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High-tech entrepreneurship in Europe: a heuristic firm growth model and three "(un-)easy pieces" for policy making

Luca Grilli

Politecnico di Milano

Department of Management, Economics and Industrial Engineering

luca.grilli@polimi.it

Abstract

Increasing the number of rapid-growth new technology-based firms (NTBFs) is considered one of the key priority for industrial and innovation policy by the European Commission. Based on the conceptual and empirical literature on the determinants of growth of high-tech start-ups in Europe, this paper builds a heuristic firm growth model for European NTBFs so to individuate three main areas of intervention for policy making aiming at sustaining the growth of NTBFs: i) reducing the social and regulatory burdens arising from firm (honest) failure, ii) acknowledge the localness nature of the venture capital industry and promote territorial marketing initiatives to attract (international) VC players, iii) leveraging the "halo and certification" effect of direct public subsidies and grants towards NTBFs. If recent initiatives of European Commission go into these directions, much remains to be done in order to increase the growth potential of high-tech start-ups in the European landscape.

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1. Introduction

The Europe 2020 agenda has renewed the Lisbon strategy goal of developing an European economy based on knowledge and innovation, where these latter dimensions are deemed to be key inputs for enabling a diffused “smart and sustainable” economic growth, which represents the main European Union (EU) policy target. One (among others) important cause for the EU scarce performance in innovation is individuated in the low presence of high-tech rapid-growth entrepreneurial firms.¹ In the words of the Europe 2020 agenda (European Commission, 2010: p. 10), 'R&D spending in Europe is below 2%, compared to 2.6% in the US. [...] Our smaller share of high-tech firms explains half of our gap with the US'. Firms like Microsoft, Google, Genentech were high-tech start-ups that were able to open up and dominate new industry segments. This type of firms abound in the U.S. but they are relatively rare in the old continent. Creating rapid growth new technology-based firms, henceforth NTBFs (i.e. also called high-tech gazelles, high-tech entrepreneurial ventures, high-tech start-ups)² represents one qualifying point of every policy agenda at the European level in the next short- and long-run future.³ Accordingly, understanding

¹ The recognition by the EU policy makers of an “European paradox” in producing high-level research that does not translate in valuable marketable innovation dates back to the early nineties (see European Commission, 1995).

² NTBF is a category of firms originally coined by Arthur D. Little (1977) that identified with this term an independent owned business (not created by another existing firm), less than 25 years old, active in technology intensive industries and based on innovative activities. Here, we focus on this type of firms. Recently, EU policy makers have also identified young innovative companies (YICs) as an interesting target. YICs are defined by the EU State Aid Rules as small (less than 250 employees), young (less than 6 years old) and R&D intensive (ratio between R&D expenditure and turnover larger than 15%). Academic evidence on the drivers of YICs growth is still scant, albeit they are attracting increasing attention (Schneider and Veugelers 2010, Czarnitzki and Delanote 2013). As to the scope of our analysis, the two categories (i.e. NTBFs and YICs) do not coincide but they clearly intersect. Consequently one could also expect growth drivers to overlap to some extent but empirical research is needed in order to corroborate this speculative argument.

³ The need for targeting policy intervention towards specific typologies of firms, i.e. NTBFs and related in this case, is the prevalent one and commonly shared as by policy makers as by scholars (e.g. Lerner 2009). Note however that is far from being unanimous at both policy and academic levels. See Mason and Brown (2013) for a dissimilar view and a discussion.

how to generate high-tech gazelles in Europe and which is the role of public policy in this domain are fundamental albeit compelling questions.

Given this picture, the aim of this paper is threefold. First, grounding on the extant empirical literature on the determinants of European NTBF growth, we develop a heuristic firm growth model for NTBF growth in Europe. This way, we aim at enucleating those salient elements that characterize the development of an European high-tech entrepreneurial venture, and those causal relationships that the extant empirical literature highlight to be more responsible for NTBF growth. Secondly, based on these consolidated heuristics we individuate three important areas of intervention for European policy making. Contextually, the survey of recent initiatives of the European Commission in these three areas puts on evidence that policy effort is at least partly directed towards the indicated areas, nevertheless it also highlights that much remains to be done in order to increase the growth potential of NTBFs in the European landscape.

The remainder of the article is organized as follows. Next section we illustrate the heuristic firm growth model for NTBFs in Europe. This model will be the base in Section 3 for individuating the three “(un-)easy” areas of intervention for European high-tech entrepreneurship policy. Section 4 concludes the article.

2. The heuristic firm growth model for NTBFs in Europe

The heuristic firm growth model for European NTBFs is presented in Figure 1. Based on a review of the empirical literature on the topic, this heuristic representation outlines the main causal inputs responsible for NTBF growth and highlight the main interrelationships occurring across different actors responsible for the growth performance of NTBFs in Europe. We will analyze the model in detail, and the discussion revolves around three fundamental building blocks: *knowledge capital*, *financial resources* and *complementary assets*.

