294	1.424	696	122
LT	168	358	138	21	4.803	1.410	795	130
LU	10	:	:	:	2.009	:	:	:
HU	1.525	12.036	2.784	438	35.154	7.432	4.027	707
MT	36	:	:	:	:	:	:	:
NL	1.813	33.772	5.023	:	84.213	51.622	25.412	3.519
AT	688	8.818	3.902	582	18.321	14.468	8.887	1.038
PL	3.461	11.700	2.387	390	73.280	22.894	11.129	1.618
PT	468	2.338	711	116	14.726	10.101	4.594	1.162
R	990	2.388	748	191	17.284	8.637	4.088	1.075
SI	347	2.331	981	228	8.543	2.657	1.243	206
SK	796	5.971	687	123	14.084	4.721	2.254	428
FI	600	11.002	2.735	234	9.223	15.102	7.382	1.299
SE	:	:	:	:	54.120	40.779	17.451	2.215
UK	6.504	37.599	16.608	1.380	180.257	237.656	120.33	15.021

Table 1. Economic statistics on high-tech sectors in 2014.[1]

[1] *Source:* Eurostat, http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=htec_eco_ent2&lang=en

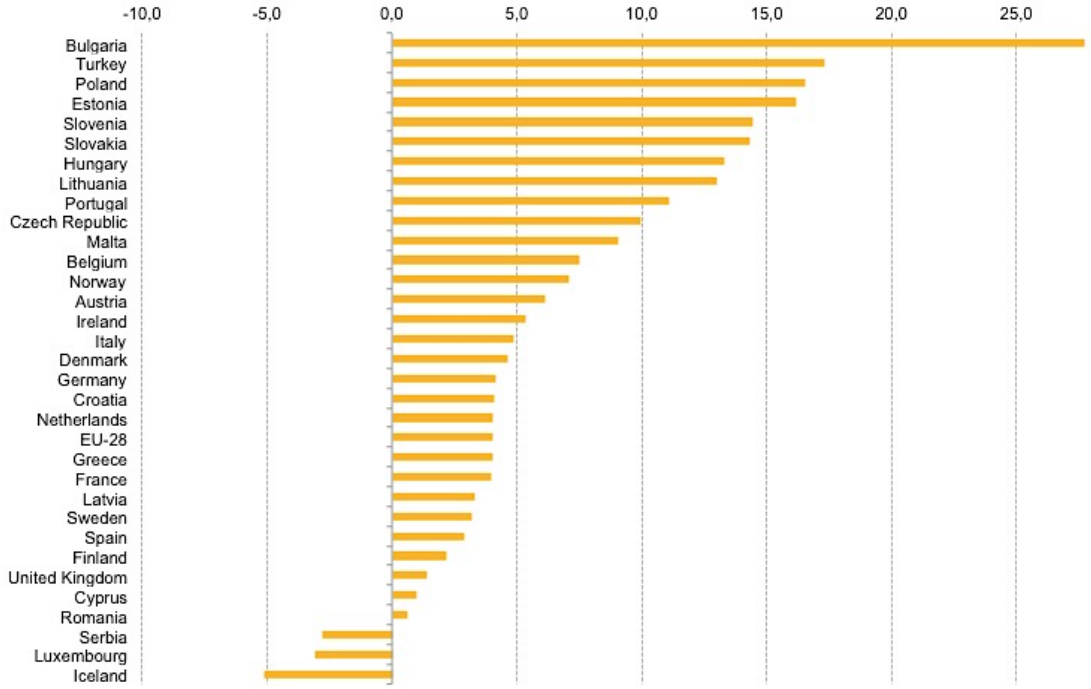

Figure 6. Average annual growth rate of R&D expenditure in business enterprises, 2005-2014.[2]

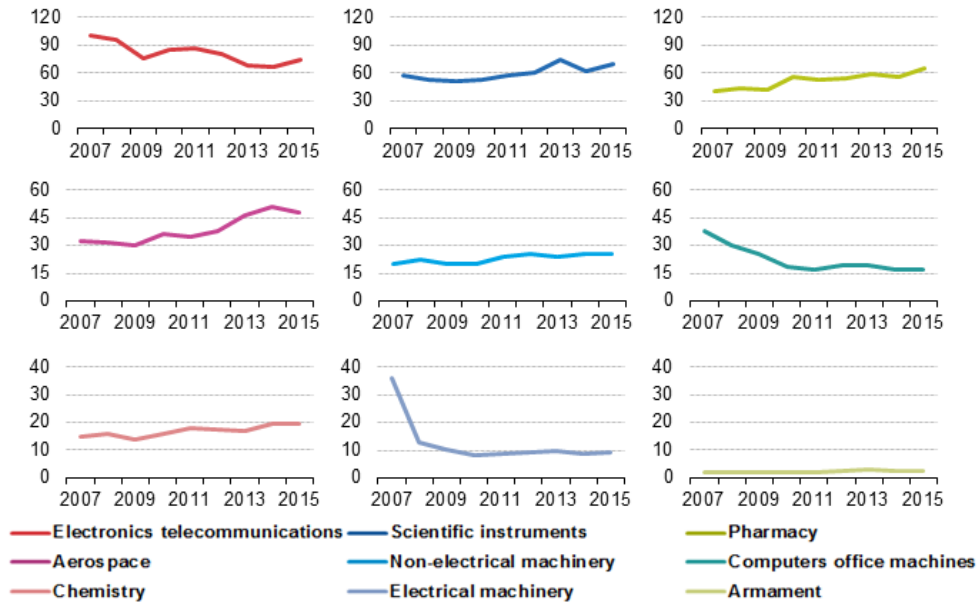

Figure 7. Total sold production of high-tech products by sector, EU-28, 2007-2015 (billion EUR)[3]

[2] Source*:* Eurostat
[3] Source: Eurostat (Prodcom database DS-045339)

4.1.1. A glance at Italy

According to the Osservatorio Startup Hi-tech promoted by the School of Management of the Polytechnic of Milan, in collaboration with Italia Startup, in 2017 investments in high-tech start-ups increased by 20% from 2016, by reaching EUR 261 million.

As far as it concerns the choices regarding the localisation of the firm, some decided to be settled in the North because of the presence of a valid support system for start-ups and the proximity to qualified personnel; others decided to be settled in the South and in the Islands because of the possibility to take advantage from public incentives and market sizes.

Hence, the start up ecosystem is going through a positive development, even though a comparison cannot be made with more mature contexts where more financial resources are available, like U.S., United Kingdom, Israel, France and Germany.

4.2. The U.S.A. industry in numbers

High-tech industries are an important part of the U.S. economy, employing nearly 17 million workers in 2014. While this accounted for about 12% of total employment, the high-tech sector contributed almost 23% of output. According to a study funded by the Workforce Information Council, the high-tech sector can be defined as industries having high concentrations of workers in STEM (Science, Technology, Engineering, and Mathematics) occupations. Although the term high-tech has been notoriously difficult to define, as technology changes all the time, this analysis provides an approach to defining jobs that are in in this sector.

Table 2 contains a list of the 33 industries identified as high-tech industries for this analysis. Sixteen are manufacturing industries, which are classified as high-tech because of the large concentration of engineers working in them. Twelve are services industries, which tend to have higher concentrations of scientists and computer and mathematical occupations.

High-tech industries accounted for 16.9 million jobs in 2014, or 12.0% of total employment. From 1994 to 2024, the share of employment in high-tech industries has stayed within a narrow range of 11.3% to 12.% . Notable during this period was the impact of the two recessions, the dot-com bubble recession of 2001, and the Great Recession of 2007–09.

High-tech employment fell from 12.1% of all jobs in 2001 to 11.3% in 2004, a decline of 1.1 million jobs, as the high-tech sector was harder hit by the bursting of the dot-com bubble and its aftermath than other sectors of the economy. Non-high-tech industries lost 689,000 jobs between 2001 and 2002, but recovered the lost jobs by 2004. During the Great Recession, however, the opposite trends played out: the high-tech sector share of total employment grew from 11.4% in 2007 to 12.0% in 2010 as that sector lost just 64,000 jobs while the rest of the economy lost 7.6 million jobs.

Industry title	2014 Employment (in thousands)	2014 Output (in billions)
Commercial and service industry machinery manufacturing	87.5	29.9
Engine, turbine, and power transmission equipment	102.9	52.0
Other general purpose machinery	264.7	109.8
Computer and peripheral equipment manufacturing	162.8	62.6
Communications equipment	93.5	60.0
Audio and video equipment	18.9	7.0
Semiconductor and other electronic component	367.8	123.0
Navigational, measuring, electromedical, and control instruments	388.3	158.4
Manufacturing and reproducing magnetic	18.9	6.1
Electrical equipment	143.7	39.9

manufacturing		
Aerospace product and parts	488.4	258.0
High tech services industries		
Pipeline transportation	47	30.4
Software publishers	312.5	192.4
Wired telecommunications carriers	607	390.4
Wireless telecommunications carriers (except satellite)	155.3	245.1
Satellite, telecommunications resellers	93.5	41.9
Data processing, hosting, and related services	279.4	133.3
Other information services	217.8	76.4
Architectural, engineering	1,380.40	322.8
Computer systems design	1,777.70	351.5
Management, scientific, and technical consulting services	1,244.40	214.2
Scientific research and development services	634.7	239.6
Management of companies and enterprises	2,169.40	574.9
Other high tech industries		
Forestry	15.8	6.9
Oil and gas extraction	197.9	410.4
Electric power generation, transmission and distribution	392.1	291.3
State government education	2,409.20	147.0
Federal government	2,136	1,062.0

Table 2. The list of the 33 industries identified as high-tech industries for this analysis

In terms of output, high-tech industries contributed $7.1 trillion in 2014, accounting for 22.8% of total output, down slightly from an all-time high of 23.3% in 2011. The high-tech share of output remained relatively constant between 20% and 21% from 1994–2006, aside from a slight increase right before the dot-com recession of 2001. However, the high-tech share of output has been at a higher level since the Great Recession, remaining close to 23% since 2010.

From 2014 to 2024, the high-tech sector is projected to gain 691,000 jobs as it grows at a slightly lower than average rate, resulting in an 11.7% share of total employment in 2024. Output is projected to grow by $2.4 trillion, in line with the overall economy, as the high-tech sector maintains its share of output at 22.9%.

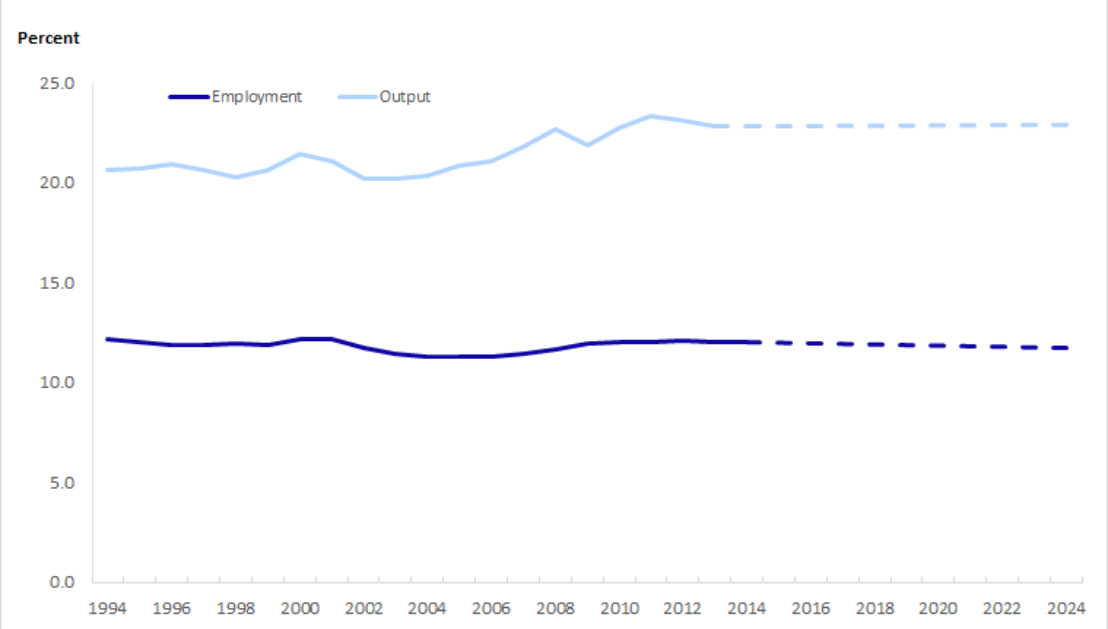

Figure 8. Annual share of high-tech industry employment and output, 1994 – 2004 and 2014 - 24 projected.[4]

4.3. Why Europe is a step backwards from USA?

European firms are still technological leaders in some sectors – such as mobile telephony – and share leadership in industries such as aerospace and

[4] Source: Bureau of Labor Statistics.

pharmaceuticals. But the EU's record in producing fast-growing high-tech businesses is poor, certainly compared with the US, but also increasingly with Asia.

There are plenty of small high-tech European firms. The problem is that very few of these small companies grow into big businesses. One explanation is the lack of venture capital.

However, the fragmentation of EU markets, combined with still insufficient levels of competition in some sectors and under-investment in human capital, are further reasons for Europe's poor record of producing large, high-tech businesses.

The Commission's approach to competition policy has traditionally been more mechanistic or formalistic than that of its US counterparts. For example, if a proposed merger between two firms would give the combined company a dominant market position, the Commission would decide against it on competition grounds. It has placed little emphasis on analyzing whether the proposed tie-up could be beneficial to consumers by, for example, allowing the merged company to exploit greater economies of scale or other synergies. It simply deduced that a position of market dominance must lead to less competition and hence anti-competitive behaviour. By contrast, the US authorities have always been more reluctant to intervene against dominant firms for fear of undermining innovation, and more trustful of the markets to punish anti-competitive behaviour. They have tended to believe that if a dominant firm exploits its position by overcharging its customers, other firms will enter the market in search of a share of its 'excess' profits.

In addition, The EU economy was much less integrated than the US one, and firms therefore found it harder to enter new markets in the EU.

Because markets were generally less competitive and more fragmented than in the US, there was less chance that anti-competitive behaviour by firms would quickly be challenged by new competitors entering the market.

However, EU competition policy has undergone significant reform in recent years, with the Commission modernising merger policy and reforming its interpretation of article 81 of the EC treaty, which deals with cartels and restrictive vertical agreements. This modernisation was the Commission's response to several developments: empirical work on what makes a market

competitive; a number of European Court of Justice rulings against the Commission; and the gradual liberalisation of many sectors across the EU, which has increased the likelihood that the market would punish anticompetitive behaviour.

