New Pecking Order Financing for Innovative Firms: an Overview

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Foreword

Ever since the Modigliani-Miller theorem (1958) came to prevail in finance literature arguing the total irrelevance of the financial structure for real decisions,[1] economists have progressively adjusted their positions. In fact, with the advent of the economics of information and incentives it has been possible to demonstrate that, removing the "heroic" hypotheses of Modigliani and Miller (M-M), the choice of the forms of financing (internal sources, bank loans, issue of bonds and shares) does, by contrast, prove relevant for production and investment decisions.

In particular the contributions by Myers (1984), Myers-Majluf (1984) and Fazzari-Hubbard-Petersen (1988) laid the foundations for the study of firm financing hierarchies and opened the way to the so-called *pecking order theory*. According to this approach the sources of financing are not perfect substitutes, one as good as another; rather, firms follow a hierarchic order in their use. Indeed, in more recent works the profitability of investments itself is no longer assumed as a datum, but the actions and choices of managers and the allocation of powers of control are recognised to have effect on the value of the firm[2] (Hart, 2001; Hall, 2002; Kaplan-Stromberg, 2002).

In this paper we look to the *pecking order* literature with the aim of analysing how it can and should be *reconsidered* for the study of innovative firm financing. Of course, firms of this description operate in the high-tech sector (applied to electronics, biotechnology, communications, etc.) and so have peculiar characteristics that set them largely apart from the traditional firms (Antonelli-Teubal, 2006). These differences have led

[1] As well-known, Modigliani and Miller assumed absence or uniformity in fiscal regimes regarding business incomes and the existence of perfect capital markets, i.e. complete, symmetrical availability of information. In this way it became in principle possible to have unlimited access to funds, and at certain and constant cost.

[2] The financial structure proves relevant from the macroeconomic as well as microeconomic point of view. In this connection see, for example: Gertler (1988); Mayer (1990); King-Levine (1993); Rajan-Zingales (1998); Fisman-Love (2003).

to considering new forms of financing adopting the system of *private equity*. It follows, therefore, that while the pecking order approach remains valid, it needs to be *modified* to take account of the importance that *private equity* in general, and *venture capital* in particular, have taken on for the development of innovation (Berger-Udell, 1998; Bergemann-Hege, 1998; Gompers-Lerner, 1998; Kortum-Lerner, 2000; Audretsch-Lehamann, 2002).

The paper is structured thus: in section 1 we look to analysis of capital market imperfections to account for the relevance of financing hierarchies for the "traditional" firms; in section 2 critical analysis is made of the issues connected with the financing of innovation; in section 3 we consider the importance and effects that venture capital has for innovative firms; finally, in section 4, we analyse *pecking order* distinguishing between the various firms' phases of development.

1. Capital market imperfections and financing hierarchies

As noted in the foreword, analysis of the presence of financial constraints for investment decisions has been an object of study and debate ever since the 1950s. It was, however, only in the 1980s that, thanks to what is known as the economics of information and incentives, the relevance of the financial structure for real decisions has made itself felt, at both the theoretical and the empirical level (cf. Gertler, 1988). By bringing the focus to bear on environments characterised by imperfect[3], asymmetrical information between managers-entrepreneurs *(insiders)* and investors-financers of various types *(outsiders*), we have in fact been able to put behind us the famous M-M theorem of the irrelevance of the financial structure. In reality, long before the revolution brought about by the economics of information, given the "ideal" hypotheses it rested on the M-M theorem has always been treated with a degree of scepticism by financial agents: an elegant theoretical abstraction devoid of practical utility.

Regardless of tax regimes (which on the one hand provide for deductible financial charges and on the other hand apply differentiated taxation to returns on dividends and capital gains[4]), abandoning the hypothesis of perfect capital markets opened the way to a great many contributions arguing against the perfect substitutability of sources of financing (inside sources, bank credit, issue of bonds and shares). A good proportion of this literature, whether at the level of "corporate finance" or "economics", has demonstrated the existence of a well-established financial hierarchy in the sources of financing for firms,[5] on the basis of which internal sources are to be preferred to bank credit, which in turn is favoured above the direct issue of shares.