2.1. Knowledge capital

Founders' human capital represents a key asset for new firms in general (Reuber and Fischer 1999, van Praag 2003), and NTBFs in particular (Cooper and Bruno 1977, p. 21; Feeser and Willard 1990, p. 88). In knowledge-intensive sectors, opportunity identification and its eventual exploitation by entrepreneurs is influenced by their human capital and more related to sectorial-specific competencies possessed by entrepreneurs (Shane 2000 and 2003; Shepherd and DeTienne 2005, Ucbasaran et al. 2008).

The great uncertainty and the highly incomplete informational context that typically surround high-tech sectors plus the non-transactional and idiosyncratic nature of entrepreneurial judgement (Schumpeter 1911; Knight 1921) make also difficult for individuals to pursue business opportunity without creating a brand new firm (e.g. the so called 'cephalisation' process firstly hypothesized by Knight 1921). The fact that business ideas are not tested make also impervious for would-be high-tech entrepreneurs to attract (especially at firm's inception when the NTBF has no track record) high-skilled workers, with the consequence that a NTBF's competences are very likely to largely coincide with those of their founders. As a matter of fact, the positive impact of founders' human capital on the growth performance of NTBFs is well documented not only in the U.S (e.g. Eisenhardt and Schoonhoven 1990) but also in the European context by several studies (see Almus and Nerlinger 1999 for Germany; Colombo and Grilli 2005; 2010 for Italy; Ganotakis 2012 for United Kingdom). Overall, the empirical literature in this field, by highlighting this basic result, also stresses other important related findings. First, the positive impact of founders' human capital may not be only due to a "*wealth effect*" (i.e. the fact that to high levels of human capital correspond on average wealthier individuals and thus a greater level of personal financial resources invested in the start-up) but also be prompted by a "*capability effect*" (i.e. the skills and competencies of the founding team, see e.g. Colombo and Grilli 2005). In this respect, the 'jack of all trades-master of none' 's stylization of the entrepreneur (Lazear 2005) seems not to be totally paying out. More precisely, what appears to really matter in fostering growth performances for high-tech start-ups is the 'specific' rather than 'generic' (or 'general') components of human capital

(see Becker 1975, for the seminal distinction). Into the ‘specific’ attribute the entrepreneurship literature generally includes all those technical and commercial competencies that founders can directly and immediately apply to the new business and have been primarily gained through professional experience in the same markets and industries on which the NTBF is called to operate. With generic (or general) human capital it is usually referred to all the knowledge that has not direct application into the business (e.g. primary education). The former component appears to be a *sine qua non* condition for ensuring success in high-tech. NTBFs whose founders are characterized by a strong technological core appear to be more likely to rapidly growth, especially when these specific technical skills are also combined with professional experience on how to commercialize products/services/technologies into markets. A third important element, is that founders’ human capital contribution seems not to be transient and transitory. But strictly adhering to the *imprinting* vision of the firm (Stinchcombe 1965; Boeker 1988) for which initial conditions shape much of the subsequent life of an organization,⁴ this empirical literature suggests that founders’ human capital continue to be an important determinant for firm growth and performances for a long period and well-beyond the actual presence of the founding entrepreneurs into the top management team of the firm (see Thompson 2005).

A second important contributor to the knowledge capital necessary for the NTBF to stay competitively in the markets and prosper is represented by the support of venture capitalists (VCs). Especially in the European context, this typology of investors are found not only to play an important role as financiers of new high-tech entrepreneurial ventures, but also to provide guidance, monitoring and coaching functions to the investee companies. Despite the “thinness” and embryonic stage of development of the VC industry in most EU Member States (see Gregoriou et al. 2006), VC appear to exert a relevant “*build winner*” function in the European context. In this

⁴ See for example Boeker (1988, p. 34, italics in original): “while organizations undergo modifications and display varying degrees of flexibility, *they are cast at birth into a mold that is discernible in all subsequent stages of their life cycle*”.

respect, European VC market does not seem to be characterized by the same sorting mechanisms between investors and investees individuated by Sørensen (2007) for the US market where VCs appear to be particularly able in “*picking winners*” rather build them. Extant work on VC investments in Europe failed to detect any significant “selection” effects (Engel 2002, Bottazzi et al. 2008; Colombo and Grilli 2010, see pp. 622 and 623). In other words, European VC investors do not seem to invest in firms with (ex-ante) superior growth prospects. Conversely, even if the literature on the European context is still limited (probably mirroring the smallness of the continental VC market), a relevant “*build winner*” function (the definition is due to Baum and Silverman 2004) is put on evidence by Colombo and Grilli (2010), Bertoni et al. (2011) for the Italian case, and also by Engel and Keilbach (2007) for Germany. This “*build winner*” or “coaching” function (Hellman and Puri 2002, see also Sapienza 1992) is found to embrace a series of activities ranging from strategic consultancy activities (see Bertoni et al. 2011 for Italy) to labour market recruitment (see Bottazzi et al. 2008 for Europe) passing through budgeting and corporate governance. Networking is another fundamental “value-added” function exerted by VC: as a matter of fact, VC-backed firms may benefit from the business contact network of VC investors, the network of other firms invested by the same VC operators or, in the case of corporate venture capital, simply the industrial company’s assets behind the financial branch. In all cases, NTBFs may gain access to resources that would probably remain out-of-reach for a non VC-backed venture (Hsu 2006, Lindsey 2008).