The ICT and pharmaceuticals sectors are crucial to Europe's economic growth prospects. It is of pivotal importance that the right environment exists for investment in these technologies. Both are fast-growing, R&D-intensive industries, in which innovation can lead to huge new markets and rapid productivity growth. The development and efficient use of ICT and the growth of successful firms in this sector would do much to help Europe close the gap in productivity with the US. While the diffusion of ICT across the EU has accelerated in recent years, EU spending on ICT-related R&D is running at a little over a third of US levels.2 In 1990, the global research-based pharmaceutical industry still invested roughly 30 per cent more in Europe than in the US. Today it invests roughly 50 per cent more in the US than in Europe.

In conclusion, in order to solve such discrepancy, the rules of competition policy should apply to high-tech sectors, just as they do to all others. But EU competition policy needs to take into account the special characteristics of high-tech industries as well as the regulatory environments in which firm operate when deciding whether to take action against them for pursuing allegedly anti-competitive practices. The presence of a dominant company does not necessarily point to an uncompetitive market.

5. INTELLECTUAL PROPERTY: OPPORTUNITY AND DANGER

The protection of intellectual property is an essential feature that effectively characterises the results of the research carried out by high tech firms, Universities and Research Centres.

The term Intellectual Property refers to the legal principles that protect intangible assets born from the human inventiveness.

Basing on such principles, creators and inventors deserve the exclusivity on the employment of their creations/inventions. As a matter of fact, they are provided with legal instruments that protect them from any abuse coming from non-authorised subjects.

Therefore, the intellectual property has a significant impact on the total wealth of a firm, even though the economic benefit coming from such knowledge cannot been seen in the balance sheets.

In order to understand how valuable the IP has become, it is sufficient to notice that the market-to-book ratio of American firms increased from 1 in the 1970 to 6 in the 2000. This was due to the increasing importance of IP in the total wealth of the firm and its capability to generate profit in the short term.

Thus, IP is a valuable asset that, in turn, can generate value in different ways:

- it can create profits by licensing, selling or commercialising some of its assets and/or services. By doing so, the market share and the firm's marginal profits increase;
- if it is managed and communicated in a correct way, IP's portfolios can increase the firm value;
- in case of sale, fusion or acquisition, IP can represent the right award to pay for the transaction.

China is a global leader of the commerce regarding intangible assets and some numbers can easily demonstrate it:

- the State Intellectual Property Office of the People's Republic of Chine (SIPO) received 1.3 million patent applications in 2016 – more than the combined total for the United States Patent and Trademark Office (USPTO; 605, 571), the Japan Patent Office (JPO; 318, 381), the Korean Intellectual Property Office (KIPO; 208, 830) and the European Patent Office (EPO; 159, 358);
- application filed in China increased from just over 210,000 in 2006 to around 1.3 million in 2016;
- China's resident application per unit of GDP increased from 1,455 in 2006 to 6,069 in 2016 – the fastest growth among the top origins.

During our recent years, the growth of patent applications is a worldwide phenomenom. The following picture shows how such growth is affecting the patents top 5 countries.

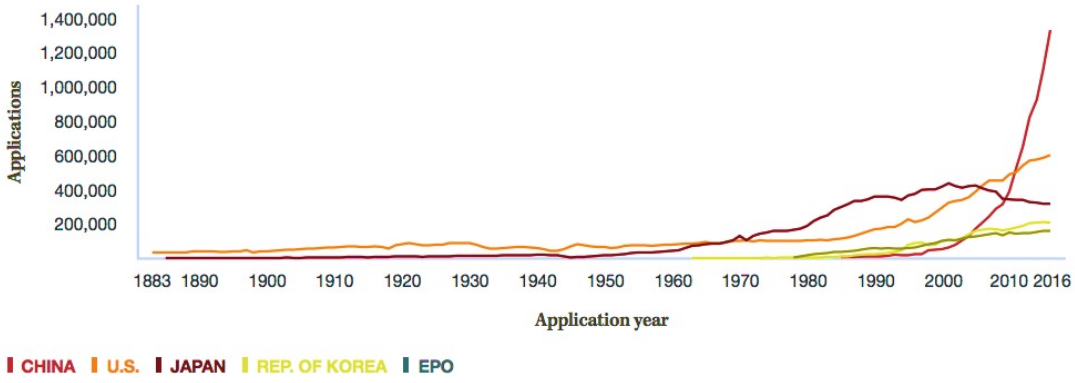

Figure 9. Trend in patent applications for the top five offices.[5]

The importance of Intellectual Property is also evident from the financial loss provoked by its violation and forgery. Therefore, it is important for a firm to protect its know-how and to create competitive barriers also because of the numerous investments needed for the creation of intangible assets.

[5] Source: WIPO Statistics Database, September 2017.

Consequently, firms are willing to incur such costs only if IP can be effectively protected. In this regard, the most important intellectual protections are:

- *brand*, that is the mark of a firm's products and services, that makes the firm distinguished also at an international level. Its protection last 10 years and it can be renewable. The brand represent a critical instrument for the retention of the market share;
- *copyright*, that guarantees to the author the exclusive right to reproduce, to execute, to spread, to distribute and to transform its own work. Thus, the copyright protect the creative works from a plagiarism that would damage the author from an economical and moral point of view;
- *patents*, that are the most important means of intellectual protection. They allow the owner to a temporary monopolism for the commercial exploitation of the invention, that is the exclusive right to realize it, to benefit from it and to commercialize it, as well as to forbid to third parties to produce it, to use it and to commercialise it.

Moreover, an entrepreneur can undertake numerous actions in order to economically exploit its patent, that are:

- the production and sale of a product in exclusivity;
- the grant of licences for the exploitation in exclusivity or in a joint participation in order to get financial resources;
- commissions and consultations linked to the industrial exploitation of the patent with important effects on the research activities;
- the grant of the patent.

All this takes to several advantages, like a facilitation in the technological transfer, an increase of prestige and the achievement of commissions and funds for the innovation sustaining, a stimulating effect for the research and development and the achievement of a dominant position.

However, the negative effects of patents must also be taken into account. First, at present there is no international patent system providing worldwide protection for patentees. Patents must be applied for in each of the different jurisdictions for which protection is desired. Second, patents can be also used as a strategic purpose, provoking the generation of entry barriers for new SMEs. Such issues will be further analysed thereafter.

5.1. Patents For Innovation

From the previous analysis of patents, what easily emerges is the fact that IP is not a tangible asset, namely it does not have a physical embodiment in plants, machinery or inventories, but it is part of the investments in knowledge-based capital (KBC).

Empirical researches extensively demonstrated that such investments have become crucial for the economic growth. As a matter of fact, according to the analysis carried out by Corrado et al. (2013), between 1997 and 2005, KBC may have contributed to around 23% of labour productivity growth in the European Union and 32% in the United States.

In this context, an important role is played by small and medium-sized enterprises (SMEs), especially the ones created with an innovation purpose. Nevertheless, these firms face several difficulties in seeking and raising the capital. Particularly, these difficulties can lead SMEs to underinvest in KBC, provoking a braking of economic growth.

Under these circumstances, IP could facilitate young innovative firms in obtaining a more favourable financing condition and, consequently, in funding their projects. Indeed, IPRs (Intellectual Property Rights) allow firms to stand out to investors, as they reveal the quality of a firm's management and of its technological capabilities and, as they can be economically exploited, they can also raise the expected firm's profitability.

Therefore, the crucial role played by the prospect of accessing new funding cannot be ignored. In a study based on a 2005 survey of the applicants at the European Patenting Office (EPO), De Rassenfosse (2012) demonstrated that 40% of the surveyed SMEs and the 15% of large firms applied for strong "monetary motivations".

5.2. The IP-Backed Finance

While firms have been investing in intellectual capital and applying for or registering IP rights for a long time, IP-based finance has developed only in recent years. Several financial instruments involving IP appear to be

increasingly, especially in the United States and the United Kingdom, although the extent and the features of these developments are not always easy to understand given the lack of comprehensive statistics. Evidence on IP-based finance is mostly drawn from surveys and expert reports or from empirical studies gathering data in innovative ways. Interestingly, this literature shows an increasing interest on the topic, while emphasising that the exploitation of IP-based deals appears to be impeded by a number of factors.

5.2.1. IP And Equity Finance

As stated before, in order to be considered by investors, and in particular by business angels and venture capitalists, high tech firms could resort to an IP or to an IP strategy. As far as it concerns business angels, the protection of the technology and the barriers to entry provided by IP are crucial. Indeed, these investors usually fund the early development stages of firms and such firms are usually very small, so that IP could be the unique asset.
For venture capitalists, instead, the signalling power of patents over different rounds of financing declines. As Hoenen et al. (2014) demonstrated in his study based on 580 US biotechnology firms, the signalling effect can be strong in the first round, whereas it tends to vanish in the second round. This is justified by the fact that, from the second round on, investors are always more familiar with the firm, so that information asymmetries between the parties decrease.

5.2.2. IP And Debt Finance

Such means of financing is mostly used by mature firms that are able to exploit their intangible assets' returns.
The importance of IP can be easily found out in the following three categories of debt finance:

- *mainstream and IP-backed lending*;
- *IP-backed securitisation*;
- *IP sale and lease back*;

5.2.2.1. Mainstream and IP-backed Lending

Through this practice, IP is directly used as collateral in a loan agreement, so that the lender can directly take it in case of insolvency.

The loan amount usually coincides with the 30% of the IP value and depends on several factors, such as the project's quality and the main risk factors.

The characteristics of such financial instrument determine both benefits and problems for the lender and the borrower.

With regard to the lender, the fact that IP is the only collateral leads to some disadvantages that are related to the greater monitoring costs and to the elevated IP's quality uncertainty. A possible solution is to add in such operation a *overcollateralization*, namely a loan that is lower than the collateral's nominal value. By doing so, the lender is more protected from losses and he is more inclined to grant loans at the same time.

As far as it concerns the borrower, instead, such loans are an additional opportunity to collect debt capital; the main benefit, thus, comes from the introduction of a new activity class for the debt financing and for the credit rating. Whereas, the problems deriving from such procedure are mainly related to two difficulties: the evaluation of intangible assets and the collateral settlement in case of failure or insolvency.

Such problems critically influence the development of such financing solutions. They also increase the transaction costs sustained by the financed firm and the communication commitment.

Further than such limitations, this financing instrument can be used by high-tech SMEs and by large companies that own a wide IP portfolio.

Recent evidence suggests that the market for IP-backed loans is increasingly important in the United States and the United Kingdom, and that specialised non-bank institutions dominate the segment (Brassell and King, 2013).

It is difficult to determine the size of the overall market for IP-backed loans, as non-bank institutions are not obliged to public their disclosure.

A study conducted by Loumioti (2011) considers 1,415 US-originated syndicated loans and points out that they grew from 11% in 1996 to 24% in 2005. Such increase, however, needs an economic consideration: lenders, in fact, accurately selected borrowers with a good reputation and more liquid and

intangibles, so that they could as for higher interest rates. Thus, even though such increase is positive for the intangibles-based financing's growth, it also underlines the strictness related to the collateralisation of IP.
In spite of these limits, however, IP can still represent a value for high-tech firms. According to Brassell and King (2013), in fact, IP can mitigate risks even if it is used in connection with other warranties, rather than as stand-alone collateral.

5.2.2.2. IP-Backed Securitisation

The IP-backed securitisation is another financing means belonging to the innovative financial instruments family.
Through this financing means, the IP owner pools and sells future IP-related income streams to a special purpose vehicle (SPV) in exchange for a current lump-sum payment; therefore, the IP owner is not the legal owner of the IP assets.
The patent owner starts the transaction by delivering to an arranger the operation's guidelines. The arranger helps the patent owner to structure the operation by defining the principle variables and by selecting the IP or the IP portfolio to securitise. Advisors, which consist in lawyers and rating agencies, will advice the patent owner for legal and financial issues. They will also provide a credit assessment and allow the operation to start.
Once the procedure starts, all the intangible assets or licensing claims will be given to an SPV. In order to guarantee the effective separation from the given activities and in order to avoid the patent owner's failure to threaten the expected cash flows of the given assets and, therefore, the SPV's activity, the SPV needs to be an independent institution.
The SPV will thus pay the capital and the interests basing on the portfolio cash flows.
IP-backed securitisation often depends on royalties that derive from licensing. However, it is also possible to resort to such instrument by basing on future cash flows deriving from the future income coming from the commercialisation of the patented products.

As far as it concerns benefits and problems related to such financial instrument, from the patent's owner point of view:

- it helps firms to gain more advantageous financing conditions. The strengthening of credit, in fact, allows the firm to obtain a lower cost of capital and a greater flexibility than the ones obtained with the standard bank loans;
- it allows to separate the activity risk from the society risk. Therefore, the collection of funds is based on the IP portfolio's value;
- it provides a direct liquidity, which is more useful than cash flows deriving form assets;
- the patent owner can collect funds without losing the firm's ownership.

As far as it concerns the investors, instead:

- it allows to access structured investments of technological niches, which have an elevated nominal rate and provide a favourable trade-off between risk and yield;
- it allows the IP financing without the need to finance the enterprise in its entirety;
- it eases the diversification.

Disadvantages are related, instead, to emission costs, the amount of stocks that has to be issued in the secondary market, the agreement complexity, the evaluation and the IP exploitation.

This implies that not all the patents owner can take advantages from such financial instrument. As far as it concerns Universities and SMEs with a consistent IP portfolio, the impossibility to resort to such means is due to the elevated costs required for the operation accomplishment. Whereas, large companies are not incentivised to resort it because have numerous financing opportunities thanks to their high level of credit quality.

Hence, in order to promote the development of this market, the role of SPVs becomes essential.

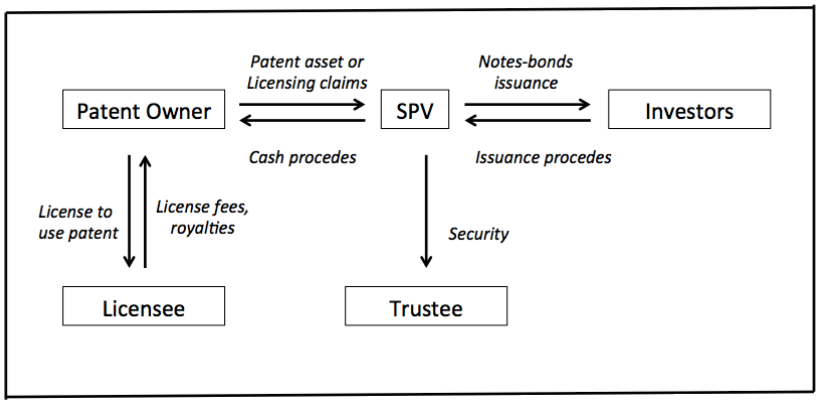

Figure 10. The patent securization process

5.2.2.3. IP sale and lease back

The third IP financing method analysed concerns the purchase of the patent owner's (the lessee) IP assets to a licensing company (the lessor) who has the right to obtain stipulated royalty payments during a given period of time.