The pioneering contributions by Myers and Majluf (1984) and particularly by Fazzari-Hubbard-Petersen (1988) laid the foundations for construction of the "stepped" finance supply curve of firms (Cf. Fazzari-Hubbard-Petersen, 1988, p. 156, Fig.1), which brings into evidence the *traditional hierarchy* in firms' finance sources.

The internal sources, consisting mainly in cash-flow (*internal net-worth*) , are preferred to bank credit since their use does not entail the agency costs deriving from the asymmetry of information, whether ex-ante or ex-post,[6] between managers-entrepreneurs and investors-financers. Resorting to external financing (through credit) thus proves more costly than drawing upon internal sources[7] precisely because there is a *lemon premium* to be

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[3] Imperfect ex-post observability of the actions taken on by insiders.

[4]In many industrialised countries the tax regime penalises income deriving from dividends as compared with capital-gains.

[5]The idea of the pecking order is in contrast with the static trade-off approach (for comparison see Shyam-Sunder and Myers, 1999). The latter has it that firms aim at determining the optimal financial structure (shown with optimal leverage), which is obtained when the marginal benefits in terms of tax saving associated with credit are counterbalanced by the marginal costs of bankruptcy.

[6]As well-known, reference is to the moment the financing contract is drawn up: when ex-ante information asymmetry gives rise to the problem of *adverse selection*, when ex-post to the problem of *moral hazard* or a cost for verification of the state of the investment plan (*costly state verification)*.

[7]The opportunity cost involved in insider financing is equal to the interest rate forming on the money market. On the basis of the marginal condition for investment if the firm draws on outsider investment, the productivity of the capital will have to amount to the sum of the monetary interest rate (including the *lemon premium)*, the cost associated with depreciation and any marginal adjustment costs there may be (Hall, 2002); this means that the cost of drawing on outsider sources is higher than when using insider sources. As we have seen, the *lemon premium* is higher in the case of direct issue of shares than for bank credit.

reckoned with (Akerlof, 1970). Observing Fig.1 it will be seen that the cost of such financing proves growing in the degree of debt (*leverage*) given the principle of lender's increasing risk (Kalecki, 1937); in fact, as the ratio between internal and external sources increases, so does the risk of bankruptcy. Thus, the higher the level of indebtedness, or the lower the value of highly liquid assets or inside collateral[8] given in guarantee, the greater will be the marginal cost involved in bank financing. Should the bank decide, on screening, to ration credit to the firm in question totally, then the rising part of the supply curve would become completely vertical and the level of investment would then depend entirely on the inside resources.

In turn, bank credit proves preferable to the direct issue of shares for two reasons basically:

1) the banks are able to apply screening and delegated monitoring directly to the firms: this reduces the degree of information asymmetry, thereby minimising the agency cost of outsider financing (Diamond, 1984);

2) in an environment of imperfect, asymmetrical information the credit agencies take on the function of producing information (Stiglitz, 1985; Stiglitz-Weiss, 1988), which has indirect positive effects on the very value of the firms financed. In fact, obtaining a loan often entails an increase in share prices (James, 1987; Bayless-Chaplinsky, 1990; Alam-Walton, 1995; Jong-Veld, 2001) since, by the very fact of obtaining financing, the firms' reputation is enhanced to the eyes not only of clients and suppliers, but also of other potential investors-financers (Diamond, 1991).

The direct issue of shares (*public equity*), on the other hand, usually triggers a dip in their price, precisely because it is perceived by the investors-financers as a *signal* that the managers-entrepreneurs hold the firm to be overvalued, or even as an indication that the firm is unable to obtain financing: this in turn implies that the investment plans the firm intends to finance are of the riskiest nature. This complex picture characterising the finance markets was accounted for by Myers-Majluf (1984) as in all cases starting from consideration of an environment marked

[8]Distinction is made between inside and outside collaterals. The former consist of capital goods or highly liquid assets in the possession of the firm, while the latter are a matter of

by information asymmetry between managers and potential shareholders. the latter interpret an issue of shares as *"bad news"* since they know that the managers, holding part of the shares, act in the interests of the shareholders and are reluctant to issue new shares on account of the *dilution* of the capital that would ensue.

Apart from the agency costs due to information asymmetry, we must also bear in mind that the issue of shares entails in addition appreciable *direct costs* (rating, publicity and certification, placement costs) which make this by far and away the most costly form of financing. A firm will therefore be ready to resort to this form of financing only after having drawn upon the inside sources and bank credit[9].