Finally, the building block represented by *knowledge capital* is completed by the intermediate link existing between founders and VC investors. Founders’ human capital is in fact an important criterion for driving VC selection. This way, founders’ human capital other than a direct capability effect may also exert an indirect positive impact on NTBF growth by attracting VC investment. Audretsch and Lehmann (2004) find this indirect role for what concerns educational achievements of the top management team members for a sample of German firms listed in the Neuer Markt. Lahr and Mina (2012) found similar findings for the UK. Colombo and Grilli (2010) highlight this

indirect role particular vivid for founders' economic education and managerial experience, testifying how upon its technological core, the NTBF needs economic and managerial competencies to interact with stakeholders, adopt an economically suitable strategic vision and possibly closing eventual cognitive gaps with important potential investors.

2.2. Financial resources

In their 1998 article in *Research Policy*, Storey and Tether, discussing about different policy schemes available in Europe for NTBFs, acknowledge 'the near universal recognition of the presence of market failure in the provision of finance for new technology-based firms' (p. 1049). Accordingly, the presence of important financing constraints that hinder the development of (European) NTBFs has been documented by a great number of empirical studies (Revest and Sapio 2012 provide an updated review).

Simply put, banks and other traditional lenders are reputed to be unsuitable to provide adequate financing resources to NTBFs (Carpenter and Petersen 2002). The main reasons are rooted in the information asymmetries existing between parties that lead to adverse selection and moral hazard concerns of the investor and to the often little collateral value of the NTBFs' assets in order to secure debt financing. These problems are exacerbated by the lack of a track record commonly suffered by any relatively newly created entrepreneurial venture. The first main consequence is that, especially at the beginning of the operations, the firm strongly relies on the financial resources brought into the firm by its founders, familiar members and friends. Clearly, since high levels of human capital are more often associated to higher levels of income and wealth, the already mentioned "*wealth effect*" of human capital is another channel through which entrepreneurs' human capital impacts NTBF growth. Accordingly, initial size of operations of new firms is found to be strongly determined by the level of founders' human capital by a number of studies (e.g. Mata 1996) and the relationship is also found to hold for NTBFs (see e.g. Colombo et al. 2004). The capacity to fuel firm growth with internal resources appears to be important also in subsequent stages of the life cycle (see Westhead and Storey 1997 for UK, Bertoni et al. 2010 for Italy).

The same problems associated with bank lending, conversely make VC financing particularly suitable for NTBFs. The problem for European high-tech entrepreneurship is that VC industry is still very underdeveloped in continental Europe (detailed figures are offered in Gregoriou et al. 2006; Revest and Sapio 2012; European Parliament 2012). The ratio between VC and private equity (PE) investments was estimated in 2009 to be 17% in Europe and 67% in the US (sources: European Venture Capital Association, EVCA; National Venture Capital Association, NVCA),⁵ and the overall value of VC investments over the GDP is nearly three times higher in the US than in Europe (Bertoni and Croce, 2011). The recent financial crisis has further weakened the European VC fundraising capacity in the biennial 2010-2011.⁶

It is worth remarking here that VCs are specialized and experienced investors. Other than the above discussed “coaching” function, VC investors are able to individuate interesting business projects and provide them with the necessary financial resources. Equally important, VC investors actively monitor portfolio companies and adopt all the necessary steps to align entrepreneurs and investors’ objectives (Kaplan and Strömberg 2003, 2004). Accordingly, VC investment is found to exert a positive impact on NTBFs growth by the majority of studies (for an ‘European exception’ see Bottazzi and Da Rin 2002, see Bertoni et al. 2011 for possible data issues explaining this discrepancy). Positive (and economically significant) influence is detected by Alemany and Marti (2005) in Spain, Manigart and Van Hyfte (1999) in Belgium, Audretsch and Lehmann (2004) and Engel and Keilbach (2007) in Germany. The analysis of this literature leads us to identify two important facts. First, compared to US, there is a great degree of institutional heterogeneity within the macro ‘VC category’. In other words, the European landscape appears to be characterized by typology of investors, like governmental and bank-affiliated operators, which in other (developed) VC markets play a marginal role. According to the recent built VICO dataset that collected data on

⁵ VC investments include seed, early stage and expansion deals. PE investments also include buyout deals.

