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Unusual Trajectories in the Growth and Performance of Firms

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Abstract

Firm growth deserves increasing attention from researchers, since it creates employment, generates wealth and enhances general economic development. Besides the generation of new business and ventures, the economic development relies on the existence of entrepreneurs and managers who are able to turn these nascent firms into solid organizations capable of withstanding international competition. According to Rajan and Zingales (1998) in the last two decades the largest part of the increase in the output of the manufacturing industry has been related, at least in the developed countries, to the growth of the incumbent firms while only a minor part has been related to the generation of new ventures. So it is not surprising that growth is considered the "*the very essence of entrepreneurship*" and "*is a subject of all times*" (Sexton, 1997).

As demonstrated by recent reviews (cf. Davidsson, Achtenhagen, & Naldi, 2007), studies about small firm growth are no longer short in supply and large evidence is devoted to the long list of internal and external factors that have been hypothesized and shown to influence firm growth. However, the topic of firm growth is as complex and elusive from a theoretical perspective as it is relevant from an empirical one. In fact, all of the authors of recent review articles complain that a coherent picture is not easy to distill from the literature. Since the review of Gibb and Davies (1990), who concluded that the body of evidence then available was inadequate, our knowledge remains fragmented and still lacks an integrative theory (Dobbs & Hamilton, 2007). This is likely due to differences in theoretical and epistemological perspectives and interpretations, operationalizations, empirical contexts, modeling and analysis approaches, as well as the inherent complexity of the phenomenon itself. Davidsson et al. uphold that it is probably the case that every theoretically reasonable suggestion for a growth determinant has been shown to have the predicted impact in some context and argue that the problem now is to develop better knowledge about the relative and combined effects of the many predictors under different circumstances. In order to deal with this complexity, researchers should developed useful strategies. Suggested ways for dealing with this problem are, for example, to give up ambitions of approaching full explanation but instead enhance our understanding of the interplay among a smaller set of specific factors or to limit the study to a more homogeneous empirical context and studying the effects of a narrow set of theory-driven and carefully operationalized predictors.

In the light of these considerations, the baseline idea of the dissertation is to investigate no more firm growth as a general topic but to look at growth in some specific, relevant settings. Specifically, the dissertation focuses on unusual trajectories in the path of growth of firms and on their related determinants (i.e. on what makes such firms to behave in a different manner than expected). Unusual means that despite in a such environment we can expect or observe a

dominant 'behaviour' in terms of growth of firms, at the same time we can also perceive the presence of behaviors that are different from the dominant one (or at least different respect to what an external observer would expect) but that could be even more interesting. In this sense the concept of unusual is close to that of anomalous. The recurrence of this dichotomy characterizes the whole research framework of the dissertation where the central question is the explanation of what drives this unusual growth. In an econometric comparison, this is the opposite of a regression, as we want to focus on the 'outliers' instead of remove them. Such an approach could give us fascinating insights which haven't still been approached by the academic literature.

The previous research idea has been declined in the dissertation into three essays. The first article (Chapter 2) regards the growth expectations implied in the offer prices of IPO firms. In efficient capital markets we should expect prices to reflect fair assumption about the future growth expectations of firms (also because investors repeatedly buy IPOs); however the article finds that this is never the case. Specifically, it compares the real ex-post realizations of IPO firms with their growth inferred from their offer prices in order to investigate the determinants of such estimation errors.

The second article (Chapter 3) regards hyper-growth firms. Literature seems to suggest that all firms experience growth and that high-growth is the norm, at least for a few, over a firm's life; however, this is not always the case and both high-growth and hyper-growth are the result of sustainable entrepreneurial efforts. This work tries indeed to investigates if hyper-growth firms are inherently different from other firms or if they are simply the results of contingencies and circumstances. The article should also seen as a first attempt to address the topic of hyper-growth which has been neglected by previous academic research.

Finally, the third article (Chapter 4) is devoted to the investigation of emerging firms in mature industries; it tries to shed light on the factors that enable firms facing unattractive and declining contexts to separate their path of growth with respect to the one prevailing in their own business arena. A deeper explanation of each topic is given in the following paragraphs.

Growth expectations of IPO firms: when reality calls

When going public, firms are faced with a difficult decision: how to determine the offer price for their shares. This is a question of considerable practical and theoretical importance to both investors and academics. In an efficient market, the price of an offer should express the firm's value fundamentals and their future expectations, which in turn are translated in Value through some equity valuation techniques. The difficulties in valuing Initial Public Offerings (IPOs) leave a great responsibility to investment banks that take public firms, that in this way are subject to reputation incentives. If the firm is undervalued, its existing shareholders will not appreciate to "leave money on the table"; if the firm is overvalued, the investors will be displeased and cautious in subscribing future IPOs underwritten by the same investment banks. Since underwriters repeatedly bring firms public, they have strong incentives to build a reputation as valuation experts and certify that the offer price reflects fundamental value (Ibbotson & Ritter, 1995). Moreover, as continuously investors buy IPOs and firms go public (despite hot and cold market period) it should be expected that on average offer prices of IPO firms reflect fair assumptions about firm growth expectations. However, this is not always the

case, as this article clearly demonstrates.

There exist two approaches to firm valuation. In direct valuation, the firm's value is estimated from its fundamentals; in relative valuation, it is estimated from the prices of comparable firms. In both approaches, the valuation faces specific difficulties related to the IPO timing decision and could results in an overvaluation of the firm. For example, firms may schedule their IPO in order to take advantage of "windows of opportunity". These are periods of market buoyancy during which other companies in the same industry tend to be overvalued (Loughran & Ritter, 1995). Thus, investors risk over-paying for stock in firms priced using relative valuation methodologies. Besides, firms may decide to go public when they are able to display positive growth opportunities, and thus induce optimistic valuations. To do this, firms may time their IPO for when transitory earnings are high, since investors have difficulty distinguishing between transitory and permanent earnings (this is the signal-jamming explanation given by Stein (1989). Finally, managers may window-dress accounting numbers to make their firms look better (Teoh, Welch, & Wong, 1998). Again, investors risk over-valuation of such firms.

Despite at the time of an IPO valuation is a key issue, the number of studies that address this topic is still slender and the relationship between IPO pricing and the valuation of the IPO firm's fundamentals is still an open question: "*Although it is difficult to come up with accurate valuation measures for IPOs, this literature is promising*" (Ritter & Welch, 2002). The present paper challenges this research gap and contributes to the literature by investigating how much the assumptions implied in the valuation of a company going public are realistic.

Since the seminal paper on valuing IPOs by Kim and Ritter (1999), a few recent papers have investigated the use of multiples of comparable firms to value IPOs (e.g. Berkman, Bradbury, & Ferguson, 2000; Purnanandam & Swaminathan, 2004; Jagannathan & Gao, 2005). All these studies use value estimates produced by researchers to test the accuracy of valuations and typically find that IPO firms are overvalued at offer prices relative to their comparables. This work approaches the problem from a different perspective, examining the accuracy of "real-world" valuation models used by investment banks. Specifically, it refers to continental Europe, where the level of disclosure of assumptions behind an IPO firm valuation is higher than in the US. In particular, it relies on hand-collected data from IPO prospectuses. This is likely the most cost-efficient means of obtaining information about the companies going public (Friedlan, 1994).

By investigating this information, researchers can hope to understand how underwriters arrive at valuations for the firms they take public. Prior studies accessing this information typically report that underwriters frequently use two or more valuation methods, and that DCF and comparable multiples are the most widely used methodologies. Only three other papers investigates how underwriters value the stocks of companies they bring public: Cassia, Paleari, and Vismara (2004) in Italy, Roosenboom (2007) in France, and Deloof, De Maeseneire, and Inghelbrecht (2009) in Belgium. The present study extends their insights by considering IPOs on the three largest stock markets in continental Europe. The empirical setting is the population of all 342 non-financial firms that went public during the period 1995-2001 in France (Euronext Paris), Germany (Deutsche Börse), and Italy (Borsa Italiana), excluding new markets.

This article finds that underwriters typically determine the initial price range for shares using traditional valuation techniques such as the DCF method or the comparable multiples method. Most IPOs were actually priced using both techniques. It could be speculated, however,

that valuation is not necessarily the first step in pricing an IPO. Underwriters may begin by obtaining a reasonable estimate of the IPO price based on current market conditions, recent transactions, or industry multiples, then tune their valuation assumptions accordingly. In other words, the more formal and defendable valuation methodologies could be used to support the underwriters' preferred IPO prices rather than to obtain them (Thomas, 2007). It is therefore of interest to infer the growth expectations implicit in the IPO pricing. There could indeed be considerable reverse-engineering behind the valuation information disclosed in official IPO prospectuses. To this extent, the article investigates a sample of 184 IPOs priced using a DCF model to address a basic research question: at what rates were the IPO firms expected to grow by their underwriters?

To answer this question, an estimation procedure which uses public information is derived to estimate the cash flow growth rates implied by IPO prices. Precisely, the underwriters' DCF models is reverse-engineered to get back the implied growth rates of free cash flow over the next five years. This approach is similar to that of estimating the internal rate of return on a bond using market values and coupon payments. Results show that the market attaches a high growth expectation to IPO firms: the cash flow of an "average" IPO firm is expected to grow by about one-third annually over five years. Unfortunately, ex-post realisations do not meet such ambitious ex-ante targets: the median post-IPO growth rates are only slightly positive (1.8%) over the five years following an IPO. IPO prices are also compared with "fair value" estimates obtained by using actual ex-post cash flows in our reverse-DCF model, and find that the median IPO firm is overvalued at the offering by 74%. Several robustness tests are provided to confirm that such optimism is implicit in the offer prices. As pointed out by Loughran and Ritter (1995), the extraordinary growth rates of some recent IPOs can justify such excessive valuation levels as long as most investors believe they have identified the next Microsoft. However, investors seem to be systematically overoptimistic in their assessments. As a consequence, nearly all IPOs are valued too highly. The expected growth rates implicit in IPOs prices are so high that it would be difficult for most IPO firms to meet them.

A regression analysis is also performed to identify the cross-sectional determinants of estimation errors, measured as the relative difference between actual and estimated cash flows. It is found that smaller and younger firms are particularly exposed to upward bias, perhaps because future cash flows are easier to predict for more mature companies (with more available information). High levels of income and high levels of debt also induce estimation errors due to unmatched growth expectations. In addition to these fundamentals, market demand for shares is a determinant of estimation errors. Firms with a high positive difference between the market and book values of their equity at the IPO are priced on growth rates that are at least partially overestimated. Last, a high initial underpricing is correlated with high estimation errors. When a specific issue appears to be overvalued, the underwriter discount the offer price more. This is in line with Loughran and Ritter (2002) conjecture that underwriters may "lean against the wind" of investor over-optimism. Estimation errors are also associated with long-term stock returns. The market does indeed react negatively to the disclosure of lower than expected cash flows. An intuitive explanation for this behaviour is that investors are constantly evaluating the accuracy of pre-IPO estimates and revising their price expectations accordingly.

Are hyper-growth firms inherently different? Evidence from a sample of fast-grown European enterprises

Powerful conceptual tools that describe firm evolution, like the corporate life cycle or stage-of-growth models, suggest that firms evolve through similarly structured and consequential stages starting as young, small and simple, and along a predictable path of transformation becoming older, larger and in general more complex (e.g. Miller & Friesen, 1984). Moreover, a recurring aspect of such models is that growth is assumed to take place mainly in an early stage of a firm's life, during which time it happens at growing rates, slowing down during firm's maturity. Hence, one might think that all firms experience growth and that high-growth is the norm, at least for a few, over a firm's life. However, this is not always the case: many firms may stagnate for a long period before experiencing a surge in sales growth, while others may not experience growth at all. In an extensive review of the literature on firm growth, Davidsson et al. (2007) remarked that most firms start, live and die small, never embarking on a significant growth trajectory (cf. Aldrich, 1999; Reynolds & White, 1997). According to Barringer, Jones, and Neubaum (2005), only a few of the new ventures started each year in the US grow enough to evolve into large firms and also within the entrepreneurship literature, there are plenty of examples of entrepreneurs who realize little to no growth in their firms (Gimeno, Folta, Cooper, & Woo, 1997). So, high growth would be better conceived as the result of sustainable entrepreneurial activity rather than as a rite of passage.

According to Fischer and Reuber (2003), past research on high-growth firms as a phenomenon has been intermittent, and the attitude toward them is somewhat ambivalent. However, there are multiple reasons why they deserve consideration in their own right (Fischer, Reuber, Hababou, Johnson, & Lee, 1997): first, rapid-growth firms are job creators, so ensuring that they prosper rather than stumble is of considerable economic importance. This has been the focus of the articles that first adopted rapid growth as their major focus of inquiry; this literature has consistently doubted the benefits of rapid growth and has investigated the actions and characteristics to cope with it, as strictly intertwined with problems related to people, processes and resources that could undermine high-growth organizations (e.g. Hambrick & Crozier, 1985). Second, by understanding high-growth firms, researchers may better understand the features involved with growth and success in general; in this sense, scholars have been interested in contrasting the characteristics of high-growth firms with those of their slow-growth counterparts for discerning whether they are distinctive and unique (e.g. Moreno & Casillas, 2007). However, despite these considerations, only a very small subset of the entrepreneurship research has initially focused on these abnormally successful firms and we are still far from an extensive comprehension of the unique characteristics and processes that they may possess. This is even more true for hyper-growth firms, which are largely excluded from academic research: "*a very surprisingly conclusion is that despite its economic upside potential, growth research has focused predominantly on 'normal' to 'high' growth rates ... while overlooking formidably high growth or hyper-growth firms*" (Markman & Gartner, 2002).

Until the denunciation of Markman and Gartner (2002), literature has never explicitly mentioned or investigated hyper-growth as a phenomenon with its own distinctive characteristics, although it is easy to conceive that firms rapidly growing hundreds of times their original size are very different from the high-growth firms usually found in the literature. Really, a closer

look at the growth literature has revealed that some articles have already dealt with this topic but unconsciously, mixing hyper-growth up with just high-growth; this means that researchers have already investigated samples of hyper-growing firms but conceiving (and naming) them only as high-growth firms and not as something structurally different. The clearest examples are those articles that, as MMarkman and Gartner, have investigated the so-called "Inc. Firms". Since 1982, a periodical dedicated to the interests of small and growing enterprises named Inc. Magazine has annually ranked the 500 fastest-growing private companies of the US based on the last five years of sales growth. Such firms are clearly an example of extraordinary-growth as their growth rates range from some hundreds to many thousands percent and have been the object of interest by some academic articles related to high-growth. However, such articles are few in number and are also focused on quite different topics. Therefore, rather than cumulative findings, we can only draw from the literature some limited insights mainly confined to the US experience and to a specific sample of hyper-growth firms.

This work is a first attempt to address this gap by focusing on the factors distinguishing hyper-growth firms in Europe in order to suggest policies that could foster growth in this context. Though the reasons for success are likely to be idiosyncratic and difficult to codify and transfer, we believe that a structural extraordinary-growth is not a mere contingent result of circumstances but rather the result of choices and intentions. Thus, understanding its determinants may unveil "the key to success". In order to address this question, a sample of hyper-growth firms has been developed from a large longitudinal dataset of European firms active between 1998 and 2006. Besides analyzing their characteristics, their uniqueness has been tested with respect to a control sample of firms growing at a normal pace. To make this comparison meaningful, this control sample has been built through a stratified random sampling from the same population from which the main sample has been drawn, matching firms in terms of countries, industries and cohorts.

According to Cooney and Malinen (2004), part of the difficulty in achieving consensus regarding high-growth firms originates from the inability to find a settled definition of what constitutes firm growth. Such consideration holds, exacerbated, when considering hyper-growth, for which a definition is even lacking, as this phenomenon has not been explicitly addressed by the literature. So, more than investigating the general phenomenon of hyper-growth, this article investigates a specific example of hyper-growth firms. The prototypical hyper-growth firm of interest is the one that experiences an extraordinary growth in sales over a short time, which should at least to some extent be accompanied by the accumulation of employees and assets so that organizational and managerial complexity increases with growth. As such, it has been coined a concept of hyper growth that is absolute rather than relative (i.e. it does not merely refers to a certain percentile of the growth rate distribution without considering absolute growth in size): a hyper growth firm has been defined as a company that grows (according to EU codification) from small (turnover lower than 10 mln €) to large (turnover higher than 50 mln €) over a short period of time (five years) and exhibit high growth in each period of this time frame (turnover growth higher than 20%). This also implies that the growth process is structural (sales could never decrease over the period).