Following Fazzari-Hubbard-Petersen (1988, Fig. 1, p. 156) to illustrate the effects of the *finance hierarchies* on the financing and investment decisions made by firms we may for the sake of simplicity take the case of a representative firm that has three possible investment demand schedules, D0, D1, D2. Taking FO to indicate the inside sources (self-financing) of the firm in question, if the investment demand stands at DO the firm will be able to finance the investment plan with inside sources, and is thus not subject to stringent financial constraints. If, on the other hand, demand stands at D1 or D2 the firm has no choice but to resort to outside sources. In the former case it will finance the investment first with inside sources and subsequently with bank credit, while in the latter case it will also fall back on the issue of shares. As we have seen, if the demand amounts to D1 or D2 the firm will have to bear a cost exceeding that of inside financing.

Thus the level of investment reached by the firm will depend on the extent of the inside sources and on whether or not it will have access to bank credit and the possibility of direct issue of shares, and the financial structure will indeed prove relevant to the investment decisions.

2. The problems involved in financing innovation

goods in the property of the entrepreneur himself (cf. Berger-Udell, 1998).

[9]From the empirical point of view Mayer (1990) demonstrates that in many industrialised

In this section, taking reference from recent contributions in the literature we set out to emphasized that innovative firms are endowed with peculiar characteristics differentiating them from firms working in the traditional sectors and calling for *reformulation* of the hierarchy of finance sources considered in the previous section.

The first observation to make with regard to the innovative firms has to do with the fact that the financial requirements and degree of risk[10] often depend on the stage of development reached with the investment plan. Basically, we can distinguish four different stages: *seed* (conception of the innovative idea)*, start-up* (starting on the innovative process)*, early growth* (initial stage of expansion), *sustained growth* (consolidation stage).

During the embryonic stage (*seed)* the degree of risk that the innovative process may prove unsuccessful is indeed high, while the financial requirement is decidedly modest, often being limited by the expenditure involved in assessing the feasibility and economic expediency of the plan. The subsequent stage (*start-up*) still holds a fairly high degree of risk, on top of which is the need for substantial financial sources to create the prototypes and cover the costs of marketing and promotion. The stages of *early growth* and *sustained growth* hold rather less risk than the previous two stages, and are differentiated between themselves by the fact that, unlike the sustained growth stage, the period of early growth still entails fairly sizeable financial requirements. In fact, to provide for growth the firm has to develop sufficiently widespread distribution and marketing for the product. To put it in a few words, the phases calling for financing are in particular, then, the start-up and early growth stages of the innovative project, while it is the seed and start-up stages that show the highest degrees of risk.

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countries firms are unlikely to resort to this way of collecting funds.

[10]Distinction is mad between economic and financial risks (Petrella, 2001). The former have to do with the probability of failure for the innovative project (pure technological risk), or the eventuality that the investment may prove obsolete on completion (temporal risk), or, finally, the possibility that the project will not meet with success on the market; the latter are connected with the economic risks and lie in the difficulty of quantifying the amount and temporal profile of the financial flows.

Turning back, now to the sources of financing considered in the previous section, the first point that strikes us is that resort to inside sources (*self-financing*) is hardly very likely for firms of this type, for they are simply not equipped to generate sufficient cash flows, above all in the early stages of development. Thus the innovative firms are markedly speculative agents in that they may well find themselves bearing liabilities (above all in the start-up stage) in excess of the expected future income flow.

As far as access to outside sources is concerned, assessment of the project by investors-financers appears to be characterised by a considerable degree of uncertainty (Hart, 2001), decidedly higher than for the firms operating in the traditional sectors, and this makes screening a particularly challenging task for the outsiders. Innovative firms are by definition young firms, which makes it hard to weigh up the risk involved in possible financing. The fact that these firms can show no track record to lighten the information problem means a greater degree of *information opacity*[11] than is met with in the traditional firms. This means that the agency costs are above average, and could even prove prohibitive for such firms. One solution to the problem of information asymmetry might be to convey all the information about the innovative investment project – in its entirety – to the investor-financer. In this case, however, the entrepreneur-innovator would lose his or her competitive advantage, which is enough to make the perfect transparency between *insiders* e *outsiders* highly dubious: in fact, an innovative project loses in value as information about it finds growing circulation (Bhattacharya-Chiesa,1995; Anton-Yao, 1998).