⁶ In the first three quarters of 2011, the European VC fundraising was estimated to be EUR 1.7 billion, which is slightly more than half of the total VC fundraising realized in 2010 (Kraemer-Eis and Lang, 2011).

a large sample of high-tech entrepreneurial firms operating in seven European countries (Belgium, Finland, France, Germany, Italy, Spain and the United Kingdom),⁷ if independent US-style VC account for the 55% of the VC investments in European NTBFs effectuated between years 1994 and 2004, VC investments by public and bank-affiliated investors represented c.a. 19% and 15% with a remaining 11% that is attributable to corporate venture capital (source: VICO 2011). Despite of the fact that the empirical literature is limited on the issue, the available (growing) empirical evidence suggests that this heterogeneity also greatly translates into different capability to foster NTBF growth. The reasons of these difference may be rooted in different objective functions across investors or unequal distribution of capabilities across VC institutional typologies. But recent empirical studies based on European samples, like those of Bertoni et al. (2013), Devigne et al. (2013), Lehmann (2006), put on evidence how different institutional VC investors and a different structure of VC syndicated investments in terms of the characteristics of syndication members lead to substantial different outcomes as to the growth of VC-backed NTBFs. The second important structural trait of the European VC market is its localness, and in this aspect it conforms very much to more developed VC markets, U.S. *in primis* (see Gompers and Lerner 2001). According to VICO figures, the internationalization rate of EU VC investments is rather modest (only 16% of the c.a. 2,000 investments were cross-border) and mostly important data show a dramatically high geographical proximity between the location of the VC investor and the one of investee NTBFs: for almost 30% of the VC investments, air distance between locations is inferior to ten kilometers, the percentage increases to almost 50% for an air distance of 50 kilometers; the target firms are located more than 300 kilometers away from the location of the investor only for the 28% of the investment events. Recent econometric analyses confirm the relevance of spatial proximity in the VC decision process also in very infrastructural dense areas (see Lutz et al. 2013 and their analysis based on

⁷ VICO dataset is the result of a research project funded by the 7th Framework Programme of the European Commission (theme SSH-2007-1.2.3 – Grant Agreement 217485). The dataset includes information on 759 VC-backed companies that received their first round of financing between 1994 and 2004, for a total of 1,903 first VC investments (and 3,475 different rounds) made by 948 investors. On the procedure used to collect data see Bertoni and Marti (2011).

Germany). This “local” vocational characteristic which seems to hold irrespective of the geographical context (i.e. it applies to Israel as well as to the U.S and the European context) is an essential element to be kept in consideration by policy makers who aim at sustaining the creation and the development of a florid VC market.

2.3. Complementary assets

NTBFs are unlikely to possess all the tangible and intangible assets which are necessary to sell their products/services/technologies in the corresponding markets. Simply, they need to interface and establish links with other organizations and thus gain access to the assets of these latter in order to sell their knowledge embodied in product/services/technologies (Teece 1986; Gans and Stern 2003). One fundamental typology of such organizations are universities and other-related public research institutions (public research organizations, PROs henceforth). In principle, informal links and formal explorative alliances established with PROs, which may also contemplate the use by NTBFs of university facilities like space and machinery in technology incubators or science parks, provide NTBFs with the necessary physical and knowledge assets to be innovative and grow. The importance of these (formal and informal) ‘knowledge inputs’ provided by PROs towards NTBFs is well documented in the U.S. context (e.g. Zucker and Darby 1996, Zucker et al. 1998) and has also been validated in the European context with reference to NTBF growth performance, with the firm’s absorptive capacity representing an important moderating factor (e.g. Audretsch and Lehmann 2005, Colombo et al. 2010). In this respect, and in line with the literature on localized knowledge spillovers (e.g. Jaffe et al. 1993), geographical proximity to universities and location in technology incubators and science parks is found to help European NTBFs establish valuable links (e.g. Lindelöf and Löfsten 2004; Patton and Marlow 2011); even if, overall, the role played by such structures in the European landscape in terms of spurring growth and innovation of incubated start-ups remains much more controversial (see for example Schwartz 2011 on the German experience).

Plausibly, other crucial providers of complementary assets to NTBFs are represented by (large) firms, and this basically holds whether the NTBF decides to act in the market for technology/ideas

or sell in the product market. In the former case the NTBF's technology or services are simply sold or licensed to other firms, and thus the NTBF commercialization totally relies on the acquirer firm(s). In the latter case, in order to reach product markets, NTBFs have to gain access to commercial assets (brand, distribution channels, etc.) which would be too costly or inefficient to replicate and they so are often in need of stipulating commercial exploitative alliances with (large) incumbents. But firms do not represent only a vital partner for a NTBF commercialization's strategy. Analogously to PROs, they can be source for trying to build new knowledge useful for NTBFs (explorative technological alliances) or be complementary for combining knowledge with exploitative purposes (e.g. exploitative technological alliances, see e.g. Mowery et al. 1996, Nakamura et al. 1996). Allegedly, NTBFs are called to operate in a continuous tension between exploitation activities of their knowledge and exploration and acquisition of new knowledge and resources. The capacity of efficiently managing this trade-off, i.e. develop *ambidexterity* capabilities, is an important trait of successful NTBFs (Lavie et al. 2011). Despite of the fact that technological (explorative or exploitative) alliances might entail important (opportunity) costs (see e.g. Kelley and Nakosteen 2005), participation and inclusion in alliance technological networks is on average found to benefit NTBF growth performance (e.g. Baum et al. 2000, see Lavie 2006 for a conceptual discussion), even though the literature highlight important moderating factors at work (e.g. Rothaermel and Deeds 2006, Sampson 2005). Among them, and focusing on the European-based evidence, the absorptive capacity of members and network stability, location and heterogeneity of members plus (of course) innovativeness and prominence of members appear to be all important discriminating factors for network success (e.g. Hurmelinna-Laukkanen et al. 2012) .