According to the previous definition, starting from a large dataset of more than two hundred thousand firms, a sample of 307 hyper-growth firms has been retrieved. Descriptive findings

show that such firms are located (with different shares) amongst all countries and industries. The share of firms listed or engaged in M&A activities is found to be quite high, especially if we think that we are considering SMEs. The compound annual growth rate of sales for such firms is astonishing (90.35% median value over five years); however, this figure is not surprising since we are investigating hyper-growth. It is interesting to notice that firm size at the beginning of the growth period is in median not so far from that of a mid-sized company, so it is reasonable to posit that such firms start to grow in a phase in which they already possess some of the managerial skills needed to manage growth. However, the average firm in the sample is found to be quite young, confirming that high-growth firms are generally young firms, although growth could arise in an advance phase of the corporate life cycle. Even though the median of total assets rises less than sales, its strong increase confirms our assumption that growth in sales is accompanied by an accumulation of assets. Finally, despite the internal turmoil related to the strong path toward growth, also profitability measures are very interesting.

When compared to their slow-growth counterparts, hyper-growth firms are found to be younger and more involved in M&A and listing activities; moreover, they are found to raise higher levels of debt, with a lower solvency and to rely more (in relative terms) upon investments in fixed assets. The affiliation to a parent company as long as a larger availability of (idle) slack resources are also found to play a distinctive role in distinguishing hyper growth firms. The fact that hyper-growth firms tend to be younger than their slow-growth counterparts confirms the strong negative relation between firm age and growth, widely evidenced by the entrepreneurship literature and is consistent with the idea that young firms are usually more innovative, proactive and risk-oriented than older firms, among other reasons because they are initiated with the purpose of taking advantage of new, previously unexploited opportunities (Shane & Venkataraman, 2000). The affiliation to a parent company and the larger availability of slack resources are two factors strictly linked; regardless of the shape of the relationships between parent and daughter companies, the former can assist the growth of the latter by providing access to managerial skills and capabilities, and to both tangible and intangible resources, in contrast with the resource limitations typical of small firms. In this sense, the affiliation with a parent company can help a firm to address and structure future growth, to settle the going public process or merger and acquisition activities (both of which have been found to be more adopted by hyper-growth firms). It can also influence firm's choices regarding the optimal financial structure or the endowment of resources. For example, the abundance of slack resources, which is a major factors explaining firm rapid growth, has been found as a factors characterizing only hyper-growth firms affiliated to a group.

The higher recourse to M&A activity is consistent with the fact that in order to grow extraordinarily, a firm must greatly increase its assets and organizational systems in such a short time period that external growth is often the favored (obliged) way to do so. In this sense, policies should create a suitable environment to facilitate external growth, for example, by aiding in the diffusion of professional competences and by fostering the integration of different corporate cultures. Policy makers should encourage mergers and acquisitions in foreign countries as well, since these operations must be carried out in order to exploit growth opportunities, wherever they arise. Authorities should also be more flexible and sensitive to economic and strategic motivations behind such operations, rather than focusing on mere market power.

In their effort to grow, hyper-growth firms raise funds through incurring substantial debt without paying too much attention to their solvency ability, thus supporting the entrepreneurial approach to growth suggested in literature (Baum, Locke, & Smith, 2001). Entrepreneurs require money in order to bring their ambitions to life, so policies should favor the development of efficient capital markets; the entrepreneurship literature clearly emphasizes how the presence of such systems encourages the entrepreneurial spirit by favoring the formation of new ventures, stimulating competition and promoting firm growth (cf. Rajan & Zingales, 1998). However, mainly due to information asymmetries, potential investors have in general little information on the entrepreneurial capabilities and growth opportunities of such firms; in fact, this could result in credit rationing (Jaffe & Russell, 1976). To remedy these market failures, political intervention should encourage relationships between banks and firms by offering incentives and grants for policies directed toward financing specific innovation and growth strategies.

Since firms that are willing to grow are often very risky and very small, raising debt might not be the best way of financing, since the risk premium would hamper good opportunities for growth. Becoming publicly listed allows firms access to a source of finance other than the banking system, which provides the opportunity to collect the resources needed to achieve growth objectives that would otherwise be limited by financial constraints (Carpenter & Petersen, 2002). In Continental Europe, unlike the US, few SMEs tap public markets for funds, and hence, policies should favor this choice through reduced bureaucratic delays and enhanced fiscal incentives. Also, third-party funding, such as venture capital and private equity operators, could finance entrepreneurial firms by providing the resources necessary to exploit growth opportunities. Policy makers should promote the emergence of such players, many of which are still underdeveloped in Europe.

Nevertheless, it should be noted that it is naive to conceive of the economy as populated by small firms that are all full of willingness and potential to grow if only the financial means were available. In fact, the issue is far more complex. As far as entrepreneurship is concerned, it is also important to look at the transformation of cultural and behavioral attitudes in many countries, particularly with respect to rewarding propensity to risk and investment. Policy makers should encourage an entrepreneurial spirit as well as create an entrepreneurial environment in which firms can be created and developed. Education assumes a decisive role in fostering an entrepreneurial orientation that can bear the uncertainty linked to new ventures. Moreover, many countries are often reluctant to offer entrepreneurs who do not succeed a second chance; these countries should revise their bankruptcy regulatory framework in order to accept and foster risk-taking as well as to create an appropriate network capable of re-absorbing and quickly re-using the knowledge and experience gained from failure.

The moderating role of industry maturity over business growth factors. The case of the Italian manufacturing industry

While in the middle of the 20th century large textiles, steel and car industries were symbols of national economic muscle, since then, at least in the OECD area, these industries have increasingly restructured with production shifting to other countries and new industries (Fukasaku, 1998). This has been the case also for Italy: in the last years there has been a clear difference between the trend of the service industry and that of the manufacturing industry: while the

former has shown a continuous path of growth it has not been the same for the latter. However, these differences should not be read, a priori, as negative: as suggested by Bazen and Thirlwall (1989), both a positive and a negative de-industrialization exists. The former originates from the process of development of the economic structure of a country, which is manifested by an increase in demand for services by consumers, or by an increase in the share of services which are used in the production of other goods. In contrast, the latter is a symptom of a loss of competitiveness of the manufacturing industry, which is contrasted with a decline in the number of employees in order to adapt the resources to demand and increase the productivity of the factors. In the first case the de-industrialization matches the process of growth of the economy toward a path of full employment, where the industrial sector, after the expansion phase typical of the take-off period of an economy, leaves step to services. In the second one, the de-industrialization is a symptom of the difficulties of the economic system to keep pace with the competitiveness of other (emerging) countries, and therefore is associated with an increase in unemployment and a process of growth slow, if not negative (Rowthorn & Wells, 1987).

This second case is the one that best represents the evolution of the Italian economy in the last years. As highlighted by some recent works (e.g. Faini & Sapir, 2005; Barba Navaretti, Bugamelli, Faini, Schivardi, & Tucci, 2007) in the last years the Italian productive structure has been focused on 'traditional' labour intensive goods, which require a low intensity of human capital and a high adoption of unskilled workers. As a result, the productive structure of Italy has been one of the main driver of the economic decline of the country: the high share of traditional industries has translated in a low propensity to innovation and in a higher exposure (respect to the other European players) to the competition of emerging countries. In such industries, the adverse evolution of both market conditions and internal dynamics has contributed significantly to a general loss of attractiveness that in turn impinged negatively on the performances of the incumbent firms and on that of the whole economic system.

From an industry life cycle (ILC) perspective this trend should be read as a continuous shift of the Italian manufacturing industry toward maturity. In such context, firms (and markets) are characterized by many common traits and external factors highly influence industry evolution; limited technical improvement opportunities (McGahan, Argyres, & Baum, 2004; Foster, 1986; Abernathy & Utterback, 1978), saturated markets (Gera & Mang, 1997; Anand & Singh, 1997; Baden-Fuller, 1989), product commoditization (Auster, 1992; Grant, 2002), increased competition and regulation (Grant; Klepper, 1996; Smallwood, 1973), social and demographic trends (Porter, 1980) are examples of the main features recognized by the literature to such phase.

From an industrial organization perspective, which stresses the role of market or industry structure in determining firm conduct and performance, mature industries are slightly attractive competitive arenas. However, as suggested by the newer resource based perspective, which stresses the importance of firm specific characteristics, the greater the power exerted by a firm's external environment, the more likely it is that the development of internal resources will provide a secure foundation for the firm's long-term strategy. Consistently with this view, some recent evidence (Cassia, Fattore, & Paleari, 2006) suggests that also in mature industries, where business opportunities shrink, it is possible to find emerging firms able to sustain paths of growth and development. This leads to reflect about the possibility that some common factors

could exist behind their observed behaviors. Many efforts among practitioners and academics have given increasing importance to understanding what factors in business firms underlie the differences in their growth rates; however, despite previous research has already focused on manufacturing firms, finding consistent relationship from nation to nation (Davidsson, Kirchhoff, Hatemi, & Gustavsson, 2002), nobody has investigated empirically the moderating role that the ILC could play on growth factors and on growth itself. We believe that such a question is worth of investigation as environmental factors, beyond the mere industry characteristics, are getting increasing importance because of the increasing attention paid by researcher to contingencies and interaction effects amongst growth factors (Dobbs & Hamilton, 2007). The concept of maturity grasp simultaneously many of the considerations related to the environment, due to its multidimensional conceptualization, and is gaining increasing importance due to the progressive decline of traditional industries in the developed countries so it represents an interesting environment where investigating firm growth. Moreover, the manufacturing industry still plays an important role in the economy of our country and so it is important to take care of it.

In the light of these considerations, the aim of this work is to investigate empirically the impact that the level of industry maturity has over firm growth as well as how the contribution of the main firm growth factors change in increasing conditions of maturity. We are not aware of other studies with such a focus before this one. To address this issue this article focuses on the Italian manufacturing industry that has progressively matured and restructured between 1995-2005, experiencing a strong structural crisis. It replicates previous researches about business growth factors in manufacturing industries while adjusting for the moderating role of industry maturity. Consistent with such research, analysis of data is done with multiple regressions where a firm growth index is the dependent variable.

The Italian manufacturing industry, as in every other developed country, is made by a wide range of different activities and even if they have progressively matured and restructured, they have not experienced the same level of crisis. Indeed, as the aim of the article is to investigate the value of business growth factors in increasing conditions of maturity, the first contribution of this work is to clarify and rank the activities that have experienced a more adverse evolution and have become most mature. In the attempt to follow a purely quantitative approach this exercise has been made through a modified application of the Fuzzy Industry Maturity Grid (FIMG - Tay et al., 1992). The baseline idea of the FIMG framework is that the overall degree of maturity of an industry is the synthesized outcome of the maturity of its distinctive characteristics, which represent an ordered continuum whereby transitions of judgment from “developing” to “mature” could be modeled. The concept of maturity can be so collapsed onto that of an hypercube whose dimensions represent each the grade of compatibility of the characteristics investigated with the concept of maturity. Overall, this cube defines a spatial volume containing all the possible state of assessment an industry can have; by determining the value along each of the dimensions, the position of the industry may be located within the cube and the overall level of maturity assessed. Fuzzy sets play a fundamental role in such model as industry characteristics are not crisp and cannot be precisely described as either “mature” or “developing”. In a fuzzy set the parametric value describing a characteristic is related through a membership function to a membership grade that represents the grade of compatibility of that parameter with the concept

investigated (i.e. "mature"). In our case industry characteristics are described by the trends of a relevant set of macroeconomic variables selected on the basis of the life-cycle literature. Results of the analysis show that instead of being a dichotomous condition, industry maturity seems to be a continuous connotation with increasing level of intensity: we cannot observe only industries with a high or low connotation of maturity as it is increasingly distributed among the various activities. So instead of mature or non mature clusters of industries, the best definition is that of clusters more or less mature than others. Manufacture of textiles, leather and related products (DB and DC industries according to the 1-digit Ateco codification) upstands among the most mature industries while the manufacture of basic metals, fabricated metals and other non-metallic mineral products (DI and DJ industries) could be found amongst the most mature.

Starting from the previous analysis, a sample of more than nineteen thousand firms belonging to the most and less mature industries has been selected for investigating a set of explanatory variables than can explain a major proportion of the observed variation in business growth rates. By considering only the firms belonging to the most mature industries it wouldn't be possible to discern what is, if exists, the marginal contribution of the growth determinants when industries progressively mature. The variables investigated are those essentially found in other studies regarding business growth factors in manufacturing industries (e.g. Becchetti & Trovato, 2002): size, age, ownership structure, industry and location. It has been controlled for the moderating role of maturity by introducing in the regression a dummy variable for firms competing in the most mature industries (both as single variable and as an interaction effect with other variables). Robust regressions techniques have been adopted for dealing with heteroskedasticity, non-normality, and bad leverage points affecting residuals.

Results confirm previous findings about business growth factors. Age and size are found to be negatively related to firm growth while the affiliation to a group (as both parent or daughter) is found to have a positive impact on it. Population density of the area where the firm resides is found to be positively related to growth, confirming past findings about the goodness of agglomeration. Also industry- and location-specific dummies are found to discriminate growth among firms. Positive effects on growth rates are also found with respect to some proxies of the internationalization of the firm.

Moreover, we also found evidence that industry maturity affects both firm growth and business growth factors. As expected from the nature of the competition, struggling in mature industries is statistically and negatively related to growth. Effects of firm size and age are increased in mature context as the corresponding interaction terms with the maturity dummy are found to be positively related to growth. This is consistent with the nature of mature industries, where bigger and older firms are more able to sustain and implement the processes at the base of competition. Despite the affiliation to a group could be expected to play an important role in mature industries, its corresponding moderated effect is found negatively related to growth. An explanation could be that independent firms, as not swamped in settled routines, can better identify the signals of decline and grasp the emerging opportunities.

Finally, an important consideration emerging from the study regards the role of entrepreneurship in mature industries. While entrepreneurial activity is highly concentrated in the initial phase of the firm's life cycle, and thus even more in the initial phases of an industry, the role of the entrepreneur has always been seen as paramount subsequently. In our view en-

trepreneurship should regain a central role in mature industries because these are the contexts where opportunities are less likely to emerge, to the extent that only an entrepreneur - or an entrepreneurial organization - could be able to recognize and exploit them. Policies devoted to sectors experiencing structural crises should take care of the suggestions emerging from these results in order to support a phase of renewal in such contexts.

References

Abernathy, W. J., & Utterback, J. M. (1978). Patterns of industrial innovation. *Technology Review*, *80*(7), 40–47.

Aldrich, H. (1999). *Organizations evolving*. Sage Publications, Newbury Park, CA.

Anand, J., & Singh, H. (1997). Asset redeployment acquisitions and corporate strategy in declining industries. *Strategic Management Journal*, *18*(1), 99–118.

Auster, E. R. (1992). The relationship of industry evolution to patterns of technological linkages, joint ventures, and direct investment between u.s. and japan. *Management Science*, *38*(6), 778–792.

Baden-Fuller, C. W. F. (1989). Exit from declining industries and the case of steel castings. *The Economic Journal*, *99*(397), 949–961.

Barba Navaretti, G., Bugamelli, M., Faini, R., Schivardi, F., & Tucci, A. (2007). Le imprese e la specializzazione produttiva, dal macrodeclino alla microcrescita? In *I vantaggi dell'italia*. Fondazione Debenedetti.

Barringer, B., Jones, F., & Neubaum, D. (2005). A quantitative content analysis of the characteristics of rapid growth firms and their founders. *Journal of Business Venturing*, *20*(5), 663–687.

Baum, J., Locke, E., & Smith, K. (2001). A multidimensional model of venture growth. *Academy of Management Journal*, *44*(2), 292–303.

Bazen, S., & Thirlwall, A. P. (1989). *Deindustrialization*. London: Heinemann Educational Publishers.

Becchetti, L., & Trovato, G. (2002). The determinants of growth for small and medium sized firms. the role of the availability of external finance. *Small Business Economics*, *19*(4), 291–306.