Quite often the innovative firms are not even in a condition to be able to offer sufficient guarantees, whether implicit or explicit, to alleviate the creditor's risk, as illustrated in the previous section. As far as the implicit guarantees are concerned, in the initial stages, at least, these firms are unable to generate the positive net flows necessary to service the debt (*pledgeable income*) while, in terms of explicit guarantees, these firms use *immaterial*[12] (patents, copyrights etc.) and/or particularly *firm specific*

[11]Although, as we shall see, the degree of information opacity depends on the degree of development reached by the firm.

[12]In this case, too, the use of intangible assets is characteristic above all of the seed stage. In fact, as the innovative firm develops we may reasonably suppose that the physical

assets, all of which adds up to greater risk for the potential financer (Hall, 2002; Gompers, 1995). The *immateriality* of the capital can constitute a severe limitation to bank credit precisely because it leaves the firm with relatively little of the *inside collaterals* that would lighten the cost of bankruptcy, and thus the risk for the creditor. On the other hand, the *specificity* in knowledge and use of capital goods increases their illiquidity, and again this means heavier bankruptcy costs for the creditor should *financial distress* arise, depriving him of the possibility to set a lower limit to loss should the project fail. The fact that no perfect resale market exists for such assets means that investment decisions and the consequent financial liabilities prove totally irreversible.

Thus a great deal of uncertainty and information opacity on the one hand, and the lack of collaterals and *pledgeable income* on the other can make it quite impossible for these firms to resort to the 'traditional' outside sources of financing, severely limiting their capacity to obtain financing with credit (Guiso, 1997) or with issue of shares.[13] Moreover, in the initial (*seed*) phases it is above all human capital that the innovative firms hold[14]: the initial investment often consists in outlay for the salaries of the technical-scientific staff. This means high costs for capital stock adjustment, leading in turn to a higher cost of capital.

Thus the peculiar characteristics of innovative firms are such as to imply a situation of *market failure* as far as use of the traditional financing tools is concerned. Indeed, in this case Bronwyn Hall (2002) spoke of a *missing market* for the financing of innovation.

3. The role and effects of venture capital

One possible solution to the problem discussed in the second section lies in the idea of *private equity,*[15] which is a matter of risk-capital

capital grows along with the human capital.

[13]In practice both credit rationing and share rationing are at work here.

[14]See in this connection: Audretsch-Lehmann, (2002) and Hall (2002).

[15]Distinction is made between the *organized* private equity market and the *informal* private equity market. VC belongs to the former, while, as we shall see, angel finance and the informal financing by the entrepreneur-innovator's family belongs to the latter.

investment in unquoted firms. Venture capital (VC) belongs to this category, and takes the form of an *intermediary* collecting financing from a group of investors (banks, pension funds, insurance companies and foundations) and investing it in the share capital of newly instituted, highly innovative firms[16].

This is a form of financing that comes under the heading of *informed capital*, as it is called, in contrast with *arm's length financing*, which consists in collecting funds with the issue of shares and bonds directly traded on the open market.

In the first place the venture capitalist attends to the *screening* of the innovative firms, so as to reduce the degree of information asymmetry existing ex-ante. In fact, the intermediary is often in possession of specific technical competence which improves as his work of mediation grows, allowing for a shrewder selection of projects than normally made by a generic outside investor-financer or a bank (Ueda, 2000). Moreover, by granting risk-capital the venture-capitalist not only has the possibility of appropriating part of the value generated by the firm but can also perform various, very particular functions ranging from managerial *consultancy* to *monitoring* and even *control* of the venture-backed firm. As intermediary the venture-capitalist carries out the vital activity of *information production*, generally performed by the banks in the case of firms operating in the traditional sectors. Thus the venture-capitalist not only has the function of financing in the strict sense, but also provides services that are not strictly financial but which prove fundamental[17] in the case of innovative firms, above all in the early stages of development.

As for the consultancy function, the intermediary often assists the financed firm in the work of management, organisation, marketing and even in taking strategic decisions. It often happens, in fact, that the entrepreneur-innovator has all the technical-scientific knowledge at his fingertips, but lacks in managerial competence. Of course, the contribution in the form of consultancy is conditioned by the level of professionalism, experience and competence achieved by the *venture capital managers.* De Carvalho-

[16]Such is the definition supplied by EVCA (European Venture Capital Association).
[17]According to Lerner (1995) in the case of venture capital financing, the non-financial

Calomiris- De Matos (2005), for example, showed that *venture capitalists* add value to portfolio firms by obtaining and transferring information about senior managers across firms over time.