Here I focused on the two main actors providing complementary assets (PROs and large firms) necessary for NTBF growth, but of course, there can be many other important stakeholders (ranging from non-research institutions to employees or end-users) providing valuable resources to the

development of the NTBF.⁸ What is arduous to controvert is the necessity for a NTBF to access resources provided by other actors of the economic system and the need for finding fitting business partners. In this respect, NTBF may encounter greater difficulties since their lack of a track record translate into deficiency in reputation and consequent great uncertainty about their true value. In other words, those information asymmetries that may make difficult for a NTBF access traditional external financing resources may also make hard access other equally needed complementary assets. Interestingly, the empirical literature on NTBF alliances highlights how PROs and VCs may play an important sponsorship or endorsement function with respect to NTBFs. The brokerage and endorsement function provided by VC may increase a NTBF's capacity to stipulate exploitative commercial alliances with other (large) firms (e.g. Hsu 2006); and formal or informal relationships with PROs may ease NTBF's access to alliance research networks (e.g. Di Gregorio and Shane 2003).

2.4. The role of public policy towards high-tech entrepreneurship

Two reasons figure prominently for advocating policy intervention towards high-tech entrepreneurship (e.g. Peneder 2008). First, the social optimal level of R&D expenditures may be higher than the private optimal level due to the presence of R&D spillovers. High-tech entrepreneurial ventures may invest less than the social optimum because they are unable to defend innovation and extract most of the rents in the product market (Teece, 1986; Griliches, 1992; Jaffe, 1996). Second, as emphasized in the incipit of paragraph 2.2, a large body of empirical literature on entrepreneurship has pointed to the presence of important financial constraints suffered from NTBFs (Westhead and Storey, 1997; Storey and Tether 1998; Carpenter and Petersen 2002). The typical short-run policy instrument aimed at solving these market failures is the provision of direct subsidies to NTBFs. The empirical literature on the effects of public subsidies towards NTBFs is

⁸ Related to this concept of multiple providers of complementary assets to the NTBF (and multiple contributors to its knowledge base) it is the paradigm of open innovation (Chesbrough 2003) which view modern firms more and more permeable with the external environment and dependent on outside actors in order to generate innovation and profiting from new technologies.

scant, with much of the attention mostly concentrated on the related albeit slightly different question of whether R&D subsidies to firms (not necessarily young and small ones operating in high-tech sectors) complement or substitute private R&D financing (see David et al. 2000 for a review of the early studies, and e.g. Almus and Czarnitzki 2003, Gonzalez et al. 2005, Czarnitzki and Lopes-Bento 2013, Takalo et al. 2013 for more recent European-based evidence on the issue). Despite of the fact that this literature on average highlights positive effects of policy measures and does not support the R&D crowding-out hypothesis, the few contributions available with a more strict focus on NTBFs (or related) cast more than a doubt on the effectiveness of this direct approach (for a skeptical view, see also Santarelli and Vivarelli 2002). Schneider and Veugelers (2010) fail to detect a significant positive effect of subsidies towards the performance of a sample of German YICs (which include NTBFs). Similar findings also applies to the Italian context (see e.g. Colombo and Grilli 2006), where nonetheless, the impact of subsidies is found to be contingent on the “type” of granted support. In particular, if “automatic” subsidies seem not to have any effect, “selective” ones have a greater and significant impact on the growth of NTBFs, especially when the firm is very young and lack a track record (Colombo et al. 2013).⁹ These results suggest that more than a direct (often small) financial contribution to NTBFs, an indirect and intangible “certification and halo” effect (e.g. Lerner 1999) of policy intervention may be more important for NTBFs exerting the same benefic function on them of the one highlighted before and arising from the endorsement and sponsorship of other reputable organizations.

A second important level of intervention of policy making is in the long-run and it aims at constituting a favorable eco-system for the creation, consolidation and growth of NTBFs. Entrepreneurs, researchers and innovators are influenced by the society in which they are

⁹ Colombo et al. (2013) defines an automatic subsidy as a scheme that gives financial assistance to applicants fulfilling the requirements specified in the law. For selective subsidies are intended those schemes that provide financial support to selected applicants, where applicants compete for receiving the subsidy. Typical examples of “automatic” subsidies are the French *Credit Impôt Recherche* or the Norwegian *SkateFunn* tax exemption scheme. The paradigmatic example of a selective scheme is represented by the Small Business Innovation Research (SBIR) program in U.S. Other examples of selective subsidies in the European context are those of the Law 488/92 in Italy or the funds provided by the Finnish Innovation agency, Tekes.

embedded. The system of values (i.e., formal and informal norms, cultural traits, social and monetary incentives and rewards) that historically emerges in a society may be sub-optimal from a social point of view for carrying on entrepreneurial, research and innovation activities at an individual or global level (Baumol 1990).