Berkman, H., Bradbury, M., & Ferguson, J. (2000). The accuracy of price-earnings and discounted cash flow methods of ipo equity valuation. *Journal of International Financial Management and Accounting*, *11*, 71–83.

Carpenter, R., & Petersen, B. (2002). Is the growth of small firms constrained by internal finance? *Review of Economics and Statistics*, *84*(2), 298–309.

Cassia, L., Fattore, M., & Paleari, S. (2006). *Entrepreneurial strategy: emerging businesses in declining industries*. Cheltenham: Edward Elgar.

Cassia, L., Paleari, S., & Vismara, S. (2004). The valuation of firms listed on the nuovo mercato: the peer comparables approach. *Advances in Financial Economics*, *10*, 113–129.

Cooney, T., & Malinen, P. (2004). Firm growth as a research issue. In T. Cooney, & P. Malinen (Eds.), *New perspective on firm growth*. Turku-Finland.

Davidsson, P., Achtenhagen, L., & Naldi, L. (2007). What do we know about small firm growth? In S. Parker (Ed.), *The life cycle of entrepreneurial ventures* (Vol. 3). International Handbook Series on Entrepreneurship. Springer.

Davidsson, P., Kirchhoff, B., Hatemi, J., & Gustavsson, H. (2002). Empirical analysis of business growth factors using swedish data. *Journal of Small Business Management*, *40*(4), 332–349.

Deloof, M., De Maeseneire, W., & Inghelbrecht, K. (2009). How do investment banks value ipos? *Journal of Business Finance and Accounting*, *36*(1-2), 130–160.

Dobbs, M., & Hamilton, R. T. (2007). Small business growth: recent evidence and new directions. *International Journal of Entrepreneurial Behaviour and Research*, *13*(5), 296–322.

Faini, R., & Sapir, A. (2005). Un modello obsoleto? crescita e specializzazione dell'economia italiana. In *Oltre il declino*. Fondazione R. Debenedetti. Roma.

Fischer, E., & Reuber, A. (2003). Public support for rapid growth firms: a comparison of the views of founders, government policy makers and private sector resource providers. *Journal of Small Business Management*, *41*(4), 346–365.

Fischer, E., Reuber, A., Hababou, M., Johnson, W., & Lee, S. (1997). The role of socially constructed temporal perspectives in the emergence of rapid-growth firms. *Entrepreneurship Theory and Practice*, *22*(2), 13–30.

Foster, R. (1986). Working the s-curve. assessing technological threats. *Research Management Journal*, *4*, 153–173.

Friedlan, J. (1994). Accounting choices by issuers of initial public offerings. *Contemporary Accounting Research*, *11*, 1–32.

Fukasaku, Y. (1998). Revitalising mature industries. *OECD Observer*, *213*, 19–21.

Gera, S., & Mang, K. (1997). The knowledge-based economy: shifts in industrial output. *Canadian Public Policy*, *24*(2), 149–184.

Gibb, A. A., & Davies, L. (1990). In pursuit of frameworks for the development of growth models of the small business. *International Small Business Journal*, *9*(1), 15–31.

Gimeno, J., Folta, T., Cooper, A., & Woo, C. (1997). Survival of the fittest? entrepreneurial human capital and the persistence of underperforming firms. *Administrative Science Quarterly*, *42*, 750–783.

Grant, R. M. (2002). *Contemporary strategy analysis: concepts, techniques, applications*. Oxford: Blackwell.

Hambrick, D., & Crozier, L. (1985). Stumblers and stars in the management of rapid growth. *Journal of Business Venturing*, *1*(1), 31–45.

Ibbotson, R. G., & Ritter, J. R. (1995). Initial public offerings. In R. Jarrow, V. Maksimovic, & W. Ziemba (Eds.), *Handbooks in operations research and management science* (Chap. 30, Vol. 9). North Holland.

Jaffe, D., & Russell, T. (1976). Imperfect information, uncertainty and credit rationing. *Quarterly Journal of Economics*, *90*(4), 651–666.

Jagannathan, R., & Gao, Y. R. (2005). Are ipos underpriced? a closer examination. In *EFMA 2005 conference proceedings*.

Kim, M., & Ritter, J. R. (1999). Valuing ipos. *Journal of Financial Economics*, *53*, 409–437.

Klepper, S. (1996). Entry, exit, growth, and innovation over the product life cycle. *American Economic Review*, *86*(3), 562–583.

Loughran, T., & Ritter, J. R. (2002). Why don't issuers get upset about leaving money on the table in ipos. *Review of Financial Studies*, *15*, 413–443.

Loughran, T., & Ritter, J. (1995). The new issue puzzle. *Journal of Finance*, *50*, 23–51.

Markman, G., & Gartner, W. (2002). Is extraordinary growth profitable? a study of inc. 500 high-growth companies. *Entrepreneurship Theory and Practice*, *27*(1), 65–75.

McGahan, A. M., Argyres, N., & Baum, J. A. C. (2004). Context technology and strategy: forging new perspectives on the industry life cycle. In J. Baum, & A. M. McGahan (Eds.), *Business strategy over the industry lifecycle*. Advances in Strategic Management. JAI Press.

Miller, D., & Friesen, P. (1984). A longitudinal study of the corporate life cycle. *Management Science*, *30*(10), 1161–1183.

Moreno, A., & Casillas, J. (2007). High growth smes versus non high-growth smes: a discriminating analysis. *Entrepreneurship and regional development*, *19*(1), 69–88.

Porter, M. E. (1980). *Competitive strategy: techniques for analyzing industries*. New York: Free Press.

Purnanandam, A., & Swaminathan, B. (2004). Are ipos really underpricied? *Review of Financial Studies*, *17*, 811–848.

Rajan, R., & Zingales, L. (1998). Financial dependence and growth. *The American Economic Review*, *88*(3), 559–586.

Reynolds, P., & White, S. (1997). *The entrepreneurial process: economic growth, men, women, and minorities*. Quorum Books, Westport, CT.

Ritter, J. R., & Welch, I. (2002). A review of ipo activity, pricing, and allocations. *Journal of Finance*, *57*(4), 1795–1828.

Roosenboom, P. G. J. (2007). How do underwriters value ipos? an empirical analysis of the french ipo market. *Contemporary Accounting Research*, *24*(4), 1217–1243.

Rowthorn, R., & Wells, J. (1987). *De-industrialization and foreign trade*. Cambridge, UK: Cambridge University Press.

Sexton, D. L. (1997). Entrepreneurship research needs and issues. In D. L. Sexton, & R. W. Smilor (Eds.), *Entrepreneurship 2000* (pp. 401–408). Chicago: Upstart Blishing Co.

Shane, S., & Venkataraman, S. (2000). The promise of entrepreneurship as a field of research. *Academy of Management Review*, *25*(1), 217–226.

Smallwood, J. E. (1973). The product life cycle: a key to strategic market planning. *MSU Business Topics*, *21*(1), 29–36.

Stein, J. (1989). Efficient capital markets, inefficient firms: a model of myopic corporate behaviour. *Quarterly Journal of Economics*, *104*, 655–669.

Teoh, S. H., Welch, I., & Wong, T. J. (1998). Earnings management and the long-run market performance of initial public offerings. *Journal of Finance*, *53*, 1935–1974.

Thomas, J. K. (2007). Discussion of how do underwriters value ipos? an empirical analysis of the french ipo market. *Contemporary Accounting Research*, *24*(4), 1245–1254.

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Chapter 1

Introduction

Firm growth deserves increasing attention from researchers, since it creates employment, generates wealth and enhances general economic development. Besides the generation of new business and ventures, the economic development relies on the existence of entrepreneurs and managers who are able to turn these nascent firms into solid organizations capable of withstanding international competition. According to Rajan and Zingales (1998), in the last two decades the largest part of the increase in the output of the manufacturing industry has been related, at least in the developed countries, to the growth of the incumbent firms while only a minor part has been related to the generation of new ventures. So it is not surprising that growth is considered the *"the very essence of entrepreneurship"* and *"is a subject of all times"* (Sexton, 1997). It shouldn't also surprise the intensity and continuity of the efforts devoted to the investigation of the determinants of firm growth. As a proxy, at the moment of the drafting of this chapter (January 2010), the search of the exact phrase "firm growth" over Google Scholar shows more than 21,800 occurrences. However, the topic of firm growth is as complex and elusive from a theoretical perspective as it is relevant from an empirical one. In fact, all of the authors of recent review articles complain that a coherent picture is not easy to distill from the literature. Since the review of Gibb and Davies (1990), who concluded that the body of evidence then available was inadequate, our knowledge remains fragmented and still lacks an integrative theory (Dobbs & Hamilton, 2007). This is likely due to differences in theoretical and epistemological perspectives and interpretations, operationalizations, empirical contexts, modeling and analysis approaches, as well as to the inherent complexity of the phenomenon itself. In this sense, some authors (e.g. Arrighetti & Ninni, 2008) describe this research area as an endless story where the characters, the plot and the narrative style change in a more or less sharp way, but the end of the story continues to be far away.

What is firm growth?

When researching growth, it is wise to first discuss what 'firm growth' actually is. By taking from the seminal book of Edith Penrose: "*The term 'growth' is used in ordinary discourse with two different connotations. It sometimes denotes merely increase in amount; for example, when one speaks of 'growth' in output, export, and sales. At other times, however, it is used in its primary meaning implying an increase in size or improvement in quality as a result of a process of development, akin to natural biological processes in which an interacting series of internal changes leads to increases in size accompanied by changes in the characteristics of the growing object*" (Penrose, 1959, p. 1). When growth is assessed as "change in size", it is the dependent

variable, the effect, and so we are seeking explanation as to why firms grow or to what explains differences in the amount of growth. When growth is instead conceived as 'the growth process', it is the independent variable, the cause of the changes that take place in an organization. As emphasized by Trau (1996) the growth process should be conceived as an event that radically alters the internal structure of firms to the extent that the differences between "the very small and very large firms are so great that in many ways it is hard to see that the two species are of the same genus" (Penrose, p. 19). Growth research has, over time, mainly focused on the change in amount perspective, while it has neglected other aspects of the process of growth; the use of the word *growth* in everyday life well reflects this discrepancy. The primary exception is the literature about stages-of-development models (or organizational life cycles) where consequences of the process of growth are the key theme. Despite this two opposite perspectives are not always clearly separable, this distinction is important for the remainder of this dissertation, that will focus on the previous use in the literature, i.e., the size-change perspective.

Assessing growth as change-in-amount

Even if restricted to the change-in-amount perspective, it seems that academic research has over time focused on slightly different research questions. At first, the main issue has been related to as why firms grow. This stream of literature, which has its roots in the field of economics, is mainly related to the rationale at the base of the growth of firms. In such approach firms are for the most part similar entities which face a similar path of evolution and slightly is said about the differences in their growth rates (i.e., what are the determinants of their growth rates); what matter most is the average distribution of firm size. In their review of different theories of the firm, Seth and Thomas (1994) identified four different 'theoretical firm' conceptualizations. These are the firm as 'production function' in neo-classical economics, as 'strategic player' in new industrial organization economics, as 'nexus' of contracts' in agency theory and 'governance structure' in transaction cost economics. These different perspective - not necessarily mutually exclusive - deal both with supply and demand issues, and involve the analysis of the role played by technological, financial and organizational determinants of growth, as well as that of the factors affecting motivation and the "degree of rationality" of agents (Trau, 1996).

Theories of firm growth

Even if it's not in the aim of this Section to give an extensive review of the different theories on firm growth, it is possible however to shed some light on the main theoretical issues that affect the transition from small to large firm according to this literature. From the point of view of the "standard" neoclassical theory all the firms within an industry are pushed to expand their size until they reach the scale corresponding to the minimum feasible cost. In this sense, the process of growth is exhausted as far as the process of optimization is completed and nothing is known about firms' rate of growth. However this theory is not consistent with the highly skewed distributions of business firms observed in modern industrial economics and better results are achieved by considering the relationship of growth with both returns to scale and firm's goals. By their very nature, the two topic can be viewed as reflecting two broadly different types of question: the analysis of returns mainly relates to technology and demand, whilst the definition of firms' goal necessarily involves organizational and financial issues as well. The findings associated to such extensions are very insightful. First of all, growth cannot

be represented as a continuous process but rather it happens through discrete jumps. This may be due to technological discontinuities or firm-specific internal economies. Examples are capital input indivisibilities that make factors substitution not continuous (e.g. Sylos Labini, 1969) or successful patents (that are size independent and transient) generating unbalanced growth in the form of quantum leaps between periods of zero growth (Penrose, 1959). Also the fixity of the managerial production factor could constrain expansion: rapid growth is particularly difficult to manage and the resulting loss of control reduces organizational efficiency (Richardson, 1964; Williamson, 1967; Penrose). Current managerial resources are in fact devoted to take the firm together and only an excess of managerial ability can push the firm to move toward a larger size. Moreover growth requires specific resources which have been slowly and expensively developed inside the firm and which cannot be made readily available by simply applying to the market. Firms know this and hence avoid rapid growth. In presence of market uncertainty problems, the transition to a large firm world could also not happen, because vertical disintegration could be a better outcome (e.g. Contini, 1984; Mills & Schumann, 1985); on the contrary the relative inefficiency of the price mechanism in allocating output among the firms could results, among a continuum, from transactions to vertical integration. In this view, authority better replaces market prices in coordinating transactions because of transaction costs (Coase, 1937; Williamson, 1975). In the real-world firm (as opposed to the neoclassical one) also the internal organization matters: the discretionary character of firm decision making has a major impact on the growth process, to the extent that a firm could choose to exceed its technical optimum size (that linked to the profit maximization goals). Since the Berle and Means's contribution 1932, the separation of control from ownership has taken a central role in the growth theory, because owners and managers are characterized by different functions and different goals by the possibility to distinguish between internal vs. external controlled firms and, by the whole range of agents interested in monitoring executives, like employees or institutional actors. (e.g. McEachern, 1978; Cubbin & Leech, 1983). Moreover, these problems are also exacerbated by the fact that there isn't a pure dichotomy between managerial-controlled versus owner-controlled firms (ranging the control along a continuum). For example Baumol (1959), among the firsts, postulated that managers, driven by personal self-interest, show special concern about the magnitude of their sales, so that firms maximize sales as long as profits satisfy the shareholders and the company's plough-back policy. Next to Baumol many others developed models where efficiency (profit) is not the firm main goal. Marris (1964) drew attention to the specific financial mechanism that link managers and owners developing a theory of firm growth intertwined with that of stock market valuation, with a structural tendency toward physical growth as outcome. Also Williamson (1964) developed an approach where the nature of firm internal running can involve a systematic drive toward a non-optimizing behavior (which is not necessarily sales or assets growth). Later, Galbraith (1967) developed a managerial view of firm growth, where once safety is ensure by a minimum of earnings, the main goals of the corporation becomes to achieve the greatest possible rate of corporate growth because is the best protection against contraction and helps taking the organization together. However the conflict between the principals (owners) and their agents (managers) will not be permanent, because firm's goals could change through firm life cycle (Mueller, 1972). Young, dynamic companies have rapid growth and high profitability so managers and shareholders are happy. But as a company

matures and its investment opportunities decline, a conflict arises: attempting managers to maximize growth at the expense of profitability. The financial side of the growth process affects also the small-firm world where separation of ownership from control doesn't take place: entrepreneur's equity shortages may set a limit to firm expansion via either 'growing risk effects' (Kalecki, 1939) or by the perceived danger of losing control of their firm (Reder, 1947). Finally, evolutionary economics (cf. Nelson & Winter, 1982) suggests that instead of optimizing, agents tend to react automatically to changes in the market environment using routines which are often specific to the firm. They stem from the skills and experience of the managers and workers in the firm and this 'know-how' is passed on to new members of the firm. Thus successful routines which have produced growth in the past, are likely to continue to do so in the future. It is true that circumstances change, but successful firms have successful routines for changing previous methods to meet new market environments. This broad round-up of theories doesn't pay pledge to the complexity of the topic and actually a theory that address all these issues doesn't exist; however it still remain important to know them for anyone who wants to address the growth topic.