Normally, the intermediate holds the IP portfolio until the leasing ends, whereas the entrepreneur can use the repurchase option in order to reobtain them at a defined nominal value.

The only advantage coming from such form of financing is the significant increase of the firm's liquidity through the purchase of intangible assets. Such liquidity can then be used for the current activities of the firm.

However, disadvantages are remarkable:

- the additional incomes coming from the purchase are not deductible from taxes;
- in order to guarantee the transaction safety, an adequate patents' evaluation is needed;
- the failure or insolvency probability related to the firm that has to be financed;
- the infringement of the licensed patents.

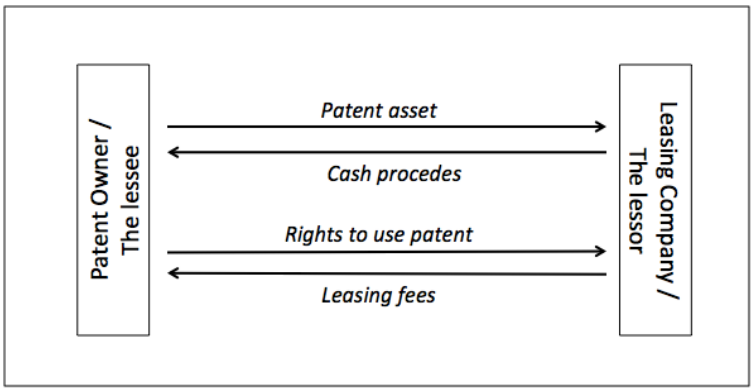

Figure 11. The IP sale and lease back process

5.2.3. Barriers To IP Finance

Even though IP-based finance has a strong potential in the innovation financing, it seems to be underutilised, especially by SMEs that would need it most. The market barriers that are preventing IP-based financing to be established as a common means of financing are several. Particularly, they threaten in a more intensive way equity finance than debt finance. What emerges, however, is that such barriers arise naturally. Therefore, new business practices or policy action cannot entirely remove them, but only mitigate them.

The first barrier IP-based finance has to face is the difficulty of it redeployment. As a matter of fact, IP is usually used in combination with other complementary tangible and intangible assets, like know-hows, dedicated employees, further IP, ext. As the IP cannot be separated from those other assets, in case of financial distress, it might be impossible to dispose it in isolation from the business.

Another IP constraint concerns the fact that IP exit markets are immature. The secondary markets for IP are allegedly too underdeveloped to guarantee a quick and low-cost resale of the asset for the creditor that needs to realise a value from it (Brassell and King, 2013). This results to be the main barrier for banks because they are not able to assess IP risks, as they usually do not are familiar with the business. As a matter of fact, most financial institutions – especially banks – have not developed the necessary methods to streamline the assessment of IP assets. This is easily understandable if one thinks that, in

order to collateralise an IP asset, financial institutions need to understand its function, its relationship with cash flows and its potential value if disposed in isolation from the company.

Moreover, transaction costs for IP as collateral are high. This means that for innovative SMEs the presence of IP cannot only represent a source of value, but also a source of uncertainty related to the expected returns of the firm's projects and to the IP value, which can vary over time.

A further constraint is given by the fact that SMEs do not register enough IP nor manage it well. This is clearly demonstrated by an OECD review of SMSs' management practices, where it is showed that most innovative SMEs do not protect their intellectual assets through IPRs and, even when they do, they do use less practical forms of protection that keeps investors away.

In addition to that, corporate reporting of IP assets and other intangible assets is still insufficient, meaning that financial institutions tend to avoid evaluating IP as collateral. Such inadequate corporate reporting is the results of two factors: the accounting rules' strictness, which do not consider intangible assets in the balance sheet, and the insufficient efforts made in order to declare all the firms' assets outside financial statements.

Finally, another element that causes such market failure is the high level of commissions that intermediaries take on patent deals – often more than 25%.

Apart from the underutilization of innovative financing by SMEs, such barriers to IP finance causes other negative effects that are:

- there is almost the absence of synergy between inventions from different sources or different domains, meaning that the duplication of resources is guaranteed;
- those that invent and those that manufacture and commercialise are rarely optimally divided;
- most patents remain unused because of the difficulty in offering and acquiring them.

5.2.4. Proposed solutions for the IP financing

As the immaturity of IP markets results to be the main barrier for the IP-based finance, several Governments have started to take measures aimed at softening such difficulty. The approaches followed are two: improving transparency and reliability in the market or creating new market infrastructure.

Insufficient information regarding the ownership of IP and its transfers and uncertainty over the legal protection of IP right are found to be significantly spread in IP markets. In reality, uncertainty over patents is closely related to the technological boundaries described in the patent claims, meaning that patents may cover inventions that are not truly original or may not be sufficiently detailed. This is caused by the fact that technological boundaries are often too broad or not detailed enough, causing an increase of the likelihood of overlapping with other patents. Furthermore, the real applications of the invention could result uncertain. In order to avoid it, the promotion of transparency and reliability of patents, as their quality has to be implemented. The US government and the government of Singapore have made outstanding efforts in this direction. The former is seeking to ask to patent owners and applicants to report and update their ownership information; in addition, the USPTO is trying to introduce the crowdsourcing of prior art, namely a way to resort to a system in which every technical field has relevant experts who deal with the knowledge up-to-dating. The latter, instead, is carrying out an extended program in order to make the country a “Global Hub for IP”; its main action concerns the encouragement of IP rights holders to disclose ownership, transfer and licensing information.

The need of creating new IP market infrastructures, instead, comes from the idea that, apparently, IP markets are underused. The patent market proposed by Terroir (2014) is illustrated in the figure 12. Its main characteristics are:

- the market should guarantee transparent and secure trading and licensing of patents to all economic entities;
- the market should be divided in two transparent and secure segment: one for standardised contracts and one for transactions over the counter;

- the segment for standardised contracts should include licensable patents and offer the possibility to trade IP packages after having bundled them;
- prices should be predictable and all processes should be cost effective;
- the market is organised and monitored by a market operator, which offers to both buyers and sellers several services, as informing potential users of the existence of the market, controlling the legal validity of patents and making available the necessary information to match supply and demand around a price.

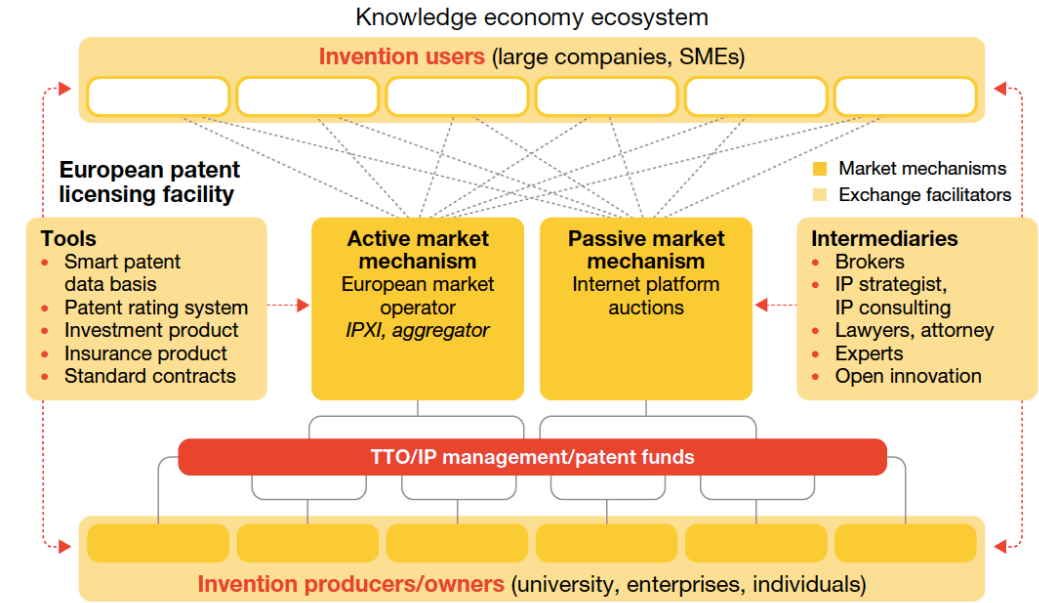

Figure 12. The patent market according to Terroir. [6]

Several governments are becoming aware about such need to operate with a large base of IP assets available for trade from the outset, in fact:

- In the United Kingdom, the online platform Copyright Hub has been sponsored by the government;
- In Denmark, the Danish Patend and Trademark Office created the IP Marketplace, as a platform where IPR holders can freely list their asset;

[6] Source: Terroir, P. (2014), "Rebalancing the patent economy", *Intellectual Asset Management*, March/April 2014 n.71.

- In Chile, SMEs and universities can trade their IP through a dedicated platform created by the National IP Institute.

5.2. Patents as weapons

As discussed above, the main aim of a patent system is to protect ideas, provide information and encourage innovation. However, all that glitters is not gold. In recent years, in fact, firms have started to recognize the power of IPs in the interaction with competitors and in the generation of revenue. This is the reason why now patents are also used for strategic purposes. When these intangible assets are used for profit, rather than protection, patents result to be authentic weapons.

As a result of that, strategies implemented by firms are numerous and have, in some case, become very sophisticated.

The new commercial trend called “Patent Arms Race” defines the process of collecting patents and developing patent portfolios.

It seems clear that, under such circumstances, companies are willing to spend great amounts in the pursuit of more patents.

Firms can acquire patents by exploiting their research and development and, thus, by increasing innovation or by purchasing patents from other companies.

One of the numerous strategic reasons why firms want to increase their patent portfolio lies into the fact that the owner of more patents has more chances to win in case of litigation for patent rights between complementary competitors and he also be facilitated in bargaining if an infringement suit is initiated. In other words, if a company has not got any patent, it has no defence.

In addition to that, companies seem to need more and more patents for the simply fact that they do not want to be in an inferior position compared to their competitors. Therefore, as competitors ask for more and more patents, they are obliged to do the same. Mr Sewell, from Intel, once said: “Would I be happy with 1,000 patents rather than 10,000? Yes, provided the rest of the world did the same thing”.

Unfortunately, what can be used for defensive purposes can also be used to attack with. At this regard, it is important to quote patent pools.

Patent pools were born in the mid 19th century because of litigation for patent infringement between Isaac Singer and Elias Howe, both manufacturers of sewing machines. A patent pool is a consortium of at least two companies agreeing to cross-license patents relating to a particular technology. The creation of such instrument can save patentees and licensees time and money, and, in case of blocking patents, it may also be the only reasonable method for making the invention available to the public.

However, such mechanism can result very harmful for companies outside the pool, including SMEs new to the industry, as it can prevent them from entering the market.

Other patent strategies linked to the concept of patent pools are:

- *patent clustering* consists in creating a group of patents that cover one and the same technology or product. They normally come into existence if a new field of technology is opened up and many improvements are patented thereafter. Such technique is often used by companies trying to impede for competitors to gain a position in the market;
- *patent blocking*: refers to the situation in which a company acquires a patent that it knows a competitor need and then refuses to license it out;
- *patent ambushing* happens when one of the standard setting organization's members keeps vital information from the rest while setting up a new standard;
- *patent fencing* consists in the collection of a series of patents obtained by a patent owner on near substitutes for its patents, thereby blocking follow-on innovators from designing around the initial patent or from obtaining improvement patents that may block the original patent owner from improving on his original patented invention;
- *patent thicket* is an overlapping set of patent rights. Such method is particularly common in the software and pharmaceutical fields. It has been also defined as the means that allows firms to defend against competitors by designing around a single patent;
- *patent blitzkrieging* that occurs when a company quickly amasses patents and then attack other companies with them. By doing this, the instigator relies on the fact that defending a litigation action for

infringement is extremely expensive, and other companies will usually want to avoid it.

The costs involved in the patent system are high, and rise as companies are forced to acquire more and more patents as a result of the patent arms race. It is a concern that this rise in direct costs may adversely affect innovation, by directing capital away from research and development.

The threat of litigation can also adversely effect innovation as companies may be forced to stop the research and development or the manufacturing of a product, because they cannot afford to risk being dragged into a patent infringement suit.

There is also concern that, in an attempt to gain enough patents to compete in the patent arms race, the quality of patents is deteriorating and companies are resorting to ‘cheap patents’. ‘Cheap’ is not a reference to the material costs of acquiring the patent, but is a reference to a lack of intrinsic value towards innovation. The worry here is a lower standard of patenting will produce lower levels of innovation, whereas a high standard of patenting is likely to encourage companies to pursue larger innovations.

It can be said that patent blocking can discourage innovation by preventing the use of technology to improve one’s own.

In complex and technical industries, such as the semiconductor and information technology industries, innovation tends to be cumulative. Companies in these industries need to cross-license in order to innovate.

By using blocking patents, other companies are being prevented from innovating. It is not only blocking patents that can have detrimental effects on innovation. Patent pools can create problems for companies that are not members, and effect innovation because the extent and scope of a patent pool may make it extremely difficult, if not impossible, to create a work-around

Patent non-use also effects innovation. By acquiring patents that they do not need, and do not intend to use, and failing to license them out to competing companies who intend to utilise them, companies are causing innovation to be detrimentally effected.

There is also the matter of the rise of the patent holding companies, derogatorily called *patent troll*.

The perceived danger of patent trolls is that they make money by licensing out the patents that they have acquired, and also by pursuing infringement litigation against other companies. Companies such as these do no research and development and so play no role in innovation but instead can be seen to slow other innovators down by imposing high costs for licenses, and increasing the number of litigation cases filed.

5.3. Benefits Of Allowing The Use Of Patents As Weapons

Although it is a contentious issue, if the growth in patents has increased in line with an increase in research and development spending then this has a positive effect on innovation. Not only does it progress society through the advancement of technology but it also provides platforms off of which other companies can work in the attempt to innovate further.

Benefits, or positive aspects, can even be seen in the most aggressive of the patent strategies that have been discussed. In the event that a competitor makes use of a blocking patent and refuses to grant a license for it, a positive consequence can be argued. Although it can be argued that this practice impinges innovation, it is also possible for the alternative can be claimed, that it can actually promote innovation. It can do this by forcing a competitor to create a work-around of the patent. The publicised information about the patent that needs to be worked-around is available, and this information can help the inventor. By trying to come up with a work-around, although it can be a lengthier and more costly process, could lead to a solution that may in fact be an innovation itself. By forcing a company to look for alternatives to problems that have already been solved, new and previously unconsidered solutions may be found.