Public policy may play a crucial role in (re-)shaping the ‘rules of the game’ and determining on a long-term perspective an institutional background encouraging the entrepreneurial spirit and innovative activities (see also the wide literature surveyed by Edquist 2004 on the concept of National Innovation Systems). In this respect, it is almost impossible to list all areas of interest for policy making and all possible actions that public policy may undertake at various playing fields, ranging from cultural and educational aspects to more immediate measures (e.g. adequate financial and labour market regulation reforms favouring VC investments). What is important to remark here is the value, especially from a policy perspective, to always keep in mind that (high-tech) “entrepreneurial activity does not exist in a vacuum” (Lerner 2009, Chapter 1).

3. Three “(un-easy) pieces” for European high-tech entrepreneurship policy

Grounding on the heuristic firm growth model for European NTBFs developed in the previous Section and revolving around its three key building blocks, it is possible to identify three specific areas of intervention for European high-tech entrepreneurship policy making.

3.1. Policy focus on firm exit rather than entry

In a famous article Arthur (1996) sentenced that high-tech entrepreneurship is not for everyone. Our review corroborates this statement. (Specific) highly-sophisticated competencies and skills have to be put in place in a continuous learning effort and knowledge renewal process in order to create NTBFs that have chances to be successful and rapidly grow in market’s acceptance. Adopting this perspective, it is important not just to encourage more people to become entrepreneurs but to push those who have chances to succeed to create their own high-tech business.

Thus, coming to a policy point of view when not the quantity of new entrepreneurs is important but it is the quality of those who decide to switch to (high-tech) entrepreneurship that matters, it is very likely that lowering the administrative and monetary barriers for entry into the self-employment condition is less effective than alleviating burdens arising from the exit (for a similar view see also Eberhart et al. 2012). In this respect, at the European level, policy interventions are needed not only at the regulatory level but probably most importantly at the cultural level. As to the former, still only few European countries have in the recent past adopted new law reforms for bankruptcy (e.g. Italy in 2007 and 2012, France 2006), but the focus remains mainly on enlarging the options for rescuing financially distressed companies rather than enabling a rapid second start for a (honest) entrepreneur experiencing a business failure.¹⁰ In this respect, Armour and Cumming (2006) neatly highlight how a regulatory switch to a “fresh and rapid start” may heavily affect (high-tech) entrepreneurship dynamics: for example, their estimates show that “the changes in the bankruptcy legislation in Germany (occurred during the late 1990s) increased the size of the German venture capital market by 6.4%” (p. 620). But still much remains to be done.¹¹ The recent economic financial crisis does not seem to have shifted the policy’s attention from incentivizing entry into self-employment to easing the social and regulatory burden associated with entrepreneurial exit. New programs have been recently launched at this scope both in Europe (e.g. Gründerland Deutschland in Germany; Startup Britain in U.K.) and in the rest of the world (e.g. Start-up America in U.S.; Start-up VISA Canada), despite the scientific evidence is doubtful on the long-run efficacy of these policy interventions (for a very skeptical and to some extent harsh view on the issue see Shane 2009’s article in *Small Business Economics* that has the emblematic title of “Why encouraging more people to become entrepreneurs is bad public policy”). Overall, in the European

¹⁰ An interesting point of view, based on personal experience as a (high-tech) entrepreneur matured both in the U.S. and Europe, on the different application of the “limited liability” norm between the two geographical contexts is offered by Gary Stewart in an article of *Forbes.com*, 19/11/2010, which has the self-explaining title of: “How Europe destroys entrepreneurship”.

¹¹ Interestingly, this same view is shared by the European Commission (2009, p. 74): “While most Member States have introduced or are introducing changes to their bankruptcy regulations on a step-by-step basis, the true importance of bankruptcy regulation for high-growth entrepreneurship is still to be fully recognised in most Member States”.

Union of 27 State Members, considering the period 2000-2009, there were only 16 reform measures for enabling a rapid second start for failed entrepreneurs against 58 policy interventions for reducing administrative burdens for the creation of start-ups (source: MICREF database). But if there is room for intervening on a regulatory and legislative basis, no less important is from a public policy's point of view, to help reducing those burdens associated with business failure that arise from a cultural sphere. The European "stigma" of business failure is well-expressed by Thomas Mann, in his masterpiece "Buddenbrooks" (1901). In the extract below the founder of the dynasty approaches his daughter (Tony) and tell her that the entrepreneurial initiatives of her husband (Grünlich) are in troubled waters. This is Tony's reaction to the news (*italics mine*, p. 216):

"Grünlich is bankrupt?" Tony asked under her breath, half rising from the cushions and seizing the Consul's hand quickly. "Yes, my child," he said seriously.

"[...] "Oh, my God!" she suddenly uttered, and sank back on her seat. In that minute all that was involved in the word "bankrupt" rose clearly before her: all the vague and fearful hints which she had heard as a child. "Bankrupt" — *that was more dreadful than death, that was catastrophe, ruin, shame, disgrace, misery, despair.* "He is bankrupt" she repeated.