Determinants of firm growth

However, in the recent years from the original question of *why firms grow*, research has progressively addressed the topic of *which firms grow*. This question, which is mainly addressed in the so-called *small business growth* field, conceives growth as an asymmetrical phenomenon that involves selectively, but not by chance, only a subset of all the firms. The central point here is why only a few of the firms grow and the identification of the characteristics that discriminate them from those that don't growth. This approach reinforces the idea that the size of the firms hides a high heterogeneity, among different size classes (small vs. large) but also inside the same size class (small vs. small). Hence the focus moves from exogenous to endogenous components, that allow the firm, regardless of initial size, to undertake paths of developmental that others cannot or don't want to implement.

In the so-called deterministic approach (Dobbs & Hamilton, 2007), which is the one that continues to dominate the small business growth literature, the objective is to identify a stable set of explanatory variables, relating to the people, the firm, and the environment, that can explain a major proportion of the observed variation in business growth rates. This is the converse of the stochastic models of firm growth, developed mainly in the field of economics, which suggest that there are a large number of factors which affect growth, thus explaining the absence of any dominant theory (McMahon, 1998). The approach stems from Gibrat's (1931) "Law of Proportionate Effect", that is this sense has been a useful benchmark for many previous studies on the determinants of business growth. There are many studies in this genre, with researchers typically applying multivariate techniques to large cross-sectional data sets to test the significance of associations between a wide range of determinants and the growth rates of small businesses. These deterministic models however have only been able to provide partial explanations of small business growth rates, leaving considerable unexplained variation. This provides support for the notion that it is indeed idiosyncratic configurations of context-specific variables that determine the growth prospects of a small business (Davidsson & Klofsten, 2003). It is the case however that, if researchers were able to identify the systematic determinants of growth, then we would observe a much-diminished share of the explanation being attributed to

random effects. It is this quest for the prescriptive model of small business growth that motivates so many studies of this type and it remains the dominant empirical approach to the study of small business growth. The complexity of these models has however led some to question if such a comprehensive model of small business growth can be developed (Barringer & Jones, 2004; Davidsson, Kirchhoff, Hatemi, & Gustavsson, 2002; Delmar, Davidsson, & Gartner, 2003; Smallbone, Leigh, & North, 1995). At first this literature has been decidedly phenomenon-driven rather than-theory driven and studies have included a broad range of aspects as in a sort of "laundry list" approach. This way of selecting growth antecedents has been however severely criticized (Davidsson & Wiklund, 2000) and over time we expect to observe a progressive shift toward more theory-driven studies. In these sense more than looking at the 'theoretical firm' conceptualizations (those discussed in the above Paragraph), researcher should rest on the theories grounded in real-world firm conceptualization, called 'empirical firm' theories by Seth and Thomas (1994), such as the resource based view (RBV) of the firm. Moreover, this approach suffers of some other pitfalls, for example related to the operationalization of growth, in terms of the choice of a suitable indicator for growth (e.g. sales vs. assets. vs. employees), the approach to the measure (i.e. relative vs. absolute) and the definition of the growth formula (e.g. difference of log vs. percent growth).

Aim of the dissertation

Taken together the sensible conclusion of this strand of research is that growth is to a considerable extent a matter of willingness and skill, but that fundamental facilitators and obstacles in the environment cannot be disregarded. The extent to which the firm governs its own destiny is also likely to vary across firms and situations. It is probably the case that every theoretically reasonable suggestion for a growth determinant has been shown to have the predicted impact in some context. We argue that the problem is to develop better knowledge about the relative and combined effects of the many predictors under different circumstances. In order to deal with this complexity, researchers should developed useful strategies. Suggested ways for dealing with this problem are, for example, to give up ambitions of approaching full explanation but instead enhance our understanding of the interplay among a smaller set of specific factors or to limit the study to a more homogeneous empirical context and studying the effects of a narrow set of theory-driven and carefully operationalized predictors.

In the light of these considerations, the baseline idea of the dissertation is to investigate no more firm growth as a general topic but to look at growth in some specific, relevant settings. Specifically, the dissertation focuses on unusual trajectories in the path of growth of firms and on their related determinants (i.e. on what makes such firms to behave in a different manner than expected). Unusual means that despite in a such environment we can expect or observe a dominant 'behaviour' in terms of growth of firms, at the same time we can also perceive the presence of behaviors that are different from the dominant one (or at least different respect to what an external observer would expect) but that could be even more interesting. In this sense the concept of unusual is close to that of anomalous. The recurrence of this dichotomy characterizes the whole research framework of the dissertation where the central question is the explanation of what drives this unusual growth. In an econometric comparison, this is the opposite of a regression, as we want to focus on the 'outliers' instead of remove them. Such an approach could give us fascinating insights which haven't still been approached by the academic

literature.

The previous research idea has been declined in the dissertation into three essays. The first article (Chapter 2) regards the growth expectations implied in the offer prices of IPO firms. In efficient capital markets we should expect prices to reflect fair assumption about the future growth expectations of firms (also because investors repeatedly buy IPOs); however the article finds that this is never the case. Specifically, it compares the real ex-post realizations of IPO firms with their growth inferred from their offer prices in order to investigate the determinants of such estimation errors. The second article (Chapter 3) regards hyper-growth firms. Literature seems to suggest that all firms experience growth and that high-growth is the norm, at least for a few, over a firm's life; however, this is not always the case and both high-growth and hyper-growth are the result of sustainable entrepreneurial efforts. This work tries indeed to investigates if hyper-growth firms are inherently different from other firms or if they are simply the results of contingencies and circumstances. The article should also seen as a first attempt to address the topic of hyper-growth which has been neglected by previous academic research. Finally, the third article (Chapter 4) is devoted to the investigation of emerging firms in mature industries; it tries to shed light on the factors that enable firms facing unattractive and declining contexts to separate their path of growth with respect to the one prevailing in their own business arena. Conclusions follow.

1.1 References

Arrighetti, A., & Ninni, A. (2008). Dimensione dell'impresa e opportunità di crescita: una introduzione. In *Dimensioni e crescita nell'industria manifatturiera italiana: il ruolo delle medie imprese*. Franco Angeli.

Barringer, B., & Jones, F. (2004). Achieving rapid growth: revisiting the managerial capacity problem. *Journal of Developmental Entrepreneurship*, *9*(1), 73–86.

Baumol. (1959). *Business behavior, value and growth*. New York: The MacMillan Company.

Berle, A., & Means, G. (1932). *The modern corporation and private property*. New York: The Macmillan Company.

Coase, R. (1937). The nature of the firm. *Economica*, *4*(16), 386–405.

Contini, B. (1984). Firm size and the division of labor. *Banca Nazionale del Lavoro Quarterly Review*, *151*, 367–380.

Cubbin, J., & Leech, D. (1983). The effect of shareholding dispersion on the degree of control in british companies: theory and measurement. *Economic Journal*, *93*(370), 351–369.

Davidsson, P., Kirchhoff, B., Hatemi, J., & Gustavsson, H. (2002). Empirical analysis of business growth factors using swedish data. *Journal of Small Business Management*, *40*(4), 332–349.

Davidsson, P., & Klofsten, M. (2003). The business platform: developing an instrument to gauge and to assist the development of young firms. *Journal of Small Business Management*, *41*(1), 1–26.

Davidsson, P., & Wiklund, J. (2000). Conceptual and empirical challenges in the study of firm growth. In D. Sexton, & H. Landstrom (Eds.), *The blackwell handbook of entrepreneurship* (pp. 26–44). Wiley-Blackwell.

Delmar, F., Davidsson, P., & Gartner, W. (2003). Arriving at the high-growth firm. *Journal of Business Venturing*, *18*(2), 189–216.

Dobbs, M., & Hamilton, R. T. (2007). Small business growth: recent evidence and new directions. *International Journal of Entrepreneurial Behaviour and Research*, *13*(5), 296–322.

Galbraith, J. (1967). *The new industrial state*. London: Hamish Hamilton.

Gibb, A. A., & Davies, L. (1990). In pursuit of frameworks for the development of growth models of the small business. *International Small Business Journal*, *9*(1), 15–31.

Kalecki, M. (1939). The principle of increasing risk. In *Essays in the theory of economic fluctuations*. London: Allen and Unwin.

Marris, R. (1964). *The economic theory of managerial capitalism*. Macmillan and Co.

McEachern, W. (1978). Corporate control and growth: an alternative approach. *Journal of Industrial Economics*, *26*(3), 257–266.

McMahon, R. (1998). Stage models of sme growth reconsidered. *Small Business Research: The Journal of SEAANZ*, *6*(2), 20–35.

Mills, D., & Schumann, L. (1985). Industry structure with fluctuating demand. *American Economic Review*, *75*(4), 758–767.

Mueller, D. (1972). The corporation and the economist. *International Journal of Industrial Organization*, *10*(2), 147–170.

Nelson, R., & Winter, S. (1982). *An evolutionary theory of economic change*. Cambridge, MA: Harvard University Press.

Penrose, E. (1959). *The theory of the growth of the firm*. Oxford University Press, Oxford.

Rajan, R., & Zingales, L. (1998). Financial dependence and growth. *The American Economic Review*, *88*(3), 559–586.

Reder, M. (1947). A reconsideration of the marginal productivity theory. *Journal of Political Economy*, *55*(5), 450–458.

Richardson, G. (1964). The limits to a firm's rate of growth. *Oxford Economic Paper*, *16*(1), 9–23.

Seth, A., & Thomas, H. (1994). Theories of the firm: implications for strategy research. *Journal of Management Studies*, *3*(2), 165–191.

Sexton, D. L. (1997). Entrepreneurship research needs and issues. In D. L. Sexton, & R. W. Smilor (Eds.), *Entrepreneurship 2000* (pp. 401–408). Chicago: Upstart Blishing Co.

Smallbone, D., Leigh, R., & North, D. (1995). The characteristics and strategies of high growth smes. *International Journal of Entrepreneurial Behaviour and Research*, *1*(3), 44–56.

Sylos Labini, P. (1969). *Oligopoly and technical progress*. Cambridge, MA: Harvard University Press.

Trau, F. (1996). *Why do firms grow?* ESRC Centre for Business Research, University of Cambridge Working Paper No. 26.

Williamson, O. (1964). *The economics of discretionary behavior: managerial objectives in a theory of the firm*. Englewood Cliffs, NJ: Prentice Hall.

Williamson, O. (1967). Hierarchical control and optimum firm size. *Journal of Political Economy*, *75*(2), 123–138.

Williamson, O. (1975). *Markets and hierarchies. analysis and anti-trust implications*. New York: The Free Press.

Chapter 2

Growth expectations of IPO firms: when reality calls

Abstract. This paper studies the valuation of companies going public in continental Europe during the period 1995-2001. Most companies were valued by underwriters using the Discounted Cash Flow (DCF) model and/or the comparable multiples approach. We propose a methodology to infer the growth rates implied in offer prices, by reverse-engineering DCF valuations. We find that the estimated growth in cash flow is much higher than its actual realisations. The cross-sectional determinants of such estimation errors are market-to-book ratio, leverage at the IPO, earnings, underpricing, and the firm's age and size (the latter two negatively correlated). The implied growth rate in *under*priced IPOs tends to be *over*estimated. We also find evidence of a negative market reaction to post-IPO disclosure of disappointing post-IPO cash flows lower than expectations.

Keywords: Initial Public Offerings, DCF model, valuation, growth rates.

JEL Classifications: G30, G31, M40

2.1 Introduction

When going public, firms are faced with a difficult decision: how to determine the offer price for their shares. This is a question of considerable practical and theoretical importance to both investors and academics. Despite considerable research efforts, however, IPO valuations are still largely mysterious. The present paper challenges this research gap.

There exist two approaches to firm valuation. In direct valuation, the firm's value is estimated from its fundamentals; in relative valuation, it is estimated from the prices of comparable firms. In both approaches, the valuation faces specific difficulties related to the IPO timing decision. For example, firms may schedule their IPO in order to take advantage of "windows of opportunity". These are periods of market buoyancy during which other companies in the same industry tend to be overvalued (Loughran & Ritter, 1995). Thus, investors risk over-paying for stock in firms priced using relative valuation methodologies. Besides, firms may decide to go public when they are able to display positive growth opportunities, and thus induce optimistic valuations. To do this, firms may time their IPO for when transitory earnings are high, since investors have difficulty distinguishing between transitory and permanent earnings (this is the signal-jamming explanation given by Stein (1989). Finally, managers may window-dress accounting numbers to make their firms look better (Teoh, Welch, & Wong, 1998). Again, investors risk over-valuation of such firms.

Since the seminal paper on valuing IPOs by Kim and Ritter (1999), a few recent papers have investigated the use of multiples of comparable firms to value IPOs (e.g. Berkman, Bradbury, and Ferguson, 2000; Purnanandam and Swaminathan, 2004; Jagannathan and Gao, 2005). All these studies use value estimates produced by researchers to test the accuracy of valuations and typically find that IPO firms are overvalued at offer prices relative to their comparables. We approach the problem from a different perspective, examining the accuracy of "real-world" valuation models used by investment banks. Specifically, we refer to continental Europe, where the level of disclosure of assumptions behind an IPO firm valuation is higher than in the US. In particular, we rely on hand-collected data from IPO prospectuses. This is likely the most cost-efficient means of obtaining information about the companies going public (Friedlan, 1994).

By investigating this information, researchers can hope to understand how underwriters arrive at valuations for the firms they take public. Prior studies accessing this information typically report that underwriters frequently use two or more valuation methods, and that DCF and comparable multiples are the most widely used methodologies. We are aware of only three other papers investigating how underwriters value the stocks of companies they bring public: Cassia, Paleari, and Vismara (2004) in Italy, Roosenboom (2007) in France, and Deloof, De Maeseneire, and Inghelbrecht (2009) in Belgium. The present study extends their insights by considering IPOs on the three largest stock markets in continental Europe. The empirical setting is the population of all 342 non-financial firms that went public during the period 1995-2001 in France (Euronext Paris), Germany (Deutsche Börse), and Italy (Borsa Italiana), excluding new markets.

We find that underwriters typically determine the initial price range for shares using traditional valuation techniques such as the DCF method or the comparable multiples method. Most IPOs were actually priced using both techniques. It could be speculated, however, that valuation is not necessarily the first step in pricing an IPO. Underwriters may begin by obtaining

a reasonable estimate of the IPO price based on current market conditions, recent transactions, or industry multiples, then tune their valuation assumptions accordingly. In other words, the more formal and defendable valuation methodologies could be used to support the underwriters' preferred IPO prices rather than to obtain them (Thomas, 2007). It is therefore of interest to infer the growth expectations implicit in the IPO pricing. There could indeed be considerable reverse-engineering behind the valuation information disclosed in official IPO prospectuses. To this extent, we investigate a sample of 184 IPOs priced using a DCF model to address a basic research question: at what rates were the IPO firms expected to grow by their underwriters?

To answer this question, we derive an estimation procedure which uses public information to estimate the cash flow growth rates implied by IPO prices. Precisely, we reverse-engineer the underwriters' DCF models to get back the implied growth rates of free cash flow over the next five years. This approach is similar to that of estimating the internal rate of return on a bond using market values and coupon payments. We find that the market attaches a high growth expectation to IPO firms: the cash flow of an "average" IPO firm is expected to grow by about one-third each year. Unfortunately, ex-post realisations do not meet such ambitious ex-ante targets; we find that median post-IPO growth rates are only slightly positive (1.8%) over the five years following an IPO. We provide several robustness tests to confirm that such optimism is implicit in the offer prices.

We perform a regression analysis to identify the cross-sectional determinants of estimation errors, measured as the relative difference between actual and estimated cash flows. The level of upward bias in underwriters' estimates appears to be correlated with the firm's market-to-book ratio, leverage, net earnings, age and size at the time of the IPO (these two with negative coefficients), and underpricing. When a specific issue appears to be overvalued, the underwriter discount the offer price more. This is in line with Loughran and Ritter (2002) conjecture that underwriters may "lean against the wind" of investor over-optimism. Estimation errors are also associated with long-term stock returns. The market does indeed react negatively to the disclosure of lower than expected cash flows. An intuitive explanation for this behaviour is that investors are constantly evaluating the accuracy of pre-IPO estimates and revising their price expectations accordingly.