One of the main dangers that has been highlighted above, is the use of patents by companies to raise the barriers of entry to an industry, by the creation of often insurmountable obstacles. Although this is a deterrent to start-up

companies it can also have positive consequences for both innovation and competition. These obstacles encourage small companies to take advantage of niche areas of industries, which have been neglected by the larger established firms, in order to gain a foothold in the industry from which to develop.

This may help to ‘fill in the gaps’ in innovation that have been skimmed over by the larger companies in pursuit of larger innovations.

The specific danger posed by patent trolls has already been discussed. However, even these companies can produce benefits for the patent system, and other companies. There is the advantage, that small firms that have managed to acquire a patent can enlist the experience, knowledge and financial capabilities of such a company, to enable it to generate revenue through licensing, and enforce the patent if needs be. As this small company may not have the experience and resources to do these things itself, it has the effect of balancing out the levels of power between small and large companies. The additional revenue that this company will gain through the aid of the patent holding company will help to make it more innovative and competitive.

6. THE ANSWER BY THE FINANCIAL INSTITUTIONS

As previously discuss, innovative firms bear agency costs that are greater than the ones sustained by traditional firms. This is, above all, due to the characteristics of their financial needs, that are size, risk level and information asymmetry. Such features vary along the life cycle of high-tech firms. In connection with this, in the 1996, the Bank of England divided such life cycle into four phases that are *seed*, *start up*, *early growth* and *sustained growth*.

The seed phase represents the embryonic stage of the high-tech firm: here the innovative idea is conceived. The entrepreneur often conceives the idea by operating into groups of research, but he can also conceive it thanks to his autonomous work. In this stage, the risk is elevated and it is due to the uncertainty linked to the project. Meanwhile, the financial needs are limited, as the entrepreneur only has to implement the project's studies of feasibility.

During the second stage (start up), the conceived idea has to be prototyped and proposed to the market. Here the main activities consist in the realization of prototype and in a detailed market study. This phase is the most complex one, as here the probability for the project to fail is at its highest level. Therefore, the financial needs are so elevated that the entrepreneur is obliged to resort to the external financing.

In the early growth and sustained growth stages, instead, the project starts to be spread out in order to reach its natural size. Such phases are exposed to inferior risk levels. Meanwhile, above all in the first of the two phases, enormous funds are needed in order to accomplish the commercial expansion associated to the distribution and commercialization of the innovative project.

By summing up, during the start up and the early growth stages, the entrepreneur will need the biggest amount of financing.

The financial system, thus, has the crucial role of supporting innovation born by technology-based ventures. In doing so, it has also the duty to find new mechanisms to support new industrial sectors, which may not yet exist but can be highly valuable in the future.

The peculiar features of innovative firms justify the distinctions among the different source of funding and underline the presence of a hierarchy in the resorting to the external financing.

Particularly, in relation to the nature (public or private) of the information at the basis of the relationship between entrepreneur and financer, a distinction can be made between internal financing (or *informed capital*) and external financing (or *arm's length*). The first category is composed of equity capital, venture capital and business angels financing and debt securities issued by banks. The second category, instead, includes all the financial instruments linked to shares and bonds that usually are exchanged in the open market.

Each financing source finds its best application in a different stage of the firm's life cycle. More precisely, it can be observed that in the seed stage, entrepreneurs resort to two different informal forms of financing that are:

- *insider finance*, that consists in the employment of the entrepreneur's capital and/or the capital of his relatives (without the intervention of intermediates) and individuals directly linked to him. If the innovative firm has a small size, the entrepreneur can also guarantee his own assets as collateral. According to Näkkäläjärvi, Sasi and Gabrielsson (2006), often the first months' financing are also supported by the so-called "*sweat capital*". It means that owners and management team work for the firm without getting any salary. ;
- *angel finance,* that consists in all the funds emitted by business angels who can also sustain the next stage (start up).

Moreover, it is also possible to resort to some public financing facilities that are particularly suitable for small companies. Among such kinds of financing, the most famous in Europe are the Innovation and Technology Equity Capital (I-TEC) and the Linking Innovation, Finance and Technology (LIFT). Meanwhile, in America, the most outstanding ones are the Small Business Innovation Research (SBIR) and the Small Business Investment Company (SBIC).

With the growing of the firm (start up and early growth stages), insider finance is often limited. High technology firms typically have high R&D costs in the development phase and practically no incoming cash flows.

Under such conditions, firms are obliged to find their adequate means of financing. This is the reason why, during these stages, the entrepreneur addresses to the private equity market. In particular, he prefers to resort to funds emitted by venture capitalists than to resort to the bank debt. This demonstrates that, even if the financing sources are hierarchally sorted, the traditional order is completely reversed, as the risk capital is preferred to the debt capital. As a matter of fact, innovative firms can resort to the bank debt only once they already obtained the venture capital fund that is used as information producer. In order to obtain an optimal innovation funding, another efficient and transparent market has to rise in connection with the one regarding the venture capital, that is the so-called *Securities Market*. Such share market facilitates the disinvestment of the capital that can be used to fund new initiatives.

Therefore, in the early growth stage, it would be recommendable to resort to the venture capital, to the bank or commercial credit and, finally, to the auto-financing. The latter can be carried out through the reinvestment of incomes obtained by the new project's success.

Finally, when the firm has already reached a certain size and notability, its financial needs start to be more similar to the ones characterising traditional firms. In the last stage, therefore, the peculiar events are quotation and direct issuing of bonds.

However, the illustrated hierarchy is not rigid, as nowadays the resorting to the bank credit and access to securities markets is becoming more common also during the first phases. This is due to a greater preparation of the credit institutions on issues concerning young firms.

Therefore, it can be stated that there is no sequencing rule among the different financing sources. As a matter of fact, the complementarity among some of them (venture capitalists, business angels and crowdfunding) and the substitutability of others is becoming always more evident.

In the following chapters, a deeper analysis of the different financing sources will be provided.

6.1. The private equity

The first possible solution to the problem of innovation financing can be found into the private equity.

All private equity funds are organized as limited partnerships, with private equity firms serving as general partners (GPs) of the funds, and large institutional investors and wealthy individuals providing the bulk of the capital as limited partners (LPs). These limited partnerships typically last for ten years.

In other words, private equity consists in private investment firms or funds that invest their risk capital into the innovative firms, with the aim to achieve earnings in the medium – long run. More specifically, the term "private equity" refers to all the operations realised during advanced stages of the development of the firm and it comprehends:

- financing of the development aimed to support the firms' growth;
- financing of change, that is:
    - *replacement capital*, that are closed-end fund and other specialised institutions whose target is the substitution of a part of the shares that are no more involved in the firm's activity;
    - *leveraged/management buyout*: the financer endorses the firm in peculiar situations, like the management turn over by frequently using the leverage as acquisition means;
    - *turnaround*: the financer helps firms that are facing a crisis by renovating them through the introduction of his capital and his specific professional knowledge.

The private equity market is divided into:

- *organised private equity market*;
- *informal private equity market*.

The former market is represented by all the shares investments in public and private firms, including the venture capital firms. The latter, instead, consists of the angel finances and the informal financing carried out by entrepreneur's relatives. Its main features are the greater number of investors in every society, the minor minimum investment and the fact that insiders represent the greatest group of shareholders.

6.1.1. The angel finance market

The main figure operating in the angel finance market is the business angel. The entrepreneur addresses to him in the early stages of his innovative firm that are the seed and start up stages. The business angel is a private subject, often ex manager of big companies or an entrepreneur with an elevated liquidity, entrepreneurial and managerial knowledge and a big network of contacts in several industries.

Business angels directly invest through an option contract in firms that are small but have a high growth potential. The only essential condition they establish is the engagement into the business.

These subjects use their own funds. Research and selection of investments occur in an informal way (this is the reason why they are also called “informal venture capitalists”). Therefore, Business Angels

contribute to the business development in a twofold manner, depending upon the intensity of their involvement into the firm:

- *financial Business Angels*, who invest risk capital without being involved into the management of the firm, turning out to be mere financial supporters of the business initiative; in such a case, the Business Angel’s intervention is aimed at supplying the necessary funds to guarantee the business advancement without interfering with its management;
- *industrial Business Angels*, who, in addition to their financial contribution to the firm, actively join the management of the firm by making available their intangible resources: know-how, managerial experience and competences for achieving a successful development of the business. In this circumstance, the Business Angels’ involvement is even more explicit by holding the office in some business function such as Finance, Accounting and Control, Marketing etc.

Particularly, the investment choice is often motivated not only by the business potential of the idea, but also and above all by the quality of the personal relationship established with the entrepreneur.

One angel is often enough for a small company, so that information production challenges are minimised. However, in some cases, more business angels are

needed. They, indeed, can also operate as a small group in order to fund bigger investments.

The main advantages related to the recourse of such informal investors are the following:

- the average amount (€ 50,000 to € 500,000) invested into the firm is usually lower than the funds a venture capitalist supplies and thus, more suitable for innovative SMEs;
- the financial involvement of the Business Angel is at the very beginning of the firm life-cycle, in its phase of lunch or development, always more often overlooked by traditional financial operators;
- are deemed value-added investors, inasmuch they supply financial resources, technical and managerial competences;
- carry out a leverage effect, making the firm more attractive in comparison with the traditional financial channels;
- finance high-innovative business, characterised by significant uncertainty and instability, which the banking industry may be reluctant to financially support.

Another feature of angel financing includes the fact that business angels often invest into local firms where they have more knowledge.

The investment usually lasts few years. As a matter of fact, the target of the business angel is to find, after three or four years, a new subject to whom he can sell the project. By doing so, both business angels and innovative firms obtain liquidity that, for the latters, can be used to launch their ideas on the market.

Compared to the venture capitalists, business angels exercise a minor control on the firm and provide a minor added value into the management support.

6.1.2. The venture capital

Venture Capital (VC) is a professional activity based on investments in innovative firms characterised by high potentials of growth and risk.

Compared to the Business Angels, the venture capitalist works as a real financial mediator. As a matter of fact, he gathers funds coming from a group of investors. Specifically, such group of investors can be divided in:

- Limited Partners (LP): they provide almost the entirety of the capital needed. These investors are usually large financial institutions (i.e. pension funds, banks, insurance companies, funds of funds), family offices or public institutions;
- General Partners (GP): they provide a marginal share of a funds' capital. However, they are responsible of the funds' decisions together with their management team. Generally, GPs own a VC firm, often managing several funds at once.

Once venture capitalists obtain the needed fund, they reinvest them in the capital of innovative firms. This is the reason why VC is considered a hybrid financing means: it presents features belonging both to the investments of risk capital and debt capital.

A VC fund is, thus, typically organised as a limited partnership.

The way in which venture capitalists choose which firm to fund has been deeply analysed by several researches. Venture capitalists decisions seem to be based on three main criteria:

- the human capital of the firm that includes management's skills and the heterogeneity of the entrepreneurial team;
- the market environment and the characteristics of the industry;
- the characteristics of the product or service;
- the exit opportunities.

Besides the responsibility on funds, the venture capitalist also carries out other functions that are similar to the ones of traditional intermediates. Indeed, he carries out the *screening* activity, in which the potential firms are analysed in terms of industry, development stage, geographical location and investments size. During the screening, therefore, the venture capitalist rejects all the proposed firms that are not consistent with his strategy.

Successively, the venture capitalist deeply analyses the remaining projects and he evaluates the perceived risk and the expected return in order to decide whether to invest. Afterwards, he deals with the monitoring of the projects that have to be funded, carefully follows the firms' trend and applies the so-called

"*fund staging*" that allows to the intermediate to keeps the option to abandon the activity, by subordinating the issuing of further funds to the achievement of fixed targets.

The financing stage, with the adoption of a portfolio logic in the investments' allocations, contributes to reduce the *ex ante* total risk of the intermediate's activity. By doing so, in case of failure, their losses are limited.

Another important result of such financing stage is the reduction of information asymmetries. As a consequence, the VC firm and the founders of the company are more likely to be aligned to the same interests.

The monitoring of the entrepreneur's performance, instead, reduces the *ex post* project's risk and it is incentivised by the active participation of the venture capitalist to the firm's shares.

Moreover, the venture capitalists tend to be specialised in a given industry. As a consequence, they develop an elevated knowledge of the sector that allows them to obtain an active role in the firm's management and to provide a continuous consilience to the management about strategies, finance, marketing and management control.

Another distinction can be made between Corporate Venture Capital (CVC) and private Venture Capital. CVC is defined by the Business Dictionary as the "practice where a large firm takes an equity stake in a small but innovative or specialist firm, to which it may also prove management and marketing expertise; the objective is to gain a specific competitive advantage". In other words, CVC is a subset of venture capital whereby a company invests, without using a third party investment firm, in an external start-up that it does not own. Some examples of active CVCs include Google Ventures, Cisco Investments, Dell Ventures, Intel Capital, Johnson and Johnson Innovation and GM Investments. Private VCs, instead, consist in a combination of wealthy partners with a large investment portfolio that seek out high-growth potential companies that offer high returns.

Particularly, the main differences between such two VC subsets are:

- *long term objectives*: as CVCs aim at providing in-depth industry knowledge and marketing assistance, they are willing to support firms for years if necessary. Private VCs, instead, are mainly driven by the

need of obtaining huge profits and accelerated growth and are, therefore, more interested in firms that are predicted to have significant results in the short run;

- *investment stages*: as CVCs are more long-term oriented, they prefer to enter at the early stage of the firm's life cycle and to start providing and sourcing resources straight away. Private VCs are willing to make follow-up investments, namely when the firm is closer to obtaining returns from its project;
- *control and management*: CVCs are not interested in the company's ownership and management; whereas, as VCs aim at high returns, they have access to the firm's control.

Finally, venture capitalists represent a key figure in the funding of high-tech firms because they contribute to the reduction of asymmetric information by improving the reputation of the firm. As a matter of fact, the financing through VC represents, towards suppliers and banks, a sign of credibility in the project that fosters the grant of further commercial credit.

Nevertheless, also the negative effects caused by the financing through venture capitalist have to be analysed. First, VC investors may have objectives and strategies that are different from those of entrepreneurs. Specifically, most VC investors could have a too short-term investment perspective compared with that of the entrepreneurs who can consider such financing determinant for long-term firm performances. Second, VC finance might pose appropriability hazards for portfolio firms because VC investors might poach the innovative business ideas of entrepreneurs and exploit these themselves.

Moreover, as a consequence of the VC financing, the entrepreneur looses his control power in order to ensure that he will not take any opportunistic behaviour that could lead to project's failure. Anyway, such loss of control is only temporary. As a matter of fact, the entrepreneur and the venture capitalist establish an implicit contract according to which, at the end of the financing, the former can reacquire the control. However, this happens only when the settlement of the invested equity happens through IPO (Initial Public Offering), a

means that allows the investors to have back their amount invested and to begin a new venture capital cycle.