Starting to build a mentality that failure does not equate to a "death sentence", it is extremely needed in the European context. Clearly, initiatives in the field may be multiple and all have necessarily returns on a long-term perspective: positive examples can be drawn from international experience, like for example the Singapore award for the "best failed business" (its role in creating a fertile and risk-love attitude in that specific context is analyzed by Lerner 2009). In this respect, it is worth emphasizing that the legislative and the cultural layers of policy intervention are mutually interdependent. But a systematic approach at the European level that embraces both of them is still lacking in the EU policy making. The costs for this inactivity in terms of immaterialized business opportunities risk to be extremely high. Skype represents an example of a high-tech start-up that seriously risk not to appear (at least in the European context) because of precedent failed entrepreneurial experiences by its founders. As reported by the co-founder Niklas Zennstrom, the Skype founding team received 26 rejections before obtaining a VC investment (from a US investor conditional on obtaining additional funds by local partners):

“We tried to raise money, and we weren’t successful. Kazaa (the previous company) was a success in terms of a lot of people using it but it was a failure from a financial point of view. We didn’t make any money at all. It caused me a lot of hassle to deal with for several years.” [Dublin Web Summit October 2010, reported in Stewart (2011)].

Skype was sold to E-bay in 2005 for 2.1 Euro billions, later bought it back and then re-sold to Microsoft for 6 Euro billions. The possibility that a certain number of other Skype-type companies do not simply come to light because of the legislative and cultural burdens originated by previous entrepreneurial failings is worth of some reflection by European policy makers.

3.2. Policy recognition of the “local” and heterogeneous nature of the Venture Capital industry

As illustrated in the heuristic model, venture capital may represent and often represent *a sine qua non* condition for enabling NTBF growth. But from a policy perspective, two important stylized facts emerge. First, venture capital is a broad and undifferentiated category that, as a matter of facts, hides a great degree of heterogeneity. These differences across investors range from their institutional nature to their managing experience, passing through knowledge of technologies and markets. These differences quite naturally also translate in different capabilities in fostering investee growth. Second, regardless of the stage of development of the market, VC appears very much a “glocal” business: if VCs invest in a foreign country, they locate nearby the investee firms, so to be able to better exert a monitoring function and provide value-added services. Accordingly, an effective policy making intervention in this area is likely requiring to attract *specific* VC operators towards *specific* areas of interest. First of all, a suitable policy approach would reconsider the opportunity and the modalities of a “hands-on approach” in the venture capital market with the setting up of government management VC funds. Conversely, it would point more promisingly towards an indirect intervention with the implementation of public co-financed schemes of private initiatives (like the Yozma program in Israel and the New Zealand Venture Investment Fund, see Lerner 2009). Secondly, it would command a prior effort in the identification and eventual matching of both geographical eco-systems (jointly made by local facilities, university, entrepreneurial and innovativeness culture), and selected credible (foreign) investors for those

specific areas. Then, publicly-sponsored *territorial marketing* activities directed to these (international) investors (like meetings, events, planned visits, road shows, regulatory advisory and consultancy services) are likely to be more effective than other general mere monetary or fiscal measures (on the importance of these “soft” public services at local level see also Hospers et al. 2009; Nishimura and Okamuro 2011).

In this respect, if the importance of a florid venture capital industry is well understood at the European Union policy level, the implemented and envisaged measures appear to have not yet recognized the local nature of the business and the typical high degree of heterogeneity of its actors. In particular, starting from the first programmatic documents (e.g. “Risk capital: a key to job creation in the European Union”, EU, 1998) much of the focus has remained anchored to a “national” playing level field and most of the effort has been devoted to removing tax obstacles and avoiding double-taxation regimes across national systems in order to favor cross-border investments (see for example the European Commission “Single Market Act I”, April 2011, p. 6). Without neglecting the importance of these macro policy interventions, nascent venture capital markets would certainly benefit from the contemporaneous locally micro approach depicted above.

3.3. Policy “certification” effect

The recent economics and financial crisis (and the level of national debt in many EU countries) constrains budgets for direct sustainment of (high-tech) entrepreneurship. But NTBFs may still benefit from a direct policy making intervention, to the extent that this latter, without providing large financial support, is nevertheless able to exert its “stamp of approval” on selected business projects and facilitate endorsed NTBFs in their relationships with third parties. As suggested before (see Section 2.4), this requires the implementation of policy measures explicitly and strictly targeted to high-tech entrepreneurial ventures (and related); in other words, a policy shift from horizontal “automatic” measures to vertical “selective” schemes. Without granting large sums of financial resources, these schemes have to be able to trigger and magnify the *certification effect* of the policy measure. Allegedly, it is of paramount relevance that they are administered by appointed

committees composed by competent professionals and experts. The larger the reputation of selectors the greater will be the certification effect stemmed from their decision. Then, it is equally important that application procedures do not entail substantial participation costs. First of all, because in this way it is possible to avoid any type of adverse self-selection out mechanisms which is extremely likely in this context, since time's opportunity costs is an increasing function of competence and skills and the absence of founders' slack may lead valuable business projects to stay out of the competition. Secondly, the certification is powerful only to the extent that it has been gained at the expenses of many contestants, so triggering a strong competition among applicants is a necessary condition to unfold the certification effect.