The remainder of the paper is organised as follows. Section 2.2 reviews the literature. The DCF methodology and our reverse-engineered model are detailed in Section 2.3, and our sample is described in Section 2.4. Section 2.5 compares ex-ante estimates to ex-post realisations. Section 2.6 looks for the determinants of estimation errors, while Section 2.7 studies their relationship to stock market returns. Our conclusions are summarised in Section 2.8.

2.2 Literature review

This study brings together diverse streams of literature from the fields of accounting and finance. But first and foremost, our work aims to extend prior studies on the pricing of IPOs. This field of investigation was opened by Kim and Ritter (1999), who were the first to employ multiples of comparable firms to study the valuation US IPOs. Considering both historical accounting numbers and forecasted earnings, they found that price-earnings multiples based on forecasted earnings yield more accurate valuations. Later, Berkman et al. (2000) estimated

the value of 45 newly listed firms in New Zealand and concluded that DCF and price-earnings valuations have similar accuracy. Purnanandam and Swaminathan (2004) found that the median offer prices of US IPOs in the period 1980-1997 were overvalued by about 50% relative to industry comparables. They attribute the discrepancy to differences in the expected growth rates. Using the Residual Income Model (RIM) and price-earnings ratios, Jagannathan and Gao (2005) studied a sample of US IPOs in the period 1981-2002 and found that they were fairly valued whatever the methodology used. In all these studies, the researchers produce ex-post value estimations to test the accuracy of valuation methods. In contrast, market participants may have access to non-public information and take into account firm-specific factors not considered by academics. Three prior studies have examined the accuracy of the valuation models actually used by investment banks, taking advantage of the more extensive disclosure required of companies going public in Continental Europe.

Cassia et al. (2004) examined the methods used by underwriters to value 83 IPOs in Italy during the period 1999-2002. They find that relative valuation is the approach more frequently adopted by underwriters (87% of the IPOs), closely followed by DCF (80%). No other valuation method is even mentioned in the IPO prospectuses. The prominence of the comparable multiples method can be attributed to the high percentage of IPOs by high-tech companies on the Nuovo Mercato during this period. The authors point out that the DCF technique has difficulty evaluating high-tech companies, which tend to have short operating histories and may not have profits to report. On the other hand, the multiples of comparable firms are typically higher than that of the firm going public. The authors therefore argue that underwriters may have selected comparables that make their own valuations look conservative.

Roosenboom (2007) studied 228 French IPOs from the period 1990-1999, finding that while underwriters often use two or more valuation methods, they base their pricing on a single method. Their choice depends on the firm's characteristics, aggregate stock market returns, and aggregate stock market volatility in the period before the IPO. In particular, the DCF model is more frequently used when aggregate stock market returns are high[1]. The DCF method is also more common when the aggregate stock market is relatively volatile, that is, when investors are concerned about the firm's fundamental value. The DCF model may provide investors with this information at the time they need it most.

Deloof et al. (2009) studied 49 IPOs from the 1993-2001 period on the Brussels Stock Exchange and found that DCF is by far the most popular valuation method, being used to price all IPOs in the sample. While multiples valuation is sometimes used, investment banks rely mostly on estimated future earnings and cash flows.

As it deals with the pricing of IPOs, our study is also related to the literature studying the accuracy of analysts' forecasts. Several studies in this field have found that analysts tend to be overoptimistic; their forecasts systematically exceed the actual figures (see Derrien (2007) for a review). The pressure on analysts to produce favourable reports on IPO firms, both before and after the offering, is well documented and has attracted considerable regulatory attention. Extant works generally compare the ex-ante expectations of absolute performance measures such as earnings to ex-post realisations. Our study employs the same methodology to compare

[1]Such conditions offer a "window of opportunity" for IPOs, during which investors are eager to buy and more willing to believe the assumptions underlying the DCF method.

actual cash flows to the underwriters' expectations.

2.3 Methodology

The challenge of using accounting numbers for valuation has long attracted financial accounting researchers and professional financial analysts. The value of a business is based on its future prospects, so valuation models involving forecasts understandably have considerable currency. Indeed, the starting point of any direct methodology is the statement that analysts have to estimate payoffs in order to value firms. In general terms, valuations are equivalent to infinite forecasting horizons (Feltham and Ohlson, 1995; Penman, 2007). And if alternative models equivalent for infinite-horizon forecasts are thus stated, they necessarily yield equivalent valuations (Francis, Olsson, and Oswald, 2000; Courteau, Kao, and Richardson, 2001). However, even though going concerns are considered to continue indefinitely, practical analysis typically deals with finite forecast horizons. This need for finite-horizon forecasting is the rationale behind considering alternative valuation models. Among all the models proposed in the literature, DCF and RIM are the two most important alternatives. The RIM introduces an explicit charge for equity, and subtracts it from the net income to define the Residual Income. The present value of the Residual Income is added to the book value of equity to arrive at an equity valuation. Various extensions (Ohlson and Juettner-Nauroth, 2005; Ohlson and Gao, 2006) reconcile RIM with standard models that rest on taking the present value of free cash flows (Ohlson, 2009). However, although RIM is gained much attention in the scientific literature, there is no evidence of its use by the underwriters of European IPOs. DCF, on the other hand, is adopted in almost all IPO valuations (Cassia et al., 2004; Roosenboom, 2007; Deloof et al., 2009).

2.3.1 The DCF model

In the enterprise DCF model, the Enterprise Value at time t (EV_t) is estimated as the present value of expected future Free Cash Flows to the Firm ($E_t[FFCF_{t+i}]$), conditional on information available at time t and discounted at a rate that reflects the relative degree of risk (see Table 2.1 for notation). Subtracting the Debt Outstanding at time t (D_t) then yields an estimate for the equity value (E_t)[2].

Unless there are specific plans or reasons for terminating the business in the near term, the assumption of ongoing concern requires one to estimate the value of future cash flows over an indefinite period (Equation 2.1).

$$EV_t = \sum_{i=1}^{\infty} \frac{E_t\left[FCFF_{t+i}\right]}{(1+WACC)^i} \tag{2.1}$$

[2]DCF can be implemented from two different perspectives: that of shareholders (the equity side, or equity DCF) or that of the firm (the assets side, or enterprise DCF). The latter is more widespread, and refers to Free Cash Flows to the Firm ($FFCF$). This quantity is defined as the residual cash flow remaining after deducting operating costs and taxes, but not interest owed on debts. $FFCF$ is discounted at a rate reflecting the firm's degree of business risk. Since a firm can be seen as a set of assets, some financed with equity and others financed with debt, the total cost of its capital is often calculated as a weighted average of the costs of the two types of funding (Weighted Average Cost of Capital, $WACC$). The usual assumptions are that the firm's financial structure can be considered constant, and that the cost of its capital does not change in the future. In this case, it follows that the $WACC$ is constant in time. A detailed description of DCF valuation techniques can be found in text books such as Penman (2007) and Damodaran (2006).

In practice, like other direct valuation models, DCF typically divides the future into two periods. For each year in the first period (the explicit forecast), the analyst constructs an individual forecast of the cash flow. A continuous formula is then used to represent the steady-state value of the firm's post-horizon assets at the horizon. That is, the continuing value (or terminal value) of the company's prospective cash flows at the horizon is determined by a steady-state growth rate. This model thus assumes that future cash flows grow forever at a constant rate g_2 (Equation 2.2).

$$EV_t = \sum_{i=1}^{\infty} \frac{E_t\left[FCFF_{t+i}\right]}{(1+WACC)^i} = \sum_{i=1}^{T} \frac{E_t\left[FCFF_{t+i}\right]}{(1+WACC)^i} + \sum_{i=T+1}^{\infty} \frac{E_t\left[FCFF_{t+i}\right]}{(1+WACC)^i}$$

$$Assuming\ E_t\left[FCFF_{t+i}\right] = E_t\left[FCFF_{t+T}\right] \cdot (1+g_2)^{i-T} \qquad \forall i = T+1, \ldots, \infty$$

$$EV_t = \sum_{i=1}^{T} \frac{E_t\left[FCFF_{t+i}\right]}{(1+WACC)^i} + \sum_{i=T+1}^{\infty} \frac{E_t\left[FCFF_{t+T}\right] \cdot (1+g_2)^{i-T}}{(1+WACC)^i} \tag{2.2}$$

The above model can be further simplified into a two-stage model, where the cash flows have different stable growth rates before and after the horizon. During the first stage, cash flows are supposed to undergo constant (extra) growth each year at a rate g_1 (Equation 2.3).

$$EV_t = \sum_{i=1}^{T} \frac{E_t\left[FCFF_{t+i}\right]}{(1+WACC)^i} + \sum_{i=T+1}^{\infty} \frac{E_t\left[FCFF_{t+T}\right] \cdot (1+g_2)^{i-T}}{(1+WACC)^i}$$

$$Assuming\ E_t\left[FCFF_{t+i}\right] FCFF_t \cdot (1+g_1)^i \qquad \forall i = 1, \ldots, T$$

$$EV_t = \sum_{i=1}^{T} \frac{FCFF_t \cdot (1+g_1)^i}{(1+WACC)^i} + \sum_{i=T+1}^{\infty} \frac{FCFF_t \cdot (1+g_1)^T \cdot (1+g_2)^{i-T}}{(1+WACC)^i} \tag{2.3}$$

In this way, the Enterprise Value at time t (EV_t) is expressed as a function of five parameters: the cash flow at time t ($FCFF_t$), the length of the first growth stage (T), the stable growth rate of cash flows in the first (g_1) and second (g_2) stages, and the Weighted Average Cost of Capital ($WACC$) (Equation 2.4).

$$EV_t = \sum_{i=1}^{T} \frac{FCFF_t \cdot (1+g_1)^i}{(1+WACC)^i} + \sum_{i=T+1}^{\infty} \frac{FCFF_t \cdot (1+g_1)^T \cdot (1+g_2)^{i-T}}{(1+WACC)^i}$$

$$EV_t = FCFF_t \left[\sum_{i=1}^{T} \left(\frac{1+g_1}{1+WACC} \right)^i + \left(\frac{1+g_1}{1+WACC} \right)^T \sum_{i=1}^{\infty} \left(\frac{1+g_2}{1+WACC} \right)^i \right] \tag{2.4}$$

2.3.2 IPO pricing using the DCF model

The DCF formula just given (Equation 2.4) is used to determine the value of IPO firms. In this study, we invert the DCF model to estimate the expected growth rates implied in IPO prices. To some extent, our approach is similar to the process of estimating the internal rate of return on a bond using market values and coupon payments. There are obviously many firm-specific factors to consider when attempting to estimate the growth rates, so Equation

(2.4) may not accurately describe many firms. However, even if the results for individual firms are only indicative, this simple two-stage model allows us to consistently estimate the short-run growth rates implied by offer prices across a broad sample.

We use the actual FCFF values known prior to the IPO to estimate post-IPO cash flows ($FCFF_t \equiv FCFF_{IPO}$). That is, subsequent $FCFF$s are estimated simply by applying the fixed growth rates g_1 and g_2 to the pre-IPO cash flow. Under these assumptions, the Enterprise Value at the IPO (EV_{IPO}) is estimated as the discounted sum of expected future cash flows expressed as a function of the cash flow prior to the IPO (Equation 2.5).

$$EV_t = FCFF_t \left[\sum_{i=1}^{T} \left(\frac{1+g_1}{1+WACC} \right)^i + \left(\frac{1+g_1}{1+WACC} \right)^T \sum_{i=1}^{\infty} \left(\frac{1+g_2}{1+WACC} \right)^i \right]$$

$$\textit{At the IPO } (t = IPO)$$

$$EV_{IPO} = FCFF_{IPO} \left[\sum_{i=1}^{T} \left(\frac{1+g_1}{1+WACC} \right)^i + \left(\frac{1+g_1}{1+WACC} \right)^T \sum_{i=1}^{\infty} \left(\frac{1+g_2}{1+WACC} \right)^i \right] \quad (2.5)$$

The enterprise value at IPO is the sum of its Equity Value at IPO prices (E_{IPO}) and the value of Debt outstanding before the IPO (D_{IPO}), less the IPO Cash Inflow (CI_{IPO}). The equity value at IPO prices is equal to the market capitalisation, measured as the offer price (P_{IPO}) times the number of shares existing after the IPO. The latter is defined as the number of shares existing prior to the IPO, (NSH_{pre}), plus the newly issued or primary shares, (NSH_{new}). The cash raised by the company at the IPO (CI_{IPO}) is the offer price (P_{IPO}) times the number of newly issued shares (NSH_{new}). Hence, the offer price (P_{IPO}) can be expressed as the difference between enterprise and debt values at IPO ($EV_{IPO} - D_{IPO}$), scaled by the number of shares outstanding before the IPO (NSH_{pre}, Equation 2.6).

$$EV_{IPO} = E_{IPO} + D_{IPO} - CI_{IPO}$$

$$\textit{Assuming} \quad E_{IPO} = p_{IPO} \cdot (NSH_{pre} + NSH_{new}) \quad \textit{and} \quad CI_{IPO} = p_{IPO} \cdot NSH_{new}$$

$$EV_{IPO} = p_{IPO} \cdot (NSH_{pre} + NSH_{new}) + D_{IPO} - p_{IPO} \cdot NSH_{new}$$

$$EV_{IPO} = p_{IPO} \cdot NSH_{pre} + D_{IPO}$$

$$p_{IPO} = \frac{EV_{IPO} - D_{IPO}}{NSH_{pre}} \quad (2.6)$$

2.3.3 Reverse-engineering the DCF model

Our procedure is in the same spirit as a recent line of accounting studies that invert the Residual Income valuation model (Ohlson, 1995; Feltham and Ohlson, 1995) to obtain estimates of the expected rate of return on equity investment[3]. If we assume that the enterprise value at IPO is estimated with the Enterprise DCF model, the offer price can be calculated in Equation (2.7)

[3]This expanding body of literature typically uses either the RIM or the Abnormal Growth in Earnings model (Gode and Mohanram, 2003; Easton, 2004) to determine the expected rate of return implied by analysts' forecasts, current book values, and current prices. The resulting rates of return are often used as estimates of the market's expected rate of return and/or the cost of capital (Daske, 2006; Dhaliwal, Krull, Li, & Moser, 2005; Francis, LaFond, Olsson, & Schipper, 2004; Francis, Khurana, & Periera, 2005; Hail & Leuz, 2006; Hribar & Jenkins, 2004). Easton and Sommers (2007) argue that analysts' earnings forecasts, which are known to be optimistic, yield upwardly biased estimates for expected rates of return.

by substituting Equation (2.5) into Equation (2.6). We use this equation to derive the growth rates implied by IPO prices. The short-term extra-growth rate (g_1) is derived, given the IPO market value of a firm, its FCFF prior to the IPO ($FCFF_{IPO}$), the long-term growth rate (g_2) and the expected cost of capital ($WACC$).

$$p_{IPO} = \frac{FCFF_{IPO}}{NSH_{pre}} \left[\sum_{t=1}^{T} \left(\frac{1+g_1}{1+WACC} \right)^t + \left(\frac{1+g_1}{1+WACC} \right)^T \sum_{t=1}^{\infty} \left(\frac{1+g_2}{1+WACC} \right)^t \right] - \frac{D_{IPO}}{NSH_{pre}} \tag{2.7}$$

As Equation (2.7) is a polynomial equation of the T-th order, the g_1 is retrieved via numerical techniques $g_1 = \mathcal{F}\left(FCFF_{IPO}, g_2, WACC, T, NSH_{pre}, D_{IPO}, p_{IPO}\right)$. Specifically, applying the perpetuity formula, we obtain our final model in Equation (8). Henceforth, we will refer to Equation (2.8) as the reverse-DCF model.

$$p_{IPO} = \frac{FCFF_{IPO}}{WACC \cdot NSH_{pre}} \left[\frac{\left(1 + g_1 \cdot \left[(1+WACC)^T - 1 + (1+g_2) \cdot (1+g_1)^{T-1} \right] \right)}{(1+WACC)^T} \right] - \frac{D_{IPO}}{NSH_{pre}} \tag{2.8}$$

As IPO firms are often young, with limited accounting information, we presume that the market will expect high initial growth rates. We are therefore mainly interested in the short term, when the firm's competitive advantages come into play. In other words, the growth rate that is applied to truncated payoffs *must* be high when the market value of firm is clearly not justified by accounting fundamentals, as is often the case[4]. Table 2.1 on the facing page summarizes the notation and definition of variables.