Actually, such way of exit is applicable only when the finance project has a positive performance, so that the firm is able to gain its listing on the stock market. If the project fails, instead, the share's value would be zero because there the innovator's moral hazard and of the investor's loss. Under such circumstance, the control power is directly given the intermediate are more likely to occur.

Another alternative used to liquidate the investment is represented by the trade sale of the shares to third parties represented by entrepreneurs interested to further develop the idea or institutional investors, such us closed-end and pension funds.

6.1.2.1. Venture Capitalists' Effects: the empirical example on Italian firms

Several econometric results strongly support the view that VC investments positively influence firm growth in terms of employment and sales.

When comparing VC backed firms with non-VC backed firms, in fact, the former's outperformance is easily demonstrated. This is not only justified by the fact that the equity capital VCs provide helps reducing the funding gap of high-tech firms, but also due to the fact that VC managerial and financial experience could be very useful in enhancing firms' grow perspectives. Finally, they can also improve firms' performances through their network connections and a signalling effect on other financiers, specifically banks.

The evidence of important VC effect is stronger in the US experience than in Europe. The most frequent results are that VC investors tend to largely increase the size and the survivorship-rate of the firms they finance. Effects on other firms' characteristics, such as profitability, productivity, innovation, financial structure and governance are sometimes documented, though less frequently analysed, specifically altogether, due to the difficulty in gathering data.

In order to measure such VC's effects on the firms they finance, several researchers concentrated their studies on the Italian sample. The reason of such decision is dictated by the fact that, differently from countries where VC is

largely developed, such as the US, the UK and Israel, VC investors in Italy face quite an adverse local environment. VC prospers in countries with a well-developed stock market that provides an efficient exit through IPO, a flexible labour market, a large private pension sector, and low capital gains taxation. With the partial exception of capital gains tax, Italy performs quite poorly in all these areas. First, historically there were substantial rigidities in the labour market; some of them were removed, but only recently. Second, private pension funds are almost non-existent. Third, and even more important, the Milan stock exchange is quite small. Most public firms operate in mature low-tech industries. Accordingly, IPOs are very rare and trade sales are by far the primary exit mechanism for successful VC investments. As a consequence, the Italian VC industry is quite underdeveloped. However, Italy is more representative of the environment in which VC operates worldwide than the US or the UK.

For their research, Bertoni, Colombo and Grilli (2011) used a sample of 538 Italian high-tech firms observed over a 10-year period. The considered sample firms operate in different high-tech industries, such as computers, electronic components, telecommunications equipment, optical, medical and electronic intruments, biotechnology, pharmaceuticals and advanced materials, robotics and process automation equipment, software, Internet, and telecommunications services. Most sample firms are privately held: only 5 firms (1% of the sample) went through an IPO. Their results led to the conclusions that VC investments have a large positive statistically significant treatment effect on the growth of employment and sales, over and beyond the effect attributable to selection. In particular, VC investments boost employment growth of portfolio firms in the period immediately after the first financing round. The estimated number of employees of a VC-backed firm at the end of the year following the first financing round is 110% larger than in the absence of VC. From year 2 after the first VC round, estimated employees continue to increase compared to growth in the absence of VC, but at a decreasing rate. The pattern is similar for what concerns sales growth. Both the initial shock and the long run effect of the VC investments are statistically and economically significant, albeit they are lower than the ones for employment.

Moreover, their results indicate that, in Italy, VC investors do not pick “winners”: they do not invest in firms that would grow also in the absence of VC. However, their study also clearly documents that VC is not a random treatment. Very young but relatively large firms attract VC investors. They also preferably invest in firms established by teams of individuals with university-level education in management and economics and prior managerial experience.

All these findings largely replicate those of previous studies on US firms (see Puri and Zarutskie, 2008). Hence, while the observable characteristics of VC-backed firms are similar in Italy and in the US, unobservable characteristics that drive VC investments differ across the two countries.

In their study, Bertoni, Colombo and Grilli, almost three quarters of the firms analysed (72,7%) declared that they received valuable “coaching” from their VC investors. The areas in which venture capitalists provided the most valuable assistance were reputed to be accounting, budgeting and finance, corporate governance and strategy formulation, which are also the areas in which entrepreneurs declared they were less competent. The majority of the entrepreneurs also asserted that after obtaining VC, their firms registered a significant improvement in the ease of access to external resources and capabilities, especially through the establishment of commercial alliances.

A more recent case of study on Italian firms is proposed by Bronzini, Caramellino and Magri (2017).

The evidence is that VC investors are able to accelerate the growth of the firms they finance and help their innovation activity. These firms show a larger increase in size (total assets, labour costs, number of employees) and they innovate more (in term of the probability and number of patent applications) compared with very similar firms in the control sample. This is not just a mechanical effect of the injection of equity capital. First, they notice that the larger increase in assets for VC-backed firms is by far greater that the wider rise in their equity. Secondly, the positive effects of VC investors in terms of firms’ growth and innovation are hence likely to be connected also with their managerial expertise or network connections.

Moreover, they find a difference between firms financed by CVC investors and in private VC investors.

All in all, the positive effect of VC arises only when financing is obtained by independent investors. As a matter of fact, they invest important amount of capital in the firms held in their portfolio that consequently grow faster and innovate more. On the contrary, CVCs invest less money in startups that are hence gathering an amount of equity similar to those who do not obtain a VC investment.

6.1.2.2. Venture Capital in Europe vs. America

While Europe has a similar sized economy to the US and double the population, European venture-capital activity is just a fifth of that seen on the other side of the Atlantic. A number of factors have prevented many European technology companies from reaching the same levels of dominance as those in the US. But there are signs that this is reaching a turning point, as a recent report reveals the European venture-capital industry and investment ecosystem has now matured.

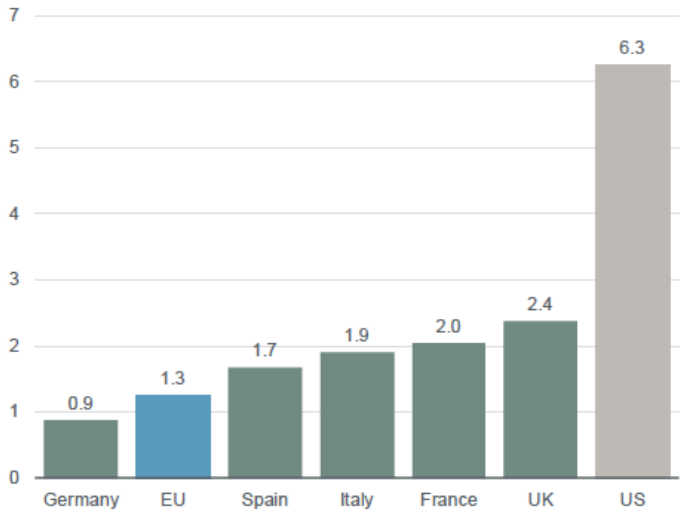

Figure 13. Mean deal size per financing round in EUR m, average 2007-2015. Average VC-backed US company receive five-times more VC than its EU counterpart.[7]

[7] Source: Invest Europe/PEREP_Analytics, PricewaterhouseCoopers/National Venture Capital Association MoneyTree™ Report Q2 2016, own calculations.

The US venture capital industry was established as early as the 1960s and 70s. More specifically, it was born in the Boston area with the aim to fund university spin-offs. Therefore, investments always addressed to those sectors that create a competitive advantage from their technology and research and development activity. The venture capital arrived in Europe only in the 1970 and only in the United Kingdom, the only country where the intermediates' activities were concentrated into scientific and technological parks. VC arrived in the Continental Europe, instead, only in the few past decades, as the manufacturing sector scarcely focused on the technological development. This means that US VC had a head start of a couple of decades on European VC. Naturally, it is more developed, with greater scale, depth and influence. It is thank to VC investments that firms like Apple Computer, Intel and Microsoft had the chance to outperform. As a consequence, a diversified range of investors (i.e. pension funds and insurance companies) composes the American Venture Capital.

The European private equity, instead, had different aims and funds. Fist, the early stage financing is not consistent, even though the venture capital definition refers to seed and start up stages. Second, as far as it concerns the address of funds, the European VC mostly funds non-high-tech firms. However, in recent years, an improvement has been made in the amount and quality of high-tech investments.

Finally, the third element of heterogeneity about the different funding sources is fading. Pensions funds and assurance companies are becoming common also in countries in which the bank loan was preferred (i.e. Germany, Holland, Spain, Denmark and Italy).

Previously, European funds have been significantly smaller than those seen in the US, but larger funds are now gaining momentum. Last records show that nearly 30% of funds raised in 2016 were over €100 million.

European policymakers are recognising the role played by venture capital in funding innovation. Last year another year-on-year increase in venture capital investment into European start-ups and SMEs was reported, reaching a total of €4.3 billion. Over the past five years, more than 16,000 European companies

have received investment, helping to them to reach new markets and create jobs.

The European Commission and the European Investment Fund this year announced a €1.6 billion VC fund-of-funds program to further increase fund sizes and attract larger global institutional investors to the market.

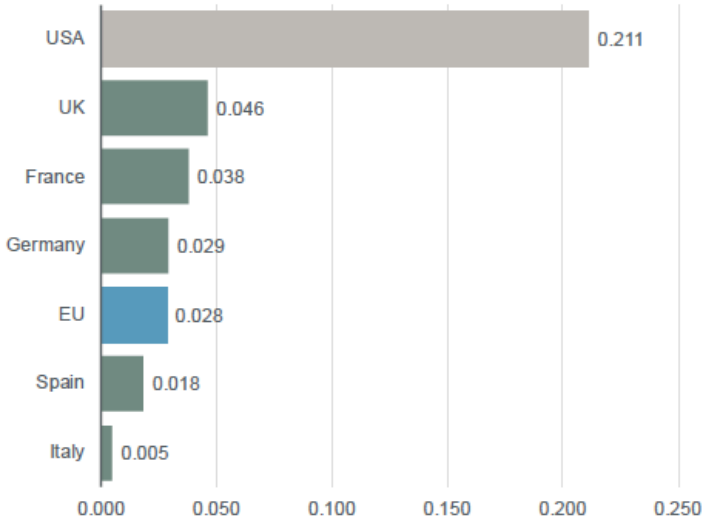

Figure 14. VC investments rates in per cent of GDP, average 2007- 2015: the United States far ahead of EU countries. [8]

Even though the European Union is the world's largest single market, there are far fewer barriers in the United States when it comes to investing in and growing companies.

The European Commission is addressing this with its Capital Markets Union plan, which includes a number of actions to reduce barriers to cross-border investments and improve access to funding for start-ups and SMEs. Particularly, the recent results regarding the capital raised by European VC funds are surprising. Whereas the United Kingdom has always been the European leader for VC fundraising , in 2017 France holds such primacy for the first time ever, as it is showed by the Figure 15.

[8] Source: Invest Europe/PEREP_Analytics, PricewaterhouseCoopers/National Venture Capital Association MoneyTree™ Report Q2 2016, US Bureau of Economic Analysis, own calculations.

However, there are advantages to Europe's diversity. While the continent lacks a single, dominant area such as Silicon Valley, it boasts an A to Z of thriving tech hubs, from Amsterdam to Zurich. And the companies nurtured in these hubs are used to internationalizing quickly and dealing with different languages and currencies.

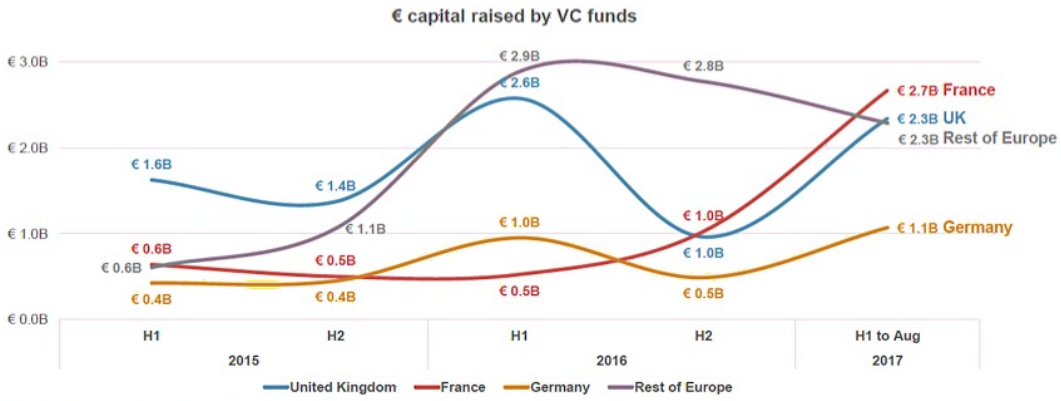

Figure 15. United Kingdom overtaken by France in funds raised in 2017. [9]

6.2. The Public Equity

Several theoretical studies demonstrated the importance of securities markets in funding firms characterised by an elevated growth potential. Such markets play a dual role:

- they indirectly facilitate the disinvestment in case of VC funding;
- they constitute an autonomous and direct funding channel for innovative firms.

As far as it concerns the first function, securities markets can considerably contribute to the VC development, as they are the advisable exit strategy both for the venture capitalist and the management of the financed firm. As a matter of fact, the formers intervene during the early stages of the firm development and they are more likely to maximize their returns through an IPO. As far as it

[9] Source: Dealroom.co analysis with help from Yannick Roux.

concerns the venture-baked firm's management, instead, the quotation in the market allows it to acquire call options for the control of its firm.

With regard to the second function, instead, securities markets can directly fund innovative firms, without the need of resorting to VC first. However, this case is characterised by an elevated information asymmetry that impedes firms to go public. In order to remediate to such problem, securities markets put their basis on the *relationship finance*: specialised intermediates intervene both in the primary market, when placing securities, and in the secondary market, when negotiating. By doing so, intermediates and management establish a close relationship, where the information exchange becomes crucial.

In the primary market, in order to reduce agency costs related to the funding of innovative projects, intermediates *sponsor* firms in order to promote the quality of the entrepreneurial project that has to be funded.

In the secondary market, instead, intermediates take on the role of *dealers*, namely they become firms' *liquidity suppliers*. At this stage, in fact, markets take into account the peculiarity of the exchanged securities and securities markets adopt negotiation strategy that differs from the ones adopted in the primary market.

In Europe, securities markets have been established during 1995-2000 for their positive impact on VC development. Among them, the most famous ones were the Alternative Investment Market (AIM), launched by the London Stock Exchange, the Nouveau Marché Paris (nowadays called Euronext Paris), the European Association of Securities Dealers Automated Quotation (EASDAQ), the Neuer Markt in Frankfürt and the Nuovo Mercato della Borsa Italiana in Italy.