Furthermore, since the venture-capitalist has invested risk-capital in the innovative firm he will also have a strong incentive to engage in the activity of *delegated monitoring*. Direct *monitoring* provides the intermediary with the possibility to reduce the degree of ex-post information asymmetry and the associated problem of *moral hazard* on the part of the entrepreneur-innovator.[18] For example, in the case of firms operating in the sector of biotechnologies, the typical moral hazard arises when the researcher-innovator might yield to the temptation to invest in research projects that enhance his or her reputation in the scientific community, but which are extremely or offer the investor lower returns than other possible projects.

Implementation of this function often has the venture capitalist sitting on the innovative firm's board of directors[19]; in other words, it means loss of controlling power for the entrepreneur-innovator, necessary, however, at this point to prevent opportunistic and/or myopic behaviours that could lead the innovative project itself to failure. It is in any case a temporary loss of control since, as we shall see in section 4, a sort of *implicit* contract (cf. Black-Gilson, 1998) comes into being between the venture capitalist and the entrepreneur-innovator, on the basis of which the latter will be able to regain control when the time for disinvestment arrives with an IPO (*Initial Public Offering*). Thus venture capital financing takes on a hybrid form, in the sense that although it is characterised by investment in risk-capital it also shows certain features suggestive of debt capital.[20] In fact, if the performance of the venture-backed firm is unsatisfactory, since it would increase the probability of moral hazard on the part of the innovator and thus the risk of loss for the investor, it is usually determined that the entire controlling power passes into the hands

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contribution actually proves more important than the financial contribution.

[18]In fact, the possibility of moral hazard increases as the *inside collaterals* and/or inside resources decrease. Thus it is more likely in the case of innovative firms (Aghion-Bolton,1992; Audretsch-Lehamann, 2002).

[19]The control exercised by the venture capitalist is, according to Black and Gilson (1998), often out of all proportion with respect to the share holding.

[20]The observation is taken up by Hall (2002), who defines VC as a hybrid form of debt/equity.

of the intermediary, allowing even for the project itself to be sold off (just as happens with the use of debt capital in cases of insolvency). If, on the other hand, the firm's performance proves positive, then controlling power remains with or returns to the entrepreneur-innovator[21].

A peculiar characteristic associated with VC, which is taking on increasing importance in the literature on contracts and efficient forms of control, is also to be seen in the system of financing in stages (*staging*), made to depend on the results achieved by the entrepreneurs-innovators (Gompers, 1995; Hart, 2001; Kaplan-Stromberg, 2000, 2002). Often, in fact, the initial financing made by the venture capitalist is far from sufficient to cover implementation of the *business plan*, thus providing the entrepreneur with a powerful incentive to make a success of the innovative project. Along with *staging financing* the venture capitalist often receives convertible bonds in return for participation in the social capital[22]. Again, this constitutes an operating strategy that gives the entrepreneur-innovator an incentive to pursue the set objectives: in this case, in fact, conversion usually proves automatic.

As for the function of *information production*, the venture capitalist is often clearly staking his reputation in guaranteeing the innovative project, thereby enhancing transparency vis-à-vis the venture backed. This means that the *informed capital* function thus performed can have positive indirect effects for third parties, who in turn increase their information on the firm and favour the success of the investment. For the suppliers the fact that financing is obtained through VC signals the soundness of the project, which encourages further provision of business credit. As for the clients, they could be confident that the innovative firm would be able to promote new products in a relatively short space of time; once the activity of the venture capitalist has alleviated the information problems, the banks might well be ready to grant loans; and, finally, the

[21]This proves and optimal form of financing in the case of incomplete contracts (Hart, 2001), since it allows for the possibility to define a priori the *process* that will be involved in the power of control over future decisions. In fact, Dewatripont and Tirole (1994) demonstrate that, should *worst states* and thus low profits result, it is preferable to hand control over to the VC (in this case more risk-averse), while in the case of *good states* and thus high profits it is better for control to be exercised by the entrepreneur-innovator (who is less risk-averse).