2.4 Sample

2.4.1 Sample selection

Our sample is composed of recent European IPOs priced using the DCF model. The list is taken from the EURIPO database, which includes all IPOs taking place in Europe since 1985[5]. We apply filters as follows. First, we select book-built IPOs occurring between 1995 and 2001 in France (the Premier and Second Marché of Eurnoext Paris), Germany (the Amtlicher and Geregelter markets of Deutsche Börse), and Italy (the Mercato Telematico Azionario of Borsa Italiana)[6]. The sample also excludes financial firms, property companies, and investment trusts because the reporting environments of these sectors are significantly different. Finally, privatisation IPOs are excluded because specific political objectives could distort our sample.

[4]IPO firms cannot be expected to outperform their counterparts in the long term; as they mature, their growth rates will approach those of their competitors. Assuming a specific long-term growth rate to estimate the short-term growth rate is therefore consistent with the two-stage DCF model. In theory, the transition between stages coincides with the end of any source of extra profitability due to competition forces (Mauboussin & Johnson, 1997; Damodaran, 2006). The second stage represents a steady state, with a perpetual growth rate (g_2) lower than the first stage's rate (g_1).

[5]EURIPO is a database on European and American IPOs managed by Universoft, a spin-off company of the University of Bergamo (www.euripo.eu).

[6]We exclude firms going public on the new stock markets as their valuation typically does not rely only on firm's fundamentals (Cassia et al., 2004). Given the large number of dot.com companies that went public on these segments, their inclusion could have introduced potential biases in the sample.

TABLE 2.1
Notation and definition of the variables

Notation	Definition
Panel A: Notation used in the reverse-engineered DCF model	
EV_t	Enterprise Value at time t
E_t	Equity value at time t
D_t	Value of outstanding Debt at time t
$FCFF_t$	Free Cash Flows to the Firm at time t
$E_t[FFCF_{t+i}]$	Expected Free Cash Flows to the Firm (estimated at time t for time $t+i$)
$WACC$	Weighted Average Cost of Capital
g_1	Growth rate during the first stage ("extra growth") of the DCF model
g_2	Growth rate during the second stage ("stable growth") of the DCF model
T	Duration of the first stage of the DCF model (years)
$FCFF_{IPO}$	Free Cash Flows to the Firm prior to the IPO, as reported in the prospectus
EV_{IPO}	Enterprise Value at IPO: $EV_{IPO} = E_{IPO} + D_{IPO} - CI_{IPO}$
E_{IPO}	Equity value at IPO price: $E_{IPO} = p_{IPO} \cdot (NSH_{pre} + NSH_{new})$
D_{IPO}	Value of outstanding Debt before the IPO, as reported in the prospectus
CI_{IPO}	Cash Inflow at the IPO due to the subscription of newly issued shares:
NSH_{pre}	Number of shares existing prior to the IPO
NSH_{new}	Number of newly issued shares (primary offer)
p_{IPO}	Offer price: $p_{IPO} = (EV_{IPO} - D_{IPO}) / NSH_{pre}$
v_{IPO}	Fair price: $\left(EV_{IPO}^{\text{actual FCFF}} - D_{IPO}\right) / NSH_{pre}$
$EE_{i,j}$	Estimation Error for firm j in year i: $EE_{i,j} = (E_{IPO}[FCFF_{i,j}] - FCFF_{i,j}) / E_{IPO}[FCFF_{i,j}]$
Over-Valuation	Over-Valuation Index (O.V.I.): $O.V.I. = (p_{IPO} - v_{IPO}) / p_{IPO}$
Panel B: Definition of the variables used in the empirical analysis	
Short-Term Implied Growth Rate (g_1)	The short-term extra-growth rate (g_1) implicit in IPO prices, derived through the reverse-DCF model (Equation 7)
Estimation Error (EE)	Estimation Errors, defined as the difference between estimated and actual cash flows, scaled by estimated cash flows: $EE_{i,j} = \frac{E_{IPO}[FCFF_{i,j}] - FCFF_{i,j}}{E_{IPO}[FCFF_{i,j}]} = \frac{FCFF_{IPO,j} \cdot (1+g_1)^i - FCFF_{i,j}}{FCFF_{IPO,j} \cdot (1+g_1)^i}$
AGE	Natural log of one plus the firm's age, measured as calendar year of the IPO minus the calendar year of founding.
SIZE	Natural log of pre-IPO sales (€m)
INCOME	Net income prior to IPO (€m)
LEVERAGE	Book value of debt divided by the book value of equity at the IPO.
P/E	Price-to-earnings ratio at the IPO
Book to Market (B2M)	The ratio between the book and market values of equity. Book value is the pre-IPO book value of equity plus the capital inflow at the IPO (primary offer); market value is the number of shares outstanding after the IPO times the offer price.
D_VC	Venture Capital dummy, equal to 1 if one or more venture capitalists are pre-IPO shareholders.
SECTOR ER	Extra return in the firm's sector over the 6 months prior to listing (the extra return of the European Datastream sector index divided by the European Datastream index).
MOMENTUM	Market momentum, measured as Datastream Country Market index return over the 6 months prior to the listing, for each firm in the sample.
D_BUBBLE	Internet Bubble, equal to 1 if the company went public during the period 1999-2001, 0 otherwise.
DILUTION	The ratio between the number of newly issued shares and the number of pre-IPO shares.
PARTICIPATION	The ratio between the number of existing shares sold by existing shareholders and the number of pre-IPO shares.

For example, the pricing process of such firms may be influenced by a mandate to disperse share ownership as much as possible, either to promote equity investing or simply to curry favour with voters. The resulting population is composed of 342 IPOs.

From this set, we build an *ad hoc* sample of IPOs to test our reverse-DCF model. We select firms that respect three additional restrictions:

1. The book-built IPO was priced using the DCF model (205 IPOs)[7].
2. The pre-IPO FCFF was positive[8] (losing 11 IPOs).
3. Cash flows are available for five years after the IPO (losing 10 other IPOs).

The final sample thus contains 184 IPOs[9]. For these firms, we invert the DCF model as described above (using pre-IPO cash flow, equity book value and outstanding debt) to estimate the expected growth rate implied by their offer price.

2.4.2 Sample description

We find that underwriters usually (declare to) determine an initial price range for the shares using both the discounted cash flow (DCF) method and the comparable multiples method[10], combining the estimates to determine a fair value for the firm's equity (Table 2.2 on the next page). This is the case for 166 out of the 252 IPOs where we could find information on the valuation techniques used by underwriters. 213 IPOs were priced using the comparable multiples method, and 205 were priced using the DCF method. Underwriters used only multiples in 47 cases (213-166) and DCF in 39 cases (205-166).

Table 2.2 subdivides our sample by IPO year (Panel A), industry (Panel B) and the market of listing (Panel C). The first four years (pre-bubble: 1995-1998) account for 56.4% of European IPOs, but only 37.5% of our sample. During this period, we were not able to access information on the valuation process for a larger fraction of IPOs. The tendency to use both DCF and multiples has increased over time, the number of cases rising from 50 IPOs (out of 114 with valuation information) in the pre-bubble period to 114 (out of 138) in the post-bubble period.

No industry specificity characterises the sample. The most representative sector is Industrials (28%), followed by Consumer Goods, Technologies and Consumer Services (around 19% each). However, note that the technology sector represents only 14% of the original sample of IPOs. The higher percentage of technology firms in our sample is mainly due to a stronger presence in later years, during which information on valuation was more widely available. All the technology firms were valued using the comparable multiples method, often in addition to DCF. In other sectors such as basic materials and telecommunications, the DCF method was more common.

As for the listing countries, 44% of the IPOs are on Euronext Paris, 28.8% are on Borsa Italiana, and 27.2% are on Deutsche Börse. Valuation information was available for all but one

[7]The underwriters often use more than one method, combining their estimates into a composite valuation. This paper focuses on IPOs using the DCF model, but not necessarily alone. All the IPOs in our final sample were allocated prices during the book-building procedure. This fact was true of nearly all IPOs in France, Italy and Germany during the period studied (1995-2001), with the exception of 13 fixed-price French IPOs. Otherwise, the relevant regulatory aspects were similar for the IPO markets in these three countries (Paleari, Ritter, & Vismara, 2008).

[8]The growth rate of a negative number does not make intuitive sense.

[9]Because the sample drops by only 10% (from 205 to 184 IPOs) after applying the last two filters, we do not believe that our results are significantly affected by selection or survivorship bias.

[10]Other methodologies such as DDM and EVA are also mentioned, but only in a minority of cases.

TABLE 2.2
Valuation techniques used to price European IPOs

	European IPOs		Valuation techniques				Sample	
	No.	%	No info	Multiples	DCF	Both	No.	%
Total	342		90	213	205	166	184	
Panel A. IPOs by Year								
Pre-Bubble 1995-1998	193	*56.4*	79	86	80	52	68	*37.5*
Bubble 1999-2001	149	*43.6*	11	127	125	114	116	*62.5*
Panel B. IPOs by Industry								
Industrials	100	*29.2*	25	61	61	47	50	*27.2*
Consumer Goods	81	*23.7*	25	44	42	30	41	*22.3*
Consumer Services	73	*21.3*	24	45	41	37	37	*20.1*
Technology	49	*14.3*	1	48	41	41	36	*19.6*
Other	39	*11.4*	15	15	20	11	20	*10.9*
Panel C. IPOs by Stock Exchange								
Borsa Italiana	81	*23.7*	1	66	64	50	53	*28.8*
Deutsche Börse	81	*23.7*	26	54	54	53	50	*27.2*
Euronext	180	*52.6*	63	93	87	63	81	*44.0*

This table classifies the IPOs of our sample by year, industry, and stock market. The final sample of 184 IPOs is compared to the population of 342 IPOs taking place from 1995 to 2001 on the stock markets of France, Germany and Italy, excluding new markets (source: EURIPO). The table also distinguishes between IPOs whose underwriters adopted the multiples method, the DCF method, or both for pricing (note that a significant fraction of the population lacked any information on valuation techniques). Industry sectors are based on the Industry Classification Benchmark (ICB) system, where 'Other' includes the basic materials, utilities and telecommunications sectors.

of the Italian IPOs, but for only two-thirds of the French and German IPOs.

2.4.3 Valuation information

In our model (Equation 2.8), the unknown parameter (g_1) is estimated as a function of seven other firm-specific variables reported in IPO prospectuses.

1. p_{IPO}: Offer price;
2. NSH_{pre}: Number of existing shares prior to the IPO;
3. $FCFF_{IPO}$: Free Cash Flow to the Firm prior to the IPO (the residual cash flow after deducting operating costs and taxes, but not debt interest owed);
4. D_{IPO} : Outstanding Debt at the IPO;
5. $WACC$: Weighted Average Cost of Capital (WACC);
6. T : Length of the first stage of the DCF model;
7. g_2 : Long-term growth rate (used after the end of the first stage).

Firm-specific variables (i.e. offer price, number of shares, cash flows and debt outstanding) were hand-collected for each IPO from the offerings prospectuses. Valuation-specific variables (i.e. $WACC$, T and g_2) were fully disclosed only in 68 cases (other 4 reported the length of the first stage but not the $WACC$). We therefore have a subsample of 68 IPOs with full disclosure of valuation information (labeled, full disclosure subsample) and a remaining subsample of 116 IPOs with missing information on the DCF estimates (labeled, estimation subsample). In this subsample, when specific information on a single variable was not available, we fill it in using the following assumptions:

1. $WACC$ (*firm-specific*). The Weighted Average Cost of Capital ($WACC$) is computed as $WACC = [E_{IPO}/(D_{IPO} + E_{IPO})] \cdot K_E + [D_{IPO}/(D_{IPO} + E_{IPO})] \cdot K_D$. Data on the firm's pre-IPO debt (D_{IPO}) and Equity (E_{IPO}) market values are taken from the EURIPO database. The cost of equity capital (K_E) is calculated using the Capital Asset Pricing Model (CAPM) as follows: $K_E = r_f + \beta \cdot (MRP)$, where $r_f$is the risk-free rate, β_E is the firm's unlevered beta[11], and MRP is the Market Risk Premium. Consistent with the literature (Claus & Thomas, 2001), we adopt the Ibbotson International Cost of Capital Reports to obtain estimates for year- and country-specific risk-free rates and MRPs. For each company, we estimate 250-day betas using its daily stock returns relative to the market index. The promised return on debt is computed as follows: $K_D = (r_f + \Delta) \cdot (1 - t_C)$. The spread Δ is defined for each firm according to its S&P risk class, based on the ratio between operating profit and interest expenses, using the conversion tables published by Damodaran (2006). The corporate tax rate t_C is the statutory corporate income tax rate for resident companies, as reported in the "Corporate Tax Rate Survey" by KPMG, and refers to the country of a company's headquarters. The estimates do not vary significantly if we use alternative tax rates obtained from the "Worldwide Corporate Tax Guide", published yearly by Ernst & Young.
2. (2) T (*constant*). The first period of the DCF model (before the steady state) is typically a-five year forecast. T is assumed to equal 5 years for all firms[12].
3. (3) g_2 (*constant*). The long-term growth rate is assumed to equal 2.5% for all firms. This value approximates the historical growth of real gross domestic product in Europe[13].

Table 2.3 on page 22 compares to original population of 342 European IPOs with our sample of 184 IPOs. Test on the differences showed that there are no selection biases. We than report the descriptive statistics for two subsample of IPOs, the one with full disclosure on valuation information (full disclosure subsample of 68 IPOs) and the one with DCF parameter estimated under the above reported assumptions (estimation subsample of 116 IPOs). Moreover, we

[11]Betas are estimated for the first 250 days of trading after the IPO (excluding the first 21 trading days after the IPO, in order to avoid a potential bias from the price stabilisation period of underwriters). These estimates use post-IPO information. We also estimated the betas using ex-ante information (i.e., average industry betas for the months prior to the IPO), but the results do not vary appreciably.

[12]The DCF method was always applied in a two-stage model, with the exception of three cases in which a three-stage is used where the first period of explicit forecast is followed by a second phase where only the main economic-financial features are explicitly forecasted. This represents an attempt to overcome the trade-off between the need to extend the stage of explicit forecast long enough, and on the other hand, the need to limit the explicit forecast period to a reasonable length so that a reliable estimate is obtained. Three-stage DCF typically improve the identification of the steady-state for the beginning of the last period of implicit forecasts (Cassia & Vismara, 2009). In our model this variable is set constant to 5 years to make implied growth rates estimates comparable amongst the sample.

[13]The correct value of a firm's stock can be computed by capitalizing nominal cash flows at a nominal rate, or real cash flows at a real rate. Assuming a constant discount rate, inflation rate, and real growth rate during the second stage of the DCF (infinite horizon), these two methods are equivalent. During periods of inflation, the nominal cost of equity is higher by virtue of higher inflation. However, the nominal growth rate will also be higher - thus, inflation's effect on the real value of the stock will be neutral. As pointed out by Ritter and Warr (2002), misevaluation will occur if investors use a nominal discount rate but fail to incorporate a higher nominal growth rate into their valuations. In our model, the $WACC$ is a nominal amount so conceptually we are discounting the future more when inflation is higher than expected. Since inflation is not changing much during our sample period, however, our results are not significantly affected by this fact. As mentioned in footnote 3, IPO firms cannot be expected to outperform in the long term; as they mature, their growth rates will approach those of their competitors. It is therefore not possible *a priori* to assume higher steady-state perpetual growth rates (g_2) for a particular company or industry (Mauboussin & Johnson, 1997; Damodaran, 2006). The long-term assumption of a general model must necessarily be the same for all the firms.

applied these assumptions to the whole sample of IPOs, including those with full disclosure. We can therefore compare two separate statistics for the sample of 184 IPOs. One is made of 68 IPOs with full disclosure and 116 IPOs with estimation; the other is built by estimation, neglecting the valuation information available for 68 IPOs. The descriptive statistics of these samples are, obviously, the same with regards to non valuation-specific variables (they are made indeed by the same IPO firms). However, also estimated valuation-specific variables (i.e. $WACC$, T and g_2) do not differ significantly among subsamples. Our estimations of valuation variables do not introduce biases and could be to infer valuation information when not disclosed in the IPO prospectuses.