6.3. The Role Played By Banks In The Innovation Financing

In the analysis about the innovation financing sources what sorted out is that the informed or intern finance is the financing method theoretically preferred by innovative firms. In this context, the bank intermediation (that is included in the informed finance), despite of its role of relationship leader, has some limits. The

bank loan's peculiarity, in fact, derives from the close and continuous communication between the borrower and the lender that lessens the information asymmetries problems.

However, the lack of collaterals and consolidated track record along with the elevated costs of monitoring required by the innovative initiatives caused the growth of some constraint in the bank loan. For this reason, such financing means is often used during the last stages of development of the high-tech firms, namely when the firm begins to be able to collect tangible collateral.

In particular, banks that have innovative firms as costumers try to adapt to their needs by borrowing more credit. However, the greater is the amount of a firm's shares, the easier is for the entrepreneur to obtain the loan.

Banks that do not fund high-tech firms justify their choice by stating that the funding requests are limited, risk is high, such firms' capital share is limited and the bank has not enough knowledge on the innovative subject.

In the last few years, however, some changes have been introduced in United States and Europe. As a matter of fact, banks have started to invest in industries with high growth opportunities even during the first stages of firms' development. Such important change is due to the introduction of a new financing method in the bank system: a new figure, the intermediate, maintains long-term relationships with the baked firm and funds it through new transactional financing methods, like the *project financing* in which the fund concerns a particular project and is protected by the assurance of getting the Intellectual Property as collateral.

The project financing is part of the so-called structured finance, which is a highly involved financial instrument offered to financial institutions or companies that have complex financing needs that don't match with conventional financial products. The financers' - or advisors' - evaluation is based on the capability of the owner of rights and obligations coming from an investment project - called Special Purpose Vehicle - to pay back all the operative costs with the cash flows generated by the initiative. The project's assets represent the investors' collateral. However, the main role is played by the potential to generate an elevated cash flow, as it is the base on which the bank grants its loan.

The issue regarding the bank loan protected by the Intellectual Property has already been largely discussed in the previous chapter.

6.4. The Italian mini-bonds

The last Great Recession strongly impacted on the Italian economical system and had consequences which are particularly unfavourable for small and medium enterprises (SMEs). The rise of a “credit crunch” phenomenon created a lack of financing sources for many Italian companies, that were forced to turn to alternative financing options, which anyway are not suitable in most of the cases. To solve this situation, the Italian Government introduced in 2012 a new financial instrument, called “mini-bond”, with features similar to the classical corporate bond but characterized by the fiscal deductibility and by the accessibility to professional investors only.

Mini-bonds are a way for individuals to lend money directly to businesses.

Typically they have terms of three to five years, and investors earn regular interest payments during the life of the mini-bond. At the end of the term, the investors receive back their initial investment plus a lump sum of interest. Unlike traditional bonds, they cannot be traded and are not listed on any market. This means that they must be held until they mature and cannot be cashed in early - which can make them a less flexible choice for investors. The regulatory requirements are much less stringent for mini bonds than for listed bonds. In particular, the main innovations that mini-bonds brought to the Italian credit market are:

- the removal of any limit related to the ratio between debt and capital owned through bonds for non-listed companies;
- the introduction of a specific discipline for the issuing of bonds and similar financial instruments by non-listed companies that include provisions of participation and subordination;
- alignment of the fiscal regime applied on non-listed companies’ bonds to the one, more favourable, applied on listed companies’ and introduction of tax benefit for investments on those instruments;
- the possibility for the insurance company to invest the assets eligible for covering the technical reserves in mini-bonds and in shares of common funds that invest in mini-bonds;
- the possibility for banks to structure covered bonds with mini-bonds as collateral;

- the introduction of fiscal facilitations for collaterals that are eligible to sustain the mini-bonds issuing.

However, for investors this means an increased degree of risk; if the issuer goes bust then the investors will have to join the queue along with all the other creditors. Investments in mini-bonds are also not protected by the Financial Services Compensation scheme. They are generally unsecured, non-convertible, un-tradeable and do carry risk so a return on investment is not guaranteed.

In the year 2017 up until September, the issues of mini-bond securities in line with the methodology depicted in the Section 3.1 are 58, 42 below the threshold of € 50 million. Figure 16 updates to September 2017 the time trend of the mini-bond issues starting from the enactment of the first decree law in 2012. The initial phase of the market exhibited sporadic issues, mainly characterised by an amount exceeding € 500 million and thus, which is not in compliance with the definition of mini-bond, introduced at the beginning of the chapter. The first signals of growth came in the second half of 2013 and intensified in

2014. The years 2015, 2016 and 2017 show a growth trend which is surprisingly linear; December 2016 recorded the maximum monthly flow of issues with 29 placements on the mini-bond market.

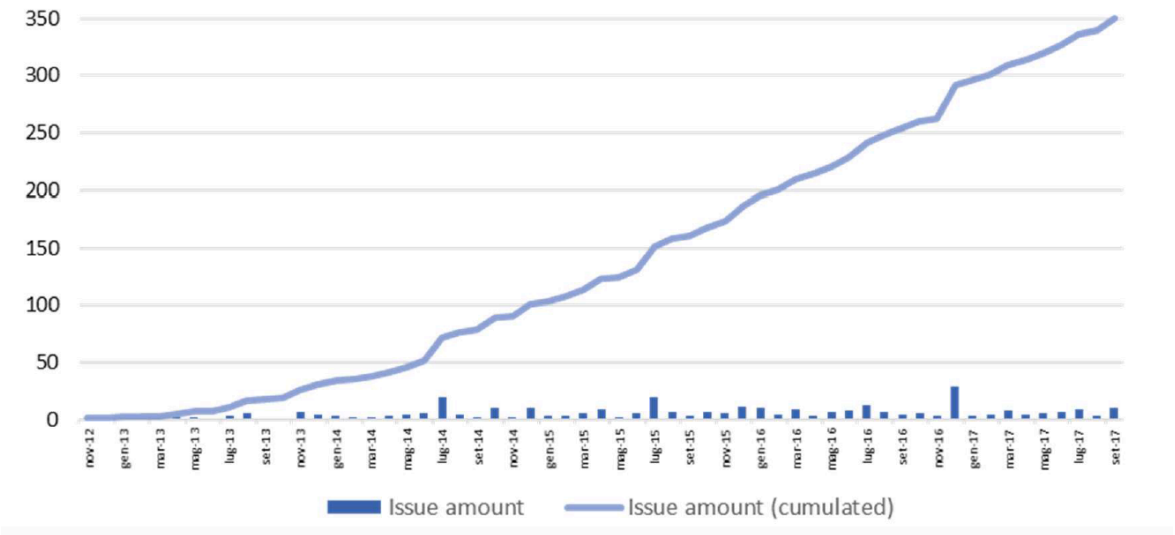

Figure 16. Mini-bond issues' timeflow up to September 2017.[10]

[10] Source: Premoli G. and Tunesi E. (2017), "The mini-bond market in Italy: do small firms raise capital to increase investments or to refinance debt?", Master's Thesis in Management Engineering.

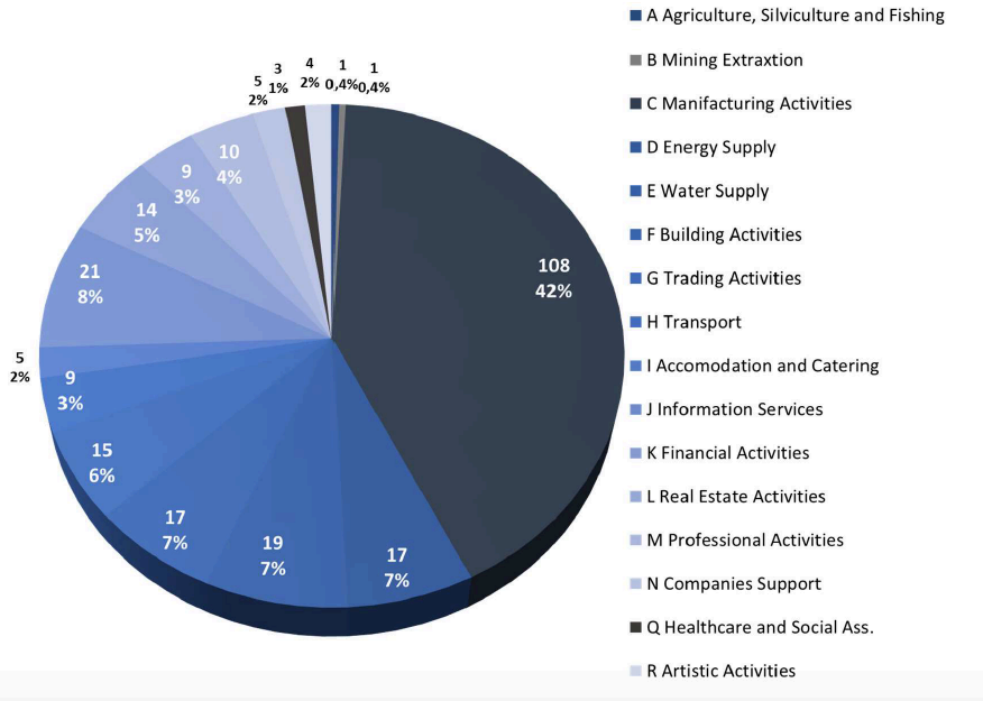

Figure 17. Issuers' segmentation according to the ATECO sectors.[11]

The Figure 17 offers an overview about the classification of the issuer companies according to the ATECO segmentation. The most represented sector is the Manufacturing Activities, with 108 cases (41% of the sample), which is remotely followed by the Information and Communication Services sector with 21 elements (8%). The Water Supply sector is the third group for relevance (19 elements, 7%), but its dimension has been strongly influenced by the two operations known as "Hydro- Bond", that were developed during the 2014 and the 2016. At the same time, the comparison of the ATECO segments between the first nine months of 2016 and 2017, offered by the Figure 18, could be interesting. The importance of the Manufacturing Activities companies has grown (+7 elements, +35%), with a strong reduction of all the less common sectors (-12 elements). Moreover, Building Activities and Energy Supply sectors has strongly grown in relative terms (+200% and +250%), although their weight is still low in absolute terms. Generally, it is possible to notice a reduction of the heterogeneity of the issuer companies.

[11] Source: Premoli G. and Tunesi E. (2017), "The mini-bond market in Italy: do small firms raise capital to increase investments or to refinance debt?", Master's Thesis in Management Engineering.

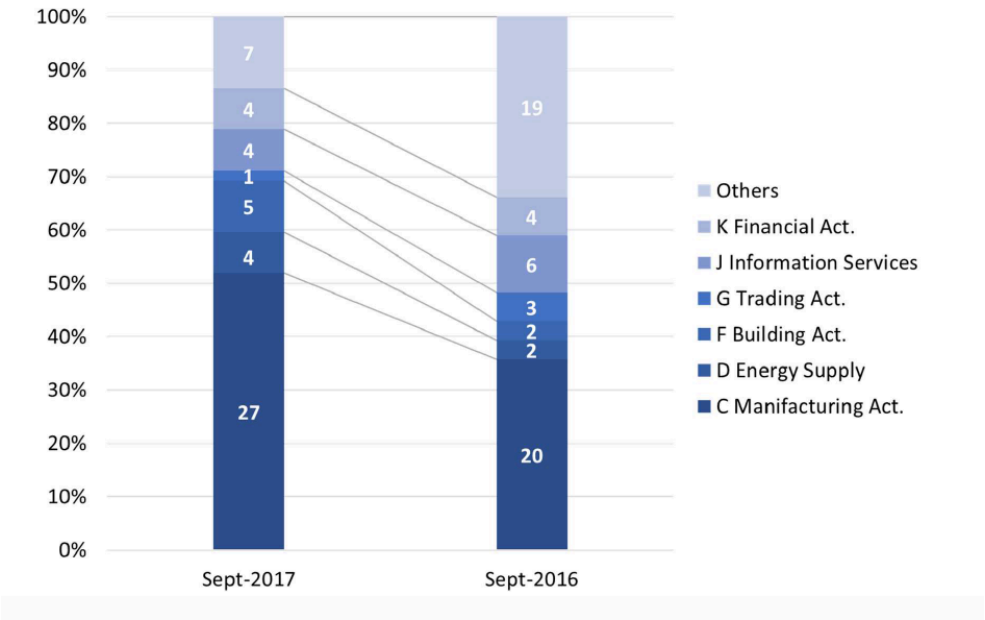

Figure 18. Issuer's segmentation according to the ATECO sectors, comparison between 09/2016 and 09/2017.[12]

[12] Source: Premoli G. and Tunesi E. (2017), "The mini-bond market in Italy: do small firms raise capital to increase investments or to refinance debt?", Master's Thesis in Management Engineering.

7. CROWDFUNDING

Crowdfunding is the practice of funding a project or venture by raising many small amounts of money from a large number of people, typically via the Internet.

Such process allows entrepreneurs to collect financial resources through an alternative channel to the classical financing methods. In the previous chapters, the difficulties encountered by SMEs when seeking financing from venture capitalists and business angels have been analysed. In such cases, crowdfunding could be the solution.

Moreover, crowdfunding can also help firms to test and promote their products, to reach a greater awareness about the customer choices and to create new products and services.

Hence, it is evident that crowdfunding has an impact not only on the entrepreneurial activity, but also on a broader spectrum of activities that includes the firm's organization. As an example, the percentage of people that habitually purchases online is 65,5% in UK, 50,5% in Germany, 51,1% in France and 20,1% in Italy.

The principle on which crowdfunding is based is not new. Several non-profit projects or political campaigns raised funds through small amounts of money from a large number of enthusiasts. However, crowdfunding introduces some innovations dictated by the greater number of possibilities it provides, the social media impact and the capability to be adopted from new fields of application.

The raising crowdfunding success is due to three main factors, which are:

- the difficulty of raising funds for new entrepreneurial realities;

the Web evolution that facilitated the development of platforms that The reasons why this happens are several. First of all, venture capitalists need to directly interact with entrepreneurs during the selection process. Moreover,

controlling the investment trend is easier for investors when firms are physically close, especially if the investment takes place during the first stages of the firm, namely when the firm does not own any balance sheet yet. The calculated average distance, in fact, between investor and entrepreneur is approximately 70 miles.

- allow entrepreneurs to get in contact with investors;
- the success of the crowdsourcing phenomenon.

As a matter of fact, crowdfunding can be seen as the crowdsourcing's evolution. In this respect, crowdfunding can be defined as a particular case of crowdsourcing, in which the public participates to the collection of the financial resources needed for the development of an idea or project.