[22]In this case, too, venture capital financing shows hybrid debt/equity features.

venture-backed firm could be facilitated in finding subscribers in the case of an IPO (Lerner, 1994; Black-Gilson, 1998)[23]. As in the case of finance staging discussed above, this function, too, which is not strictly financial (*reputational capital*) is often conditioned and split so that an incentives compatibility constraint is respected in the action of the entrepreneur-innovator.

4. The new pecking order for innovative firms

In the previous section we saw how *venture capital financing* actually offers a way to overcome the problem of market failure for the financing of innovative firms. Nevertheless, although VC enhances the efficiency of the financial system, it is not suitable if the projects to be financed are at the embryonic (*seed*) stage, and/or call for limited financial resources.[24] This happens when there are marked scale diseconomies of in the management and monitoring (*small ticket problem*) which discourage venture capital financing. Moreover, as we saw in the previous section this entails the possibility of rapid disinvestment through IPO: the firms that have advanced beyond the start-up and early growth stages, and are thus at the stage of sustained growth, must of necessity look to other forms of financing (credit, issue of shares and bonds). Thus, in the case of innovative firms, too, despite the fundamental role played by VC, there is still a hierarchy in the sources of financing. This hierarchy will depend on the sizes of the firms, but above all on the various stages of development to which correspond different degrees of information opacity and financial requirement: it is a matter of what is known as the *financial growth cycle* (Berger-Udell,1998).

On the basis of the financial growth cycle, before turning to the organized private equity market (which includes VC financing), the

[23]During placement the function of intermediary agents is provided for to act as sponsors; suffice it to mention such figures as nominated advisors, designated sponsors etc. (cf. Petrella, 2001, p. 15).

[24]In order to analyse the financial hierarchies, together with the stage of development it is also important to consider the size (small-medium-large) of the innovative firms (Berger-Udell, 1998).

innovative firm resorts to two "informal" forms of financing: a) *insider financing* (Avery-Bostic-Samolyk, 1998), or in other words use of the capital in the possession of the entrepreneur-innovator and/or members of his or her family; b) *angel finance* (Lerner, 1998). While the outlay of resources by the entrepreneur himself and/or members of the family[25] characterises above all the seed stage, *angel finance* is among the possible resources for the subsequent stage of development (*start-up*). *Angel finance* consists of direct (non-mediated)[26] provision of risk-capital in the early stages of innovative projects calling for limited financial resources. More often than not it is a matter of affluent entrepreneurs, still active or retired, who have no parental ties with the innovator and are looking to diversify their wealth (cf. Petrella, 2001).

At the seed stage of the innovative project there are also two forms of easy-term public financing that are taking on increasing importance, above all for the small-size firms. Suffice it here to recall SBIR (Small Business Innovation Research) and SBIC (Small Business Investment Company) in the USA[27], the ETF (European Technology Facility), I-TEC (Innovation and Technology Equity Capital) and LIFT (Linking Innovation, Finance and Technology) in the European Union. The effects that can derive from *easy-term public financing* are both direct and indirect, and have come under the scrutiny of various authors (David-Hall-Toole, 2000; Klette-Moen-Griliches, 2000). In an empirical analysis Lerner (1999) demonstrates, in particular, that firms having access to this finance channel show the fastest growth due largely to the "*quality certification*", thanks to which they are subsequently able to obtain further funds on the market.

Continuing with our analysis of financial hierarchies, we observe that, given the peculiar characteristics of the innovative firms discussed in section 2, VC as a form of *private equity* generally proves to be the source the entrepreneur-innovator draws upon *after* having resorted to the three

[25]In the case of small innovative firms the entrepreneur in need of financing may even be driven to give in guarantee assets of his own or his family's property: in this case he is resorting to forms of outside collateral, since he is tying up assets that are not the property of the firm.

[26]Reference is made to the *informal* private equity market (Berger-Udell, 1998).

[27] Taken together, in 1995 SBIR and SBIC supplied 2.4 billion US dollars, 60% more than the VC financing of that year.

sources mentioned above, but *before* drawing on credit. The traditional hierarchy considered in section 1, which sees the use of *debt capital* preferred to *risk-capital* is in fact perfectly *inverted* in the case of the innovative firms. The innovative firms can resort to bank financing only after obtaining resources through VC, and this applies regardless of the size of the firms. If they are to be able to draw upon credit it is also necessary for the immateriality of the capital assets employed to be reduced, as well as the information opacity (Berger-Udell, 1998).