Companies going public are in median 17 years old at IPO. Median sales are 39 €m, while the median market capitalization at IPO prices is 96 €m (size of the offers 23 €m). The proportion of shares sold by existing shareholders (secondary offer) accounts for 10% of outstanding pre-IPO shares, while the median number of newly issued shares (primary offer) relative to pre-IPO shares is 16%. The offer price is typically lower than the first-day price (median underpricing 3.7%), but higher than the preliminary offer price (the median book-building partial adjustment is 3.6%)[14]. Finally, Section 2.10.1 (Appendix) describes several robustness checks we have made on the model.

2.5 Implied growth rates and estimation errors.

We shall now determine at what rates the IPO firms were expected to grow by their underwriters. To do so, we estimate the reverse-DCF model expressed in Equation (2.8). Panel A of Table 2.4 on page 24 reports the results. Given the skewness of distributions of firm-specific variables, throughout the paper we provide descriptive statistics in terms of averages, medians, and percentiles. We also estimate each variable at an "aggregate" level (i.e., a sum of the variable over all firms in the sample).

We find that the "average" IPO firm is expected to grow by 33.8% annually during its first five years as a public company. The median values of growth rates are lower than the averages (between 19% and 23%), as is the case with nearly all the variables used in the model (see Table 2.4). The average implied growth rate is 38.1% when referring to first-day prices rather than offer prices, and 33.1% when referring to preliminary offer prices. Estimations using the first-day prices yield higher results due to underpricing, whereas estimations based on preliminary offer prices yield lower results due to the partial adjustment phenomenon (the offer price is typically higher than the preliminary offer price).

In light of the underwriters' optimistic tendencies, the growth rates implied by IPO prices are likely to be higher than their realisations[15]. Our results certainly confirm this hypothesis

[14]The first pricing information is provided to the public in the form of an offer price range in the prospectus. We define Preliminary Offer Prices (POP) the midpoint of this book-building price range. Later, the Offer Price (Offer) is set by the issuing firm the day before the offering, and shares are allocated to investors at this offer price. Often the Offer Price is substantially higher than the Preliminary Offer Price, and the percentage difference between the two prices is termed Partial Adjustment. Beginning with Hanley (1993), various empirical studies have documented the magnitude of Partial Adjustment is the single biggest predictor of IPO underpricing (Loughran & Ritter, 2002). This learning process by which the price is discovered is even more important in Europe, as interactions with potential investors prior to registration are indeed routine there, whereas they strictly prohibited in the US (Jenkinson, Morrison, & Wilhelm, 2006).

[15]Of course, it is also possible that the differences between real IPO prices and fair values are incentive-based

TABLE 2.3
Descriptive statistics

	Europe	Sample	Subsample Full disclosure	Subsample Estimation	Sample Estimation
No. Firms	342	184	68	116	184
Age	27.8	25.8	24.9	26.3	-
	18.0	*17.0*	*15.0*	*18.0*	
Sales (€m)	449.8	415.5	408.9	419.3	-
	59.1	*39.4*	*37.2*	*42.1*	
Growth (%)	102.2	71.3	74.9	69.2	-
	21.1	*27.1*	*29.3*	*26.5*	
Return-On-Assets (%)	15.4	16.3	16.7	16.1	-
	15.1	*15.9*	*16.5*	*14.8*	
Market value (€m)	477.0	807.7	798.4	813.2	-
	65.5	*95.7*	*93.6*	*99.8*	
Size of the offer (€m)	102.7	108.6	111.5	106.9	-
	16.9	*22.7*	*23.1*	*22.3*	
Dilution (%)	18.2	20.7	19.8	21.2	-
	12.5	*16.2*	*16.7*	*16.1*	
Participation (%)	15.2	13.8	13.6	13.9	-
	15.7	*10*	*10.7*	*10*	
Market-to-book	4.0	5.1	5.8	4.7	-
	3.1	3.8	*3.5*	*3.9*	
Underpricing (%)	14	26.4	24.9	27.3	-
	3.3	*3.7*	*3.2*	*3.9*	
Partial adjustment (%)	2.4	3.1	3.3	2.9	-
	2.8	*3.6*	*3.2*	*3.8*	
Valuation uncertainty (%)	18.8	15.8	14.2	16.8	-
	16.8	*14.9*	*13.9*	*15.4*	
p_{IPO} (€)	-	21.9	22.5	21.6	21.9
		19.0	*19.4*	*19.0*	*19.0*
NSH_{pre} (000)	-	144.2	145.5	146.5	144.2
		4.0	*3.9*	*4.2*	*4.0*
$FCFF_{IPO}$ (€m)	-	160.7	158.4	162.1	160.7
		2.9	*2.8*	*2.9*	*2.9*
D_{IPO} (€m)	-	177.5	178.1	177.2	177.5
		0.2	*0.3*	*0.1*	*0.2*
E_{IPO} (€m)	-	807.7	802.8	810.5	807.7
		95.7	*95.2*	*96.4*	*95.7*
$WACC$ (%)	-	11.5	11.3	11.6	11.4
		11.2	*10.8*	*11.3*	*11.0*
T	-	5.2	5.5	5.0	5.0
		5.0	*5.0*	*5.0*	*5.0*
g_2 (%)	-	2.5	2.6	2.5	2.5
		2.5	*2.0*	*2.5*	*2.5*

This table compares the population of 342 European IPOs with our sample of 184 IPOs. Mean and median values (in italics) are reported. Some valuation information ($WACC$, T, g_2) is published in the IPO prospectuses of only 68 to 72 firms. Where missing, variables were estimated according to Section 2.4.3. The third and fourth columns split the sample in two subsamples. The "Full disclosure" is made of 68 IPOs with full disclosure on valuation information in the prospectuses, while the "Estimation subsample" is made of 116 IPOs for which at least a valuation variable has been estimated (see section 4.3). Last, the statistics reported in the final column refer to the estimations applied to the entire sample of IPOs, including those with full disclosure. Age, Sales and Return-On-Assets are measured for the year before listing. Growth is percent growth in sales the year prior to the IPO. The market value is at IPO prices (number of shares after the IPO times offer price). The size of the offer is the number of shares offered (both primary and secondary) times the offer price. Dilution is the ratio of newly issued shares over the number of pre-IPO shares. Participation is the ratio between the number of existing shares sold by existing shareholders and the number of pre-IPO shares. Market-to-book is the ratio between book value and the market value of equity at the IPO. Underpricing is the first day's return. Partial adjustment is the relative difference between the offer price and the midpoint of the book-building range. Valuation uncertainty is the ratio of the book-building price range to the midpoint of the range itself.

(Panel B of Table 2.4). In fact, the median Compound Annual Growth Rate (CAGR) of $FCFF$ is *negative* in the first years after the IPO. In the first year (CAGR_1), the median is below -100%, meaning that most of the companies in our sample showed a negative cash flow in the first year after going public, although all had positive $FCFF$ values prior to the IPO (this was one of our selection criteria). This may be taken as evidence of either intense investment activity after listing or market timing motivations to go public (i.e., the signal-jamming and window-dressing hypotheses). Cash flows recover as time passes, however; the median CAGR over five years (CAGR_5) is positive at 1.8%. However, even at this time actual growth rates are much lower than expected (the corresponding median values implied by offer prices is 21.5%) and for only 66 firms actual flows were higher than expected.

For each firm j, the expected cash flows in individual years i following the IPO are estimated conditional on information available at the time of the IPO (Equation 2.9). Ex-ante (implicit) underwriters' expectations are compared to actual ex-post figures by evaluating Estimation Errors ($EE_{i,j}$), defined as the difference between expected and actual cash flows, scaled by expected cash flows (Equation 2.10).

$$E_{IPO}\left[FCFF_{i,j}\right] = FCFF_{IPO,j} \cdot (1+g_1)^i \qquad \textit{for firm } j \textit{ in event year } i \tag{2.9}$$

$$EE_{i,j} = \frac{FCFF_{IPO,j} \cdot (1+g_1)^i - FCFF_{i,j}}{FCFF_{IPO,j} \cdot (1+g_1)^i} \qquad \textit{for firm } j \textit{ in event year } i \tag{2.10}$$

Panel C of Table 2.4 gives details on these Estimation Errors (EE). We find a median EE of 99.6% three years after the IPO (EE_3), and 61.0% after five years (EE_5)[16]. This result would seem to provide strong evidence for over-optimism in the DCF model assumptions used by underwriters. At the aggregate level, however, estimation errors are much lower (about 50% after three years and close to zero after five years). This means that investing in IPO firms is not in and of itself a losing strategy, but the ability the cherry-pick matters a lot.

We further investigate this issue by comparing the IPO prices (p_{IPO}) to *fair* value estimates. We define the fair value of a company at the IPO (v_{IPO}) using our reverse-DCF model, but with actual ex-post realisations of the cash flow over five years rather than the pre-IPO cash

(i.e., deliberate) and therefore unrelated to overconfidence. The difficulty of valuing IPOs is indeed keenly felt by investment banks, who are subject to reputation incentives. If the firm is undervalued, its existing shareholders do not appreciate "leaving money on the table". If the firm is overvalued, investors will be displeased and exercise caution in subscribing to future IPOs underwritten by the same banks. Underwriters who repeatedly bring firms public will have strong incentives to build their reputation. If they only handle a firms each year, however, or if the IPO market is not yet developed enough for accurate financial analysis, reputation-based incentives for underwriters may not be sufficient. Since investors cannot enter into direct contact with issuers, in such situations the latter must publicly convey information that can be used to value their shares. This may reduce information asymmetries between managers and public investors, and reinforces the need to explicitly state the valuation metrics used for pricing in IPO prospectuses. Such speculation lies beyond the scope of this paper, whose aim is to estimate how much growth expectations exceed the rates driven by fundamentals.

[16]We do not report EE one year after the IPO, as most of the $FCFF_1$ values are negative. In Table 2.4, EE estimates are given for all three price standards (preliminary offer price, offer price, and first-day closing price).

TABLE 2.4
Implied growth rates and estimation errors

	Average	25th	50th (median)	75th	Aggregate	St. Dev.
Panel A. Estimations (short-term implied growth rate)						
g_1 POP	33.1	-3.6	19.8	53.0		54.13
g_1 Offer	33.8	-3.7	21.5	56.9		54.26
g_1 1st Day	38.1	-1.9	22.5	55.9		60.44
Panel B. Realisations (actual CAGR of FCFF)						
$CAGR_1$	n.s.	-447.1	-137.6	15.7	-41.4	12,938
$CAGR_3$	-111.3	-240.8	-71.1	14.8	-32.3	207.14
$CAGR_5$	-55.5	-191.3	1.8	29.9	-8.7	128.24
Panel C. Estimation errors						
EE_3 POP	122.9	-23.8	95.2	230.9	51.6	519.73
EE_3 Offer	145.8	-22.3	99.6	247.6	52.3	554.27
EE_3 1st Day	125.7	-15.2	99.6	251.7	57.9	471.15
EE_5 POP	93.6	-53.3	65.0	128.6	-2.9	608.64
EE_5 Offer	85.5	-55.4	61.0	126.6	0.7	85.49
EE_5 1st Day	127.3	-31.6	70.2	119.3	13.2	127.29
Panel D. Over-valuation indices						
O.V.I. POP	125.9	-13.6	74.2	119.7		754.55
O.V.I. Offer	119.7	-16.1	73.8	117.7		705.69
O.V.I. 1st Day	86.5	-0.6	74	113.4		457.78

This table reports the short-term implied growth rates (Panel A), the actual post-IPO cash flows (Panel B), estimation errors (Panel C) and over-valuation indices (Panel D) resulting from reverse-DCF estimations of the final sample. "POP" refers to estimates based on the preliminary offer price (the midpoint of the book-building range), "Offer" to the actual offer price, and "1st Day" to the first-day closing price. Numerical subscripts refer to the individual year (or number of years in the case of *CAGR*) following the IPO for which the index was calculated. Aggregate *CAGR* values are obtained by summing the cash flows of all sample firms. Aggregate estimation errors are defined as the difference between the sum of estimated cash flows and the sum of actual cash flows, scaled by the sum of estimated cash flows. All values are in percentages.

flow[17]. The long-term hypothesis (g_2) is the same (Equation 2.11).

$$\begin{cases} p_{IPO} = \dfrac{EV_{IPO} - D_{IPO}}{NSH_{pre}} \\ p_{IPO} = \dfrac{FCFF_{IPO}}{NSH_{pre}} \left[\sum_{t=1}^{T} \left(\dfrac{1+g_1}{1+WACC} \right)^t + \left(\dfrac{1+g_1}{1+WACC} \right)^T \sum_{t=1}^{\infty} \left(\dfrac{1+g_2}{1+WACC} \right)^t \right] - \dfrac{D_{IPO}}{NSH_{pre}} \end{cases}$$
$$\begin{cases} v_{IPO} = \dfrac{EV_{IPO}^{actualFCFF} - D_{IPO}}{NSH_{pre}} \\ v_{IPO} = \dfrac{1}{NSH_{pre}} \left[\sum_{i=1}^{T} \dfrac{FCFF_{t+i}}{(1+WACC)}^i + \sum_{i=T+1}^{\infty} \dfrac{FCFF_{t+T} \cdot (1+g_2)^{i-T}}{(1+WACC)^i} \right] - \dfrac{D_{IPO}}{NSH_{pre}} \end{cases} \tag{2.11}$$

Finally, we define an Over-Valuation Index as the difference between real IPO prices (p_{IPO}) and fair values estimated using ex-post actual $FCFF$ (v_{IPO}), scaled by IPO prices (Equation 2.12). We find that the median IPO firm is overvalued at its offering by 74% (Panel D of Table 2.4).

$$\text{Over Valuation Index} = \frac{p_{IPO} - v_{IPO}}{p_{IPO}} \tag{2.12}$$

Table 2.5 on the facing page provides a breakdown of the implied growth rates, actual

[17]Our definition of 'fair value' is based on actual ex-post realisations of the cash flow over five years, unknown at the moment of the IPO. Hence, the cash flows estimated by analysts at the IPO may have been perfectly fair, given the available information about growth prospects at that time.

TABLE 2.5
Sample breakdown

	No. Obs.	g_1 (%)	CAGR (%)	EE_3 (%)	EE_5 (%)	OVI (%)
Panel A. IPOs by year						
Pre-Bubble 1995-1998	68	21.04	-62.43	224.91	135.78	185.76
		(10.52)	(-1.50)	(114.18)	(47.00)	(58.00)
Bubble 1999-2001	116	41.35	-51.42	100.16	56.48	81.44
		(26.53)	(3.50)	(90.89)	(76.00)	(77.00)
Panel B. IPOs by industry						
Industrials	50	21.24	-74.58	160.81	81.12	69.38
		(13.30)	(-8.00)	(41.21)	(59.50)	(55.50)
Consumer Goods	41	19.85	-64.50	33.42	111.25	100.75
		(-2.03)	(-21.50)	(76.15)	(73.00)	(75.00)
Consumer Services	37	31.25	-15.03	307.09	-81.20	-35.30
		(18.48)	(13.00)	(120.21)	(26.50)	(60.00)
Technology	36	58.50	-43.10	46.30	62.06	126.96
		(36.75)	(9.00)	(125.98)	(81.50)	(91.50)
Other	20	25.35	-80.04	230.54	301.19	387.52
		(10.79)	(-2.50)	(96.69)	(45.00)	(60.00)
Panel C. IPOs by stock exchange						
Euronext	81	20.71	-57.32	162.84	19.10	36.99
		(10.23)	(-1.00)	(74.67)	(55.00)	(67.00)
Deutsche Börse	50	51.96	-51.37	120.70	138.19	255.37
		(34.87)	(8.00)	(110.42)	(65.00)	(77.00)
Borsa Italiana	53	33.32	-57.79	148.28	138.35	89.07
		(12.81)	(-3.00)	(128.52)	(69.00)	(73.00)
Panel D. IPOs by size ($FCFF_{IPO}$)						
$<$ 1 €m	60	75.18	-60.60	222.54	131.98	112.27
		(69.29)	(18.00)	(148.91)	(83.50)	(93.00)
1 €m - 10 €m	81	19.93	-49.93	141.53	106.07	161.10
		(17.27)	(-1.00)	(112.15)	(55.00)	(67.00)
$>$ 10 €m	43	2.38	-58.84	44.56	-20.52	50.19
		(-10.42)	(-2.00)	(31.38)	(9.50)	(37.00)

This table summarises the short-term implied growth rates that can be inferred from offer prices using the reverse-DCF model. The sample is classified by listing year, industry, stock exchange and operating free cash flow at the IPO.