7.1. Crowdfunding Models

Crowdfunding can be found in several forms. However, the definition of crowdfunding models cannot be precise because, often, different platforms put in place hybrid forms that combine characteristics of several models.
However, the four dominant models are:

- *Reward based*: it is the most common type of crowdfunding option available. This type of crowdfunding involves setting varying levels of rewards that correspond to pledge amounts. A standard rewards campaign offers at least three levels of pledges/rewards. Rewards campaigns are suitable for client-facing, tangible products that require less than $100,000 in funding and typically last for 1-3 months.
- *Equity based*: it consists in the exchange of actual shares in a private company for capital. In this form of crowdfunding, entrepreneurs can set investor caps, minimum pledge amounts as well as approve or deny investors who wish to view their business documents. Equity campaigns are typically several months or longer in length and fit well with start-ups seeking $100,000 or more in funding.
- *Lending based*: it allows entrepreneurs to raise funds in the form of loans that they will pay back to the lenders over a pre-determined timeline with

a set interest rate. Lending campaigns tend to take place over a shorter timespan of around five weeks and works well for entrepreneurs who don't want to give up equity in their startup immediately.

- *Donation based*: it is exactly what it sounds like - the campaigns amass donations without being required to provide anything of value in return. This type of campaign serves social causes and charities best. Donation campaigns are often 1-3 months in length and work well for amounts under $10,000.

7.2. The Actors

Three are the players implicated in a crowdfunding campaign: people and organizations that ask for financial resources in order to sustain the development of their projects (creators), the crowd (crowdfunders), the crowdfunding platform where ideas and project can be uploaded and the request of funding can be advertised.

7.2.1. Crowdfunding platforms

Crowdfunding platforms are an online system designed for the collection of capitals. Individuals and firms that want to develop a project can log in, upload the idea and advertise it.

Platform appeared for the first time in America in 2000. Kickstarter is one of the most famous platforms. Such American platform was created in 2009 and it became famous because it allowed the financing of important projects, such as Diaspora, a social network that succeeded to collect $200,000, OUYA ($8 million) and the Pebble smartwatch ($10 million).
In Italy the phenomenon is more recent, as the first platforms appeared only in the 2009, with the creation of Kapipal, followed by the creation of numerous initiatives, such as Eppela and Starteed.

Crowdfunding platform must be considered as Multi-sided Platforms, namely “an organization that creates value primarly by enabling direct interaction between two (or more) distinct typed of affiliated customers” (Hagiu A., Wright J., 2011).

Such platforms have three characteristics in common:

- the possibility for creators to log in a community of possible financers for the presented project;
- the possibility to contribute to the financing even with a small amount of money, broadening the participation to the financing process and rationing the project’s risk among a greater number of financers;
- the providing of information about creators and financers and instruments for the direct communications

7.2.2. Creators

Crowdfunding campaigns provide producers with a number of benefits, beyond the strict financial gains. The non-financial benefits of crowdfunding are:

- *Profile*: a compelling project can raise a producer's profile and provide a boost to their reputation.
- *Marketing*: project initiators can show there is an audience and market for their project. In the case of an unsuccessful campaign, it provides good market feedback.
- *Audience engagement*: crowdfunding creates a forum where project initiators can engage with their audiences. Audience can engage in the production process by following progress through updates from the creators and sharing feedback via comment features on the project's crowdfunding page.
- *Feedback*: offering pre-release access to content or the opportunity to beta-test content to project backers as a part of the funding incentives provides the project initiators with instant access to good market testing feedback.

There are also financial benefits to the creator. For one, crowdfunding allows creators to attain low-cost capital. Traditionally, a creator would need to look to "personal savings, home equity loans, personal credit cards, friends and family members, angel investors, and venture capitalists." With crowdfunding, creators can find funders from around the world, sell both their product and equity, and benefit from increased information flow. Additionally, crowdfunding that supports pre-buying allows creators to obtain early feedback on the product. Proponents of the crowdfunding approach argue that it allows good ideas which do not fit the pattern required by conventional financiers to break through and attract cash through the wisdom of the crowd. If it does achieve "traction" in this way, not only can the enterprise secure seed funding to begin its project, but it may also secure evidence of backing from potential customers and benefit from word of mouth promotion in order to reach the fundraising goal.

However, crowdfunding also comes with a number of potential risks or barriers. For the creator, as well as the investor, studies show that crowdfunding contains high levels of risk, uncertainty, and information asymmetry.

- *Reputation*: failure to meet campaign goals or to generate interest results in a public failure. Reaching financial goals and successfully gathering substantial public support but being unable to deliver on a project for some reason can severely negatively impact one's reputation.
- *IP protection*: many Interactive Digital Media developers and content producers are reluctant to publicly announce the details of a project before production due to concerns about idea theft and protecting their IP from plagiarism. Creators who engage in crowdfunding are required to release their product to the public in early stages of funding and development, exposing themselves to the risk of copy by competitors.
- *Donor exhaustion*: there is a risk that if the same network of supporters is reached out to multiple times, that network will eventually cease to supply necessary support.

- *Public fear of abuse*: concern among supporters that without a regulatory framework, the likelihood of a scam or an abuse of funds is high. The concern may become a barrier to public engagement.

7.2.3. Investors or Crowdfunders

Larralde and Schwienbacher (2010) define such individuals as “people with values and cultures linked to industrial commercial society”.
They are the basis upon which the community manages to collect capitals.
As statet above, a crowdfunders can be anyone, individual or society, who trust a project and is willing to finance it. The reasons that lead them to take part to the community are several. Weng and Fesenmaier (2003) identified five main reasons why crowdfunders invest. They are: instrumental, efficacy, quality assurance, status, and expectancy. An example of instrumental motivation is using Facebook to expand one's social network. Specific instrumental motivations include seeking/providing emotional support, finding friends/peers, relationship building, group attachment/commitment, expressing identity, and increasing self-esteem/respect. Second, an example of efficacy as a motivation is providing health advice on an online health forum. Efficacy motivations include satisfying other members' needs, being helpful to others, seeking/providing advice, and sharing enjoyment. Third, an example of quality assurance motivation is editing Wikipedia to make sure information is correct and up to date. Basic quality assurance motivations are controlling products, service quality, and enforcing suggestions/evaluations. Fourth, status motivations include gaining prestige and attaining status in the community. Lastly, an example of expectancy as a motivation includes waiting for a reply on a Twitter feed. The main expectancy motivations are seeking future exchange from anybody and seeking future exchange from someone who provides help.

There are several ways in which a well-regulated crowdfunding platform can provide attractive returns for investors:

- *Crowdfunding reduces costs*: The platforms reduce search and transaction costs, which allow a higher participation in the market. Many individual investors would otherwise have a hard time to invest in early-stage companies because of the difficulty of identifying a company directly and the high costs of joining an Angel Group or doing it through a professional venture firm.
- *Current early stage investing isn't efficient*: Venture capital firms often neglect the consumer sector and focus mainly on high-tech companies. Crowdfunding opens up some of these neglected markets to individual investors. Crowdfunding doesn't make sense in every industry, but for some, like retail and consumer, it does.
- *Value of new investors*: Another reason why crowdfunding is attractive is that the investors add value to companies. They act as brand advocates and can even be used as a focus group. Crowdfunding allows individual investors to be a valuable part of the company they invest in.

However, investors may also encounter some risks. On crowdfunding platforms, the problem of information asymmetry is exacerbated due to the reduced ability of the investor to conduct due diligence. Early stage investing is typically localized, as the costs of conducting due diligence before making investment decisions and the costs of monitoring after investing both rise with distance. However, this trend is not observed on crowdfunding platforms - these platforms are not geographically constrained and bring in investors from near and far. On non-equity or reward-based platforms, investors try to mitigate this risk by using the amount of capital raised as a signal of performance or quality. On equity-based platforms, crowdfunding syndicates reduce information asymmetry through dual channels – through portfolio diversification and better due diligence as in the case of offline early-stage investing, but also by allowing *lead investors* with more information and better networks to lead *crowds* of backers to make investment decisions

7.3 Do Crowds And Investors Choose Differently?

In order to evaluate whether crowdfunding is an effective instrument to fund firms that do not manage to collect capitals because of market imperfections, the decisional processes used by the different investors must be taken into account. Particularly, a comparison between Venture Capital and crowdfunding will be made.

If crowdfunders adopts a decisional model that is similar to the one adopted by venture capitalists, one should conclude that such financing instruments are in competitions. As a matter of fact, by adopting the same decisional model, they would invest on the same projects. Otherwise, if crowdfunding finances projects that are not considered by traditional investors, it is a complementary tool that can be used by firms that find hard seeking traditional financing.

The venture capital model has already been largely analysed in the previous chapter. What came out was the fact that, generally, venture capitalists base their choice on the human capita, the market environment, the characteristics of the product and the exit opportunities. In the next section, the decisional process adopted by crowdfunders will be analysed.

7.3.1. How crowdfunders evaluate potential investments

In the financing through crowdfunding a great number of individuals decide independently whether to take part to the investment. The reasons why an individual decide to invest are several and have already been analysed in the previous section.

Researches undertaken on a sample of high-tech projects financed through Kickstarter highlighted that the success factors used by the venture capital are similar to the ones adopted by non-professional investors.

In particular, three hypothesis have been tested:

- Entrepreneurs who already gained entrepreneurial success are more likely to receive funding;
- Entrepreneurs with a third party endorsement are more likely to receive funding.

- Highly educated entrepreneurs are more likely to receive funding.

As far as it concerns the first hypothesis, what emerged was that projects that specify the team members' names and the past projects are more likely to successfully conclude a crowdfunding campaign.

Hence, crowdfunders, like professional investors, consider past successes as a prediction of future results.

The second hypothesis, whereas, is peculiar for venture capital investments, but not for crowdfunders. The crowdfunding features, however, cannot permit to have an unique definition of network, as the endorsement's reciprocity deriving from the participation to a certain network is absent.

In a crowdfunding environment, the endorsement can be defined as an explicit recommendation made by organisations considered trust-worthy by investors.

Under these assumptions, the empirical evidence confirmed such hypothesis.

As far as it concerns the third hypothesis, instead, crowdfunders are mostly lead by non-economical projects, like the passion for a certain cause. Therefore, the entrepreneur's ability to develop a project is not measured by its education, but, rather, by the presence of a first product's prototype coupled with a pitch video.

Such features are also considered important by venture capitalists. Thus, also the third hypothesis is confirmed.

Consequently, such results demonstrate that firstly, the factors taken into account by venture capitalists in order to evaluate a project can indeed predict the possible results and secondly, the evaluation process is the same for crowdfunders and specialised investors.

Under these conditions, one could think that such financing instruments are substitutes. However, it has to be highlighted that the crowdfunding evaluation process is not affected by some bias that affect venture capitalists. While venture capital funds efficaciously use success factors in order to predict the winners, the methods through which they identify such signals tend to introduce geographical and gender bias. In the crowdfunding financing, instead, such bias seem to have a reduced effect.

The first bias that has to be analysed is the geographical one: venture capital funds are highly concentrated near the most important hubs. Such thesis is confirmed by the high presence of VC in Silicon Valley and Israel.
In particular, a recent research undertaken by UC Berkley University analysed data from 2009 to 2015 on successful Kickstarter campaigns and venture capital investments.
Researchers identified 55,005 Kickstarter projects in categories similar to the industries in which venture capitalists invested, and 17,493 venture capital investments in industries engaged in activities similar to those of Kickstarter campaigns. The researchers then used this dataset to map Kickstarter projects and venture capital investments by county and by year. Although the typical Kickstarter campaign involved a smaller amount of money, these campaigns covered a broader swath of the nation. Several places with the largest number of successful Kickstarter campaigns have not been magnets for venture capitalists' investments, such as Chicago, Los Angeles and Seattle. Venture capitalists' investments were highly concentrated. According to the data set, just four countries, located in the Boston area and Silicon Valley, account for 50% of all matched venture capital investments. To adjust for differences in population and other factors that might produce more investments in all types of innovative activity in some places, the researchers calculated the relative intensity of Kickstarter versus venture capital dollars in each region. They found that Kickstarter allocates a much larger share of its resources than venture capitalists to the interior of the country, away from coastal population centres and traditional technology hubs. Even in the Boston area and Silicon Valley, Kickstarter investments were concentrated in different areas than venture capitalists' funding.

The study found that crowdfunding in a region, and in particular successful technology campaigns, appeared to cause an increase in venture capital funding in the region. This occurs as venture capitalists look for promising new ideas and a successful campaign is a very good indicator of potential.

The reasons why this happens are several. First of all, venture capitalists need to directly interact with entrepreneurs during the selection process. Moreover, controlling the investment trend is easier for investors when firms are physically

close, especially if the investment takes place during the first stages of the firm, namely when the firm does not own any balance sheet yet.

As far as it concerns the gender bias, instead, the different amount of entrepreneurial women and men has to be taken into account. Although in US entrepreneurial women account for 40% of all the entrepreneurs, less than 6% are the venture-baked firms with a woman as CEO and only the 1,3% are the firms with a female founder. Research from PwC (2017) indicates that investors, especially venture capital (VC) investors, prefer a pitch from a male, rather than from a female entrepreneur, even if both pitches are essentially the same.

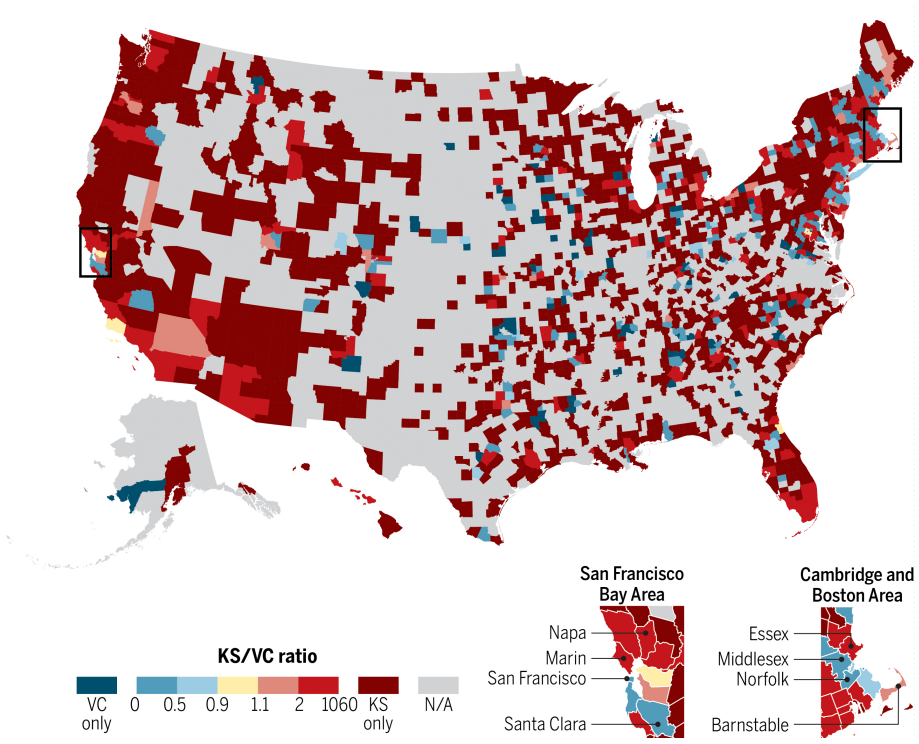

Figure 19. County-level distributions of Kickstarter campaigns and venture capital investments, and the ratio of the amount of Kickstarter to venture capital funding in the period 2009–2015.[13]

[13] Source: Sorenson O., Assenova V., Li G.C., Boada J. and Fleming L. (2016), "Expand innovation finance via crowdfunding", Vol. 354, Issue 6319, 1526-1528.