More in particular, from the point of view of the financial hierarchies the *financing growth cycle* shows that VC financing proves the most appropriate source above all for the start-up stage[28], characterised as it is by the need for substantial resources and a degree of information asymmetry and risk that remains high, although not so high as in the previous seed stage.

Thanks to the action of the venture capitalist as producer of information, the innovative firm sees its opacity steadily clearing, which opens the way to other forms of financing. However, in order that the financing of innovation prove optimal the need is that there be, alongside VC, a second, efficient and transparent market[29] allowing for the unfreezing of the capital invested via the IPO exit. Between the VC action and the presence of a share market facilitating the quotation of innovative firms there are, in fact, synergies at work, and with them a close relation of complementarity. The fact that VC can bring the firms to quotation quite *rapidly* means that the successful entrepreneurs have the option to reacquire control, while VC can release "expert" capital for the financing of new projects (Black-Gilson, 1998). The *shortage* of venture capitalists is due to the shadow cost of dealing with a particular company compared with a new profitable project. For Jovanovic-Szentes (2007) this may explain why VC-backed firms reach IPO earlier than other start-ups and why they are more

[28]This applies above all in the USA, while in Europe venture capital financing can also be used for firms in the early growth stage (Hall, 2002)

[29]With the precise aim of fostering the diffusion of venture capital, in many European countries a great many new securities markets have emerged for innovative firms: suffice it to mention the Nouveau Marché of the French Bourse; the Mew Market of the Italian Borsa; the alternative Investment Market of the London Stock Exchange; Easdaq; the Neur Markt of the Deutsche Borse, etc.

worth. The *price discovery* role played by VC provides agents with further signals that can help in assessment of the innovative firms and facilitate the subsequent business credit by suppliers or bank financing[30].

As for *public equity* and the issue of bonds, they prove viable when the degree of information opacity and risk has been appreciably lowered and the firm has established a sound reputation. We may summarise by saying that the pecking order for innovative firms sees the sources in the following order (Fig. 2): 1) *insider capital, informal private equity and easy-term public financing* (SEED)*;* 2) *venture capital financing* (START-UP*);* 3) *self-financing*, *bank and/or business credit*; (EARLY-GROWTH); 4) direct issue of *bonds* and *public equity* (SUSTAINED-GROWTH).

Between the various forms of financing, moreover, there are interconnections giving rise to complementarity or substitutability between the sources. There is clearly a close relation between *venture capital* financing and the New Markets, as mentioned above. The fact that *angel* financing precedes the use of VC is in turn indicative of the fact that these two finance channels are complementary. As for business and bank credit, they can be seen as substitutes. Actually, recourse to business credit depends negatively on the degree of *relations* firms have with their banks. As we have seen, the financial structure of the firm can also condition the future cost and the availability of other sources of financing (Myers, 2001), and so the degree of growth the firms achieve: obtaining a credit contract may raise the price of shares and favours access to *public equity*.

Conclusions

When the environment considered is one characterised by imperfect, asymmetric information on the capital market between managers-entrepreneurs (*insiders)* and financers-investors (*outsiders)*, the

[30]From the macroeconomic point of view, this can start off a pro-cyclic process, driving towards a stage of boom.

M-M theorem – arguing the total irrelevance of financial structure to investment decisions – proves groundless. In fact, beginning with the contribution by Myers (1984), a substantial part of corporate finance literature has demonstrated that the sources of financing are not perfectly substitutable among themselves, but rather that a positive financial hierarchy (*pecking order*) applies, which sees insider sources preferred to credit, and the latter preferred to the direct issue of shares.