The US SBIR program represents an often cited example of an effective selective policy scheme aiming at the creation and growth of viable NTBFs. Established in 1982, it required to devote 2.5% of the budget of eleven Federal Agencies to extra-mural R&D and specifically to high-tech start-ups. Constituted by three different stages of financing (i.e. feasibility, potential for commercialization, commercialization), it led to the formation of very well-known high-tech "gazelles" (e.g. Apple, Intel, Compaq, Symantec, Chiron) and its validity has been recognized and acknowledged by a vast spectrum of scientific and non scientific contributions (see Lerner 2009 for an updated review, Wallsten 2000 for a partial exception).¹² Apart from financial and soft competencies brought by Agencies to targeted firms and their (often embryonic) business projects, a conspicuous stream of literature has put on evidence the relevance of the "halo and certification" effect that this type of public intervention brings along. Many scholars and observers pointed to the presence of this "indirect" and non-expensive form of support as one of the principal benefits for SBIR-supported firms, starting from Lerner (1999) till more recent evaluation exercises (see for example, Wessner 2008).

¹² One detailed description and in-depth review of the main features and benefits of the US SBIR program over time is offered by Connell (2006). As to the universal recognition of the benefits of the program, the author states (p. 41): "Whatever weight one places on studies to measure the economic impact of the SBIR (and STTR) programmes in the US, one fact is indisputable. It is virtually impossible to find anyone in either the US public or private sectors who does not believe they play a key role in the national innovation system".

Accordingly, the recent proposal by the EU Commission in Europe 2020 agenda of constituting an European-based program inspired by the American SBIR scheme should be positively welcomed. However, from a policy perspective, it has to be stressed that it may only represent a step in the right direction. The implementation of SBIR-alike schemes in other geographical contexts rather than US has been sometimes far from producing the expected outcomes (see OECD 2010 for a complete review, and Connell 2006 for an insight into the UK experience). Of course even the US SBIR contains some potential risk factors and motive of concerns (OECD 2010); but nevertheless, the main challenge that policymakers have to face seems the one to avoid a mere superficial and only formal re-proposition of the SBIR program without considering that in this context “devils is in the details” (see Connell 2009). In this respect, questions like: (a) who will effectively manage the funds since Europe lacks a system of Federal Agencies like the US; (b) if a system of quotas to EU state members will be put in place in order to govern the allocation rules are not of secondary importance. To the extent that these critical issues will be solved in order to ensure the highest possible degree of competition among the largest number of applicants, the consequent “halo and certification” effect triggered by the policy measure is likely to be extremely beneficial from a social welfare point of view.

4. Concluding remarks

The absence of rapid-growth new technology-based firms (NTBFs) in the European context is deemed by European policy makers as one of the most worrisome structural weakness of Europe and a main obstacle to meet the goals of becoming the most dynamic and competitive knowledge-based economy in the world. European policy makers recognize that without a more vibrant and vital high-tech entrepreneurship sector the European objective of “smart” growth will simply remain out of reach. This paper departs from this starting point, and based on the extant conceptual and empirical literature on the determinants of growth of high-tech entrepreneurial ventures in

Europe, builds a heuristic firm growth model for European NTBFs. By individuating the main critical drivers of European NTBF growth at the empirical level, the heuristic model individuates three specific areas of intervention for policy making aiming at sustaining the growth of NTBFs: 1) reducing the social and regulatory cost for (honest) failing in order to increase the quality rather than the quantity of high-tech entrepreneurs; 2) acknowledge the localness nature of the venture capital industry and promote territorial marketing initiatives in order to attract (international) capable VC players; 3) in the presence of national hard budget constraints and scarce financial resources, leveraging the “halo and certification” effect of direct public intervention in the high-tech entrepreneurship segment in order to ease access of NTBFs towards private external financing sources and complementary assets provided by key stakeholders.

If recent initiatives have steered EU policy in the right direction; in author’s view, policy intervention in most Member States is still too timid and scarce in these three areas for inducing that abrupt and radical change of course in the investigated dynamics that is needed in order to meet the ambitious objectives of the Europe 2020 agenda. Quite obviously, we are conscious that any policy intervention for the growth of NTBFs has to be inserted in a more general and macroeconomic policy approach in order to be truly effective. Nevertheless, our contribution, by documenting on a scientific ground the importance of these three single and specific “pieces” of high-tech entrepreneurship policy making, is aimed at increasing the awareness and sensibility at the policy level towards these themes. By the same token, it also provides an answer to the call of delivering to policy makers less bland and vague operative indications about entrepreneurship policies (e.g. Mason and Brown 2013) and at the same time it invokes a higher degree of factual effort than the one produced up to now by European policy makers and legislators in order to make “easy” these only apparent “un-easy” areas of policy intervention.

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Figure 1. The heuristic firm growth model for European NTBFs