Moreover, men in the US, on average, start their business with nearly *twice* as much capital as women. And it's not just the US. For 220 early-stage, digital businesses in the UK, male entrepreneurs were 86% more likely to be VC funded than their female counterparts.

Such bias could depend on sexual prejudices, but it can also depend on the greater predisposition of investors to finance entrepreneur of the same gender, as they can share the same network and preferences.

As far as it concerns the crowdfunding, instead, PwC states that female crowdfunders tend to use more emotional and inclusive language in their campaigns, which appeals to all crowdfunding investors (male and female) and is found to be positively correlated with fundraising success. If one looks at all the crowdfunding campaigns across 2015 and 2016, he sees that those led by females were 32% more successful than those led by men.

Figure 20. Women achieve greater crowdfunding success in all geographic regions.[14]

Even if one moves away from the big picture and start slicing up the data, he still finds that women secured their funding goals more than men for every business sector and every territory. Supposedly 'more masculine' sectors are being flipped upside down. For example, in the technology industry, where

[14] Source: The Crowdfunding Center, 2015 & 2016 data.

there is 1 female entrepreneur for every 9 male entrepreneurs, females were still more successful than males in achieving their crowdfunding goal.
Therefore, even if crowdfunding financing uses the same factors in order to recognise the potential success of a project, it is not affected by the analysed bias. In conclusion, it can be stated that crowdfunding represents the solution for innovative firms that could not address to traditional investors in order to obtain the needed resources for the development of their projects.

7.4. The Crowdfunding made in Italy

As far as it concerns Italy, crowdfunding has been introduced through a *Decree* in 2012 with the clear aim to fund innovative start-ups. The same Decree (Decreto Sviluppo-bis) introduced significant innovations like the status of innovative start-up and the generation of a mini-bond market.
However, such law also imposed some limits to the Italian crowdfunding. The most important one are:

- the capital must be collected through Internet platforms managed by investment firms and banks that communicated to CONSOB the existence of such platform;
- the crowdfunding campaigns must be proposed by innovative start-ups;
- offers cannot exceed EUR 5 million.

The research conducted by Starseed demonstrated a solid market consolidation. As a matter of fact, since its foundation, the total amount gathered on crowdfunding platforms is equal to 133.197.153,17, of which 41.406.243,66 were collected in the 2017. In particular, the market grew by the 45% if compared with the 2016. The following pictures show the growth per each crowdfunding model.

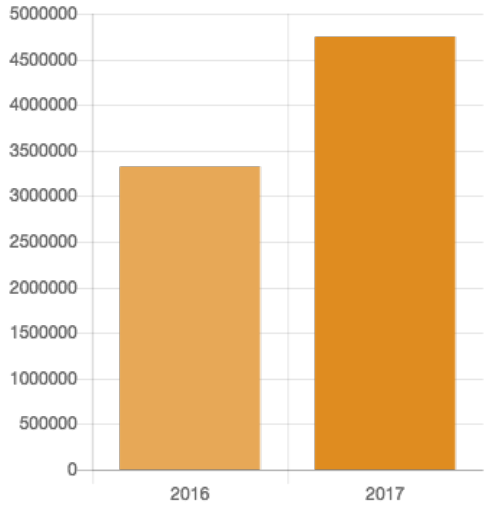

Figure 21. Total growth rate gathered by by projects funded through *Do it yourself.*[15]

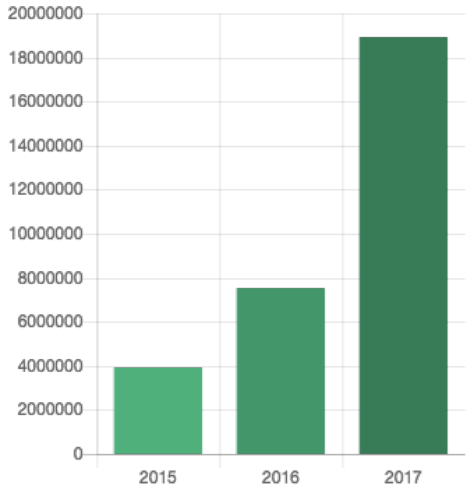

Figure 22. Total growth rate gathered projects funded through *Equity Crowdfunding.*[16]

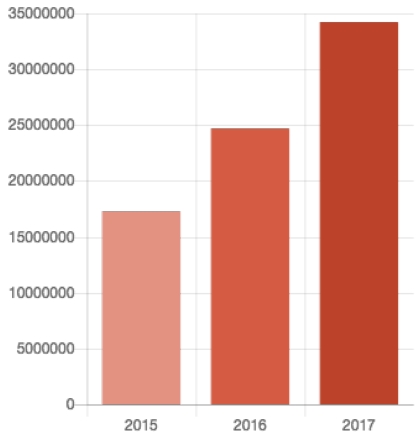

Figure 23. Total growth rate gathered by by projects funded through *Donation/Reward.*[17]

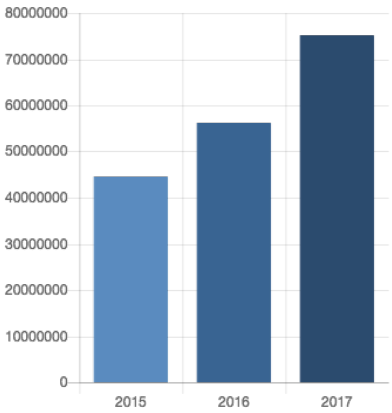

Figure 24. Total growth rate gathered projects funded through *Lending.*[18]

[15] Source: http://www.crowdfundingreport.it

[16] Source: http://www.crowdfundingreport.it

[17] Source: http://www.crowdfundingreport.it

[18] Source: http://www.crowdfundingreport.it

In 2017, 19 equity crowdfunding platforms were authorised by CONSOB. A study conducted by the Polytechnic of Milan took into account 109 equity crowdfunding campaigns. The figure 25 shows for each platform of the sample the average collecting value. It can be easily seen that some platforms – such as OPStart, Wearestarting and Crowdfundme – are more specialised on tiny offers; whereas others – such as Investi.re, Next Equity, Starsup and Assiteca Crowd – aimed at more elevated targets.

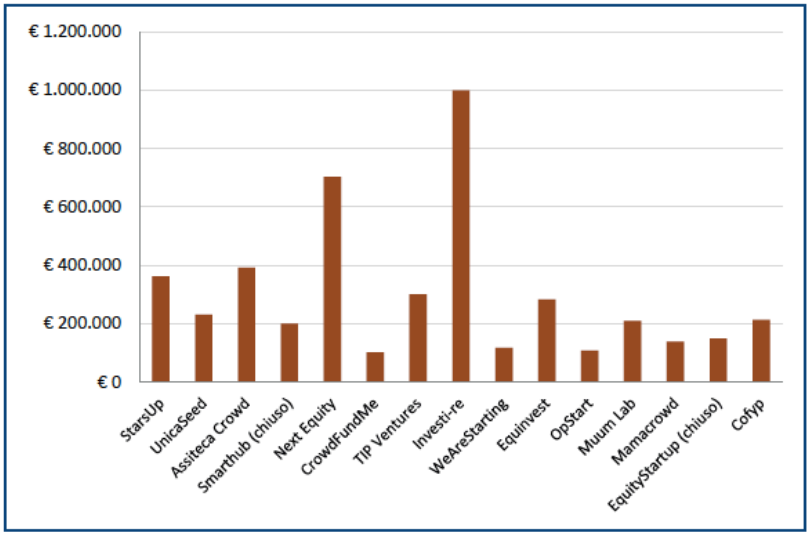

Figure 25. The average value collecting value for the 109 sample campaigns.[19]

The figure 26 shows the geographical distribution of the issuers. It is not surprising the fact that Lombardy is on pole position with 43 firms that are the 40,3% of the total, followed by Lazio with 12 firms and Tuscany with 8. It is important to highlight the good performance of Sardinia with 6 firms and Apulia with 4 of its 5 firms born in the last year.

[19] Source: Osservatorio Crowdfunding (2017), 2° Report italiano sul Crowdinvesting.

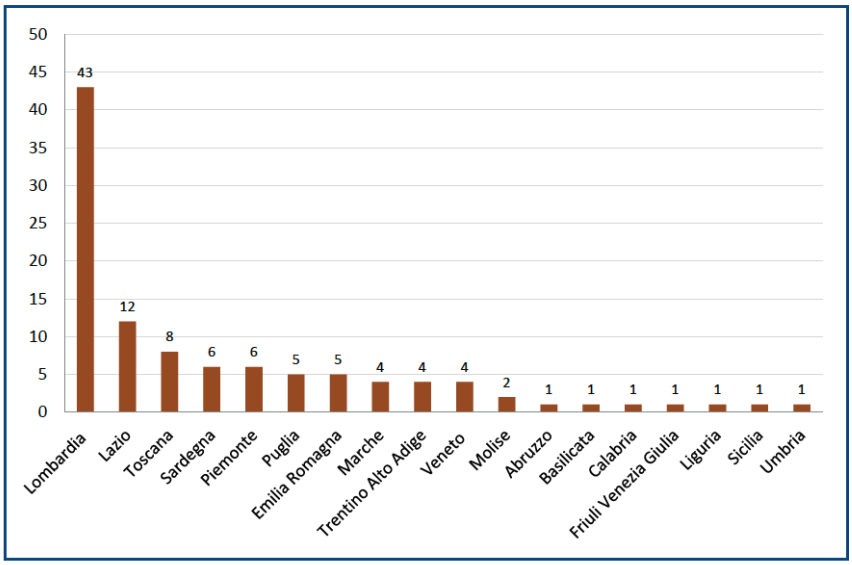

Figure 26. The geographical localization of the 106 sample firms taken into account by the Polytechnic of Milan for its research.[20]

[20] Source: Osservatorio Crowdfunding (2017), "2° Report italiano sul Crowdinvesting"

8. CONCLUSIONS

The consideration of a context characterised by imperfect information and asymmetry on the capital market allowed the overcome of the Modigliani Miller Theorem as far as it concerns the financial structure of a firm and its investment choice. Indeed, starting from the contribute of Myers in the 1983, a part of the corporate finance literature underlined the fact that the financing sources are not perfect substitutes by demonstrating the existence of a financial hierarchy that, however, has to be reconsidered for innovative firms.

Technology-oriented start-up businesses have been demonstrated to be of high importance for the economy, since they significantly promote innovation and new employment. As in other commercial start-ups, their founders often lack experiences that are relevant for managing a new venture and, as a consequence, many firms do not survive their first years. It was revealed that with their focus on innovative products and services, the uncertainties entailed in the creation of the business are higher than in other start-ups. Their knowledge-intensity furthermore increases the relevance of the founders, with human capital often being the main source of value in such ventures. These ventures pass through three main stages. The initial stage is the so-called *early stage*, in turn separated into *pre-seed*, *seed* and *start-up* phase and followed by the *expansion* and the *later stage*. The capital needs of the venture have been proven to rise throughout these stages but already in the initial phases, where the business is not yet legally founded, it has been shown that capital is necessary.

Financing the business, however, is considered one of the main problems of young ventures. As revealed, the characteristics of start-ups with technology orientation increase these difficulties additionally, especially during the very early phases. For the founders, the options of financing their start-up with own

funds, altering the business model towards no or very small capital needs or financing the venture internally by bootstrapping strategies exist. But often this is not possible, so that they have to found an external source of funds.

Even though Europe made great strides in recent years in order to sustain innovation, United States keeps on being the leaders of the innovative industry.

The reasons why such differences still exist are several. However, the most important ones are the existence of a consolidated American market for the Venture Capital and the fragmentation of the European markets.

Nevertheless, the European Union made several reforms in order to lessen such gap. Particularly, as far as it concerns Italy, mini bonds have been introduced in order to ease the innovation financing.

As far as it concerns the answer to such issue by financial institutions, banks are seldom a possibility since they refrain from dedicating funds to ventures regarded as implying high risks. Also government support programs are often not available to them.

In recent years, the market evolution and the business and technology innovations strengthened the awareness about the Intellectual Property that can be monetised not only through the purchase or the licensing, but also by being used as collateral. Therefore, the intellectual property is turning into a real financial instrument that gives birth to the IP finance. However, patents can be also used as weapons through which firms and entrepreneurs strategically remove their concurrences from the market. The numerous strategies that can be adopted can, hence, block the innovation instead of promoting and fostering it.

However, the initial depiction of Venture Capital companies, business angels and crowdfunding demonstrated that they are generally promising financing forms for technology-oriented start-ups in their earliest phases.

In particular, Venture Capital companies are most suitable for start-ups that are located in major cities, rely on a business model that is to a certain extend proven and have a large capital demand. In exchange for the highest amount of funds of the three financing forms, venture capital companies claim the most extensive rights regarding the monitoring of the venture and the influence on it, also their exit can mean distinct consequences for it. At the same time, they have the most experience in professionalising ventures as well as the widest

contact networks and can hence provide a lot of value to the ventures they invest in. Business angels seem to best fit young ventures that are searching for a knowledgeable partner in realising a specialised business model. They understand the industry and can see possibilities where other investors back off, base their involvement on trust towards the founders and support the venture with their experience and contacts; chances are that their exits are rather smooth. Their capital provision is located in the medium range and may help securing additional funds through a signalling effect. Crowdfunding, instead, is most promising for ventures that value its global availability and come with novel, unusual business models and products that attract enthusiastic investors. In crowdfunding based on donations, sponsoring or pre-selling, the venture can acquire various capital amounts in exchange for comparably modest rewards, no further exit problems and only passive influence on the business. Equity or lending based crowdfunding often allows higher capital provisions but also increases the duties and the influence from investors the venture has to accept. However, the costs it has to bear are below-average and it keeps the main control of the venture.

Finally, the analysis has shown that venture capital companies, business angels and crowdfunding can serve as financing forms for technology-oriented start-ups in their earliest phases but that their suitability and impact on the start-ups differ. The most promising financing form is therefore dependent on the particular case of the start-up and which impacts the entrepreneur in search of an external source of financing is content to accept.

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