Nevertheless, as we have sought to show in this paper, the *pecking order* comes up for reconsideration if examination extends to the financing of innovative firms. These are young firms, often on a small scale, using mainly immaterial and/or firm-specific assets and in the early stages of development (*seed and start-up*) are unable to generate financial flows sufficient to service debt. These characteristics, together with an above-average degree of information opacity, can imply *equity rationing* or *credit rationing* should the traditional sources of financing (credit or issues of shares) be used. This flaw of inefficiency in the financial system – innovative projects with positive net current value risk not being financed – has in part been remedied with the introduction and development of VC. Venture capital appears as a *hybrid* form of financing: it consists in investment in risk-capital, but is also characterised by the function of intermediation performed by the venture capitalist. Over and above the traditional activities of *screening* and *monitoring,* with venture capital financing it is also possible to allocate power of control over decisions (Kaplan-Stromberg, 2000, 2002), depending on the performance of the venture-backed firm. In this way VC succeeds in reconciling the points of force at work in the *market-centred* financial system with those of the *bank-centred* system (Black-Gilson, 1998; Rajan-Zingales, 2001). As we have sought to demonstrate, however, this does not mean that venture capital financing is the answer to all the problems involved in the financing of innovative firms (Hall, 2002).

In fact, given the considerable scale diseconomies involved in the management and monitoring of the firms resort to VC is not the solution if the projects to be financed are in the seed stage and/or call for limited financial resources. In such cases innovative firms look to *insider*

financing, *angel finance* or *easy-term public finance* (SBIR, ETF etc.). Thus, as we have been at pains to point out in this paper, a *pecking order* still applies in the case of innovative firms, too. More specifically, in the light of the *financial growth cycle* approach proposed by Berger and Udell (which shows how the optimal financial structure will depend on the degree of development achieved by the firm) we have seen that for innovative firms, unlike the traditional firms, risk capital *precedes* debt capital in the *pecking order*. It is only when VC has already performed its function of *information production* and reduced the degree of information opacity that the innovative firm can turn to bank credit. For venture capital to be able to develop its activity it is also necessary, as we learn from experience in the USA and the introduction of New Markets in Europe, for a transparent and efficient second market to be a work, able to ease the process of disinvestment and set the favour the *venture capital cycle* in motion once again (Gompers-Lerner, 2001).

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Appendix

FIG. 1

Pecking order financing and investment for traditional firms (see: Fazzari-Hubbard-Petersen, 1988; Hall, 2002)

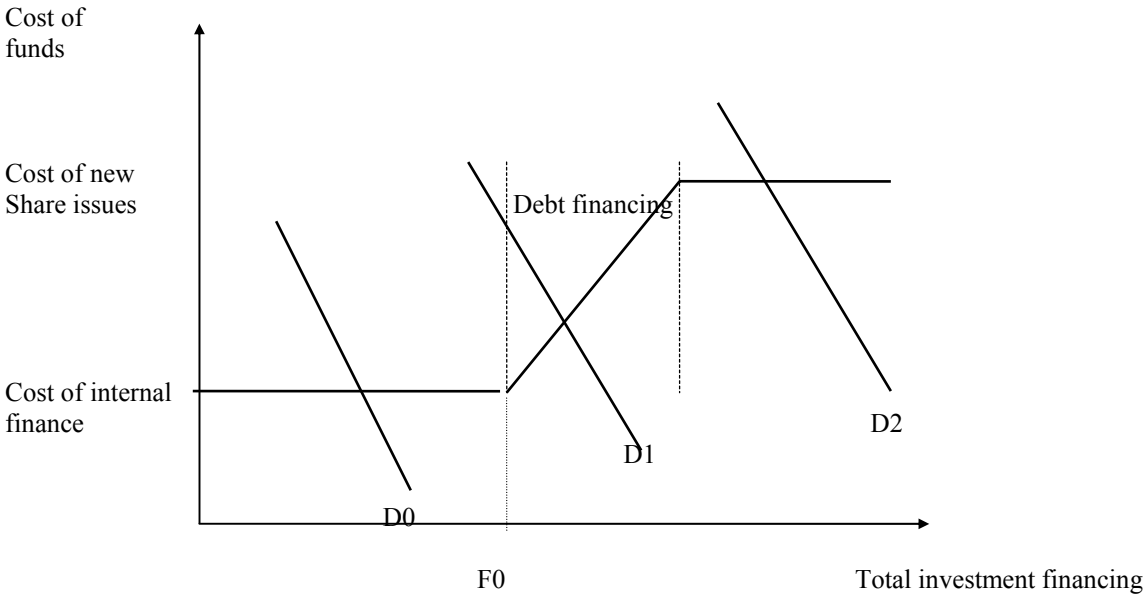

FIG. 2

New Pecking Order for Innovative Firms