CAGR values, estimation errors, and overvaluation indices by year of listing, industry, stock exchange, and size. Our basic result holds irrespective of the dimension considered, especially when looking at the median values. The underwriter's growth expectation (g_1) is uniformly higher than the actual ex-post realisation (CAGR of free cash flows), as measured by both the estimation error (at three and five years) and the over-valuation index.

As expected, IPOs that occurred during the Bubble Period (1999-2001) were given higher (almost twice as high) implied growth rates than previous years' IPOs. High-tech IPOs were expected to have the strongest growth, and also ended up with the highest median levels of estimation error and over-valuation. Euronext appears to be the most conservative market, with lower expectations and estimation errors. Finally, we split the sample into three $FCFF_{IPO}$ classes to investigate the sensitivity of these indices to firm size. We find that firms with lower FCFFs prior to their IPO are characterised by higher expectations (g_1). This makes sense from the DCF valuation perspective, in that very low initial cash flows ($FCFF_{IPO} <$ 1m€) require very high growth potential to justify a high IPO valuation. Such expectations might be feasible given the (presumably) fast-growing nature of these small firms. This assumption is borne out to some extent in their ex-post realisations (the median CAGR is +18% for small firms,

TABLE 2.6
Reverse-DCF models of UK IPO firms with no disclosure of valuation information

	Average	25^{th}	50^{th} (median)	75^{th}	Aggregate	St. Dev.
g_1	30.9	4.0	19.2	52.1		42.09
$CAGR_1$	9.1	-104.5	-5.9	66.6	n.s.	1,239
$CAGR_3$	-40.6	-142.3	-0.2	36.3	14.2	169.52
$CAGR_5$	-30.7	-13.4	14.6	35.1	-31.5	123.22
EE_3	10.3	-92.3	32.4	105.9	35.5	354.25
EE_5	46.2	-50.1	11.5	94.1	48.7	526.64
O.V.I.	34.6	-27.1	18.0	80.3		291.28

This table provides descriptive statistics of the short-term implied growth rate (g_1), actual post-IPO cash flows ($CAGR$), estimation errors (EE), and over-valuation indices (O.V.I.) for a sample of 109 UK IPOs for which no information on valuation methods was disclosed in the offering prospectuses. Valuation variables were estimated according to the assumptions specified in section 4.3.

compared to a negative CAGR for largest firms).

Finally, we applied the reverse-DCF model to an independent sample of firms for which we do not have access to information on the valuation techniques used by underwriters due to lack of disclosure. This sample is composed of 109 United Kingdom IPOs occurring in the same period (1995-2001)[18]. We apply to these IPOs the assumptions exposed in section 4.3 and report the results of this analysis in Table 2.6. Our findings confirm the tendency to attach high growth expectations to IPO firms (the average expected short-term growth rate is 31%, which are not sustained afterwards (the average 5-year $CAGR$ is -31%). The averages and shapes of the distributions has a similar behavior to previous findings, with only slightly better performances for the UK sample. Hence, our model should be helpful for estimating the expected growth rates implied by IPO pricing even when no information is disclosed on their valuation.

2.6 Determinants of estimation errors

The cross-sectional determinants of estimation errors (EE) are investigated using robust OLS regressions. When identifying the explanatory variables, we focus on variables that prior studies have shown to have some predictive power and checked for the absence of mutual correlations. Precise definitions of the variables are provided in Table 2.1, while the correlation matrix is reported in Table 2.11 (Section 2.10.2 in Appendix). An examination of the correlations indicates that multicollinearity is not a problem[19]. We used the Akaike Information Criteria to identify the most parsimonious regression model. The dependent variable are the logarithm of one plus the age of the firm at the IPO (AGE), the logarithm of sales (SIZE), net earnings in the year before listing (INCOME), leverage at the IPO (LEVERAGE), book-to-market ratio (B2M), and the first-day return (UNDERPRICING)[20]. The final regression model is than specified as

[18]The procedure for selecting these companies was the same as that applied to the sample of French, Italian, and German IPOs, except that criteria regarding valuation information were skipped. We were able to collect information for 109 UK IPOs listed on the main market, all with positive pre-IPO $FCFF$ and available cash flow data over the following five years.

[19]Tables 2.7 and 2.8 report the average variance inflation factor (VIF) which is equal to the mean VIF of each variable. No variables had an average VIF higher than 10, which is usually considered the threshold of attention.

[20]Underpricing is not known prior to the IPO. The results of the model excluding this variable are qualitatively the same as the results when it is included, with lower fitting. As a robustness analysis, we include other control variables in the regression. None of these variables have statistically significant coefficients or a significant impact

follows:

$$EE = \alpha + \beta_1[AGE] + \beta_2[SIZE] + \beta_3[INCOME] + \beta_4[LEVERAGE] + \beta_5[B2M] + \beta_6[UNDERPRICING] + \epsilon_j$$

Table 2.7 on the following page reports the results and the descriptive statistics for the independent variables. AGE and SIZE are significantly and negatively related to estimation errors, meaning that older and larger firms tend to have smaller estimation errors. Future cash flows may be easier to predict for more mature companies, for which more information is available. The future cash flows of younger and smaller companies tend to be overvalued compared to their ex-post realisations. On the other hand, a firm's leverage at the IPO is positively related to estimation errors. This means that more indebted firms are less likely to fulfil expectations of cash flow growth rates. The book-to-market ratio (B2M) is negatively related to estimation errors. Firms with a high positive difference between market and book value of equity at the IPO are priced on growth prospects that are at least partially overestimated.

The level of income at the IPO is positively correlated with the estimation error. One possible motivation would be that higher earnings lead to a higher price-to-earnings ratio, which induces a higher firm valuation. This in turn would bring higher expected growth rates and a higher probability of obtaining large estimation errors. Price-to-earnings is indeed the most frequently used ratio for pricing IPOs on the main markets in this period (Cassia et al., 2004). However, if this is the case, this would mean that the implied growth rate in the DCF-valuation and the DCF-valuation itself would be determined by the P/E valuation. We control for P/E ratio (Model 2) and refuse this interpretation. Large earnings before the IPO increase the probability of estimation errors, independently by the price-to-earnings.

Finally, the coefficient of UNDERPRICING is significantly positive, which suggest that the implied growth rate in *under*priced IPOs tends to be *over*estimated. In other words, when a specific issue appears to be overvalued, the underwriter may discount the offer price more. Loughran and Ritter (2002) conjecture that underwriters may "lean against the wind" of investor over-optimism. They also identify a risk allocation hypothesis, in which underpricing protects the underwriter's reputation with investors, and enables the underwriter to indirectly compensate investors for participating in overpriced IPOs. As such, underpricing is part of an effort to maximize expected net proceeds. Similarly, Derrien (2005) argues that partial adjustment arises because underwriters compensate for overly optimistic demand for an issuer's shares.

2.7 Estimation errors and long-run performance

This section examines whether estimation errors are associated with long-term stock returns. The aftermarket performance is measured using Buy-and-Hold Abnormal Returns (BHAR), which are calculated for stock i over a time period T as follows:

on the other variables' coefficients. Only the market momentum, measured over a six-month period prior to the listing, displays a weakly negative correlation with 3-year estimation errors (statistical significance 90%). See Model 4.

TABLE 2.7
Determinants of estimation errors

		Estimation errors year IPO +3 (EE_3)				Estimation errors year IPO +5 (EE_5)			
COEFFICIENT	Descriptive Statistics	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
AGE	2.69	-0.062*	-0.062*	-0.062*	-0.069**	-0.033*	-0.033*	-0.033*	-0.036*
	(2.74)	(0.032)	(0.032)	(0.033)	(0.033)	(0.019)	(0.019)	(0.020)	(0.020)
SIZE	17.66	-0.696*	-0.696*	-0.757**	-0.698*	-0.417*	-0.417*	-0.433*	-0.410*
	(17.44)	-0.378	-0.378	-0.381	-0.377	-0.226	-0.226	-0.229	-0.225
INCOME	24.13	0.019**	0.019**	0.020**	0.019**	0.012**	0.012**	0.012**	0.011**
	(1.59)	(0.008)	(0.008)	(0.008)	(0.008)	(0.005)	(0.005)	(0.005)	(0.005)
LEVERAGE	0.68	0.206***	0.206***	0.202***	0.202***	0.128***	0.128***	0.126***	0.128***
	(0.34)	(0.031)	(0.031)	(0.032)	(0.031)	(0.018)	(0.018)	(0.019)	(0.019)
B2M	0.21	-0.317***	-0.317***	-0.324***	-0.318***	-0.189***	-0.189***	-0.191***	-0.188***
	(0.08)	(0.028)	(0.028)	(0.029)	(0.028)	(0.017)	(0.017)	(0.017)	(0.017)
UNDERPRICING	26.40%	0.995***	0.996***	1.014***	0.974***	0.565***	0.565***	0.568***	0.553***
	(3.70%)	(0.138)	(0.138)	(0.140)	(0.138)	(0.082)	(0.083)	(0.084)	(0.082)
P/E	31.63		-0.001				-0.007		
	(7.63)		(0.001)				(0.074)		
D_VC	26.63%			-1.728				-0.117	
				(2.193)				(1.318)	
DILUITION	20.70%			0.279				0.527	
	(16.20%)			(2.674)				(1.606)	
PARTICIPATION	13.80%			1.096				4.467	
	(10.00%)			(0.785)				(4.715)	
SECTOR ER	1.44%				0.723				0.398
	(3.13%)				(0.578)				(0.345)
MOMENTUM	7.79%				-1.641*				-0.922
	(5.50%)				(0.939)				(0.561)
D_BUBBLE	62.50%				-2.943				-0.564
					(2.761)				(1.65)
Intercept		6.925***	6.964***	5.927***	10.250***	3.228***	3.231***	2.574**	4.369***
		(1.294)	(1.295)	(1.845)	(2.742)	(0.774)	(0.777)	(1.108)	(1.638)
Adj R^2 (%)		46.21	46.15	46.02	46.5	45.82	45.51	45.18	46.23
F-Value		27.20***	23.40***	18.34***	18.67***	26.79***	22.84***	17.76***	18.48***
V.I.F. (average)		2.264	2.08	1.904	2.077	2.264	2.08	1.904	2.077

This table contains the results of OLS regressions on our European sample of 184 IPOs using White's heteroscedasticity-consistent standard errors. The dependent variable is the estimation error either 3 or 5 years after the IPO. Mean and median values (between brackets) of independent variables are reported in column (1). The variables are defined Table 1. V.I.F. is the Variance Inflation Factor. */**/*** denote significance at the 90%/95%/99% confidence levels.

$$BHR_{i,T} = \left[\prod_{t=1}^{T}(1+R_{i,t})\right] - 1$$

$$BHAR = \frac{1}{N}\sum_{i=1}^{N}\left[\left(\prod_{t=1}^{T}1+R_{i,t}\right) - \left(\prod_{t=1}^{T}1+R_{M,t}\right)\right]$$

where $R_{i,t}$ is the return of stock i at time t and N is the number of stocks in the portfolio. For each company, the corresponding DJ EURO STOXX industry index is used as a benchmark to compute industry-adjusted normal returns[21]. We find that our sample under-performs the benchmark index by about 25% over three years and 14% over five years. A regression analysis on the determinants of long-run performance is presented in Table 2.8 on the next page.

Cash flow estimates are a major factor in valuing new issues, so errors in this variable are expected to be an important determinant of aftermarket stock performance. IPOs whose actual ex-post cash flows exceed expectations are likely to experience higher abnormal returns in the years after issue, while those whose $FCFF$s are less than expected are likely to suffer lower BHARs. We therefore hypothesise that EE will be negatively correlated with BHAR if investors use the cash flow expectations implicit in IPO valuations. If the underwriter's estimate turns out to be erroneous, stock prices should react accordingly. To investigate the relationship between estimation errors and aftermarket performance, we run the regression whose results are presented in Table 2.8. Our main variable of interest, EE, does indeed have a negative coefficient in both the 3-year and the 5-year BHAR regressions. However, its coefficient is only significant at the three-year mark. This confirms the expected market reaction to disappointing cash flows.

We also find significant negative correlations between BHAR and other variables, such as leverage at the IPO (LEVERAGE), market-to-book ratio (inverse of B2M) and underpricing (UNDERPRICING). We therefore confirm that underwriters underprice more when an issue is likely to be overvalued relative to its long-run value (Kerins et al., 2007)[22]. Worse post-IPO market performance is also found for firms going public after a period of unusually high returns for seasoned companies in their sector (SECTOR ER) and for venture-backed IPOs (the dummy variable D_VC)[23]. As expected, the coefficient on the Bubble dummy is positive (D_BUBBLE).

We therefore confirm that underwriters underprice more when an issue is likely to be overvalued relative to its long-run value (Kerins, Kutsuna, & Smith, 2007).

[21] We exclude the first 21 trading days after the IPO date to avoid a potential bias from the price stabilisation period of underwriters. We also repeated the analysis employing local Datastream market indexes. The empirical findings reported here are robust with respect to the index employed.

[22] Loughran and Ritter (2002) conjecture that underwriters may "lean against the wind" of investor over-optimism implies that initial returns and long-run returns should be negatively correlated. Purnanandam and Swaminathan (2004) also conclude that IPOs are overpriced at offer and that the most overpriced IPOs provide the lowest long-run risk-adjusted returns.

[23] Our results do not confirm previous US-based findings of venture-backed IPOs outperforming non-venture backed IPOs (Megginson & Weiss, 1991; Brav & Gompers, 1997). Given that there are significant differences in the nature of venture capitalists in Europe and the US, however, findings on the role of venture capital and its influence on long-run performance are not generally transferable between the regions (Hege, Palomino, & Schwienbacher, 2009). Evidence on the performance of venture-backed IPOs in continental Europe is mixed. For instance, Rindermann (2004) finds that venture-backed IPOs in France, Germany and UK from the period 1996 to 1999 do not outperform those without venture backing. Among German Neuer Markt IPOs, Kraus and Burghof (2003) find that venture-backed IPOs have an inferior mean abnormal return.

TABLE 2.8
Estimation errors and long-run performance

		BHAR year IPO +3				BHAR year IPO +5			
COEFFICIENT	Descriptive Statistics	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
EE_3	145.80%	-0.050***	-0.032***	-0.032***	-0.032***	-0.031**	-	-	-
	(99.60%)	(0.013)	(0.011)	(0.011)	(0.011)	(0.014)			
EE_5	85.50%	-	-	-	-	-	-0.044	-0.043	-0.05
	(61.00%)						(0.105)	(0.107)	(0.108)
D_VC	26.63%	-0.269**	-0.230**	-0.212**	-0.220**	-0.242*	-0.186	-0.172	-0.184
		(0.106)	(0.105)	(0.107)	(0.109)	(0.138)	(0.134)	(0.136)	(0.138)
D_BUBBLE	62.50%	0.369***	0.377***	0.393***	0.516***	0.470**	0.362***	0.380***	0.464**
		(0.098)	(0.100)	(0.100)	(0.161)	(0.204)	(0.128)	(0.129)	(0.208)
SECTOR ER	1.44%	-0.181*	-0.194*	-0.184*	-0.190*	-0.335**	-0.336**	-0.326**	-0.331**
	(-3.13%)	(0.106)	(0.104)	(0.104)	(0.105)	(0.133)	(0.133)	(0.134)	(0.135)
LEVERAGE	0.68		-0.344**	-0.342**	-0.343**	-0.391*	-0.415**	-0.428**	-0.401**
	(0.340)		(0.150)	(0.153)	(0.156)	(0.198)	(0.192)	(0.197)	(0.201)
B2M	0.21		0.581***	0.465**	0.487**	0.549**	0.681***	0.580**	0.629**
	(0.080)		(0.174)	(0.189)	(0.193)	(0.245)	(0.220)	(0.239)	(0.245)
UNDERPRICING	26.40%		-0.229***	-0.191**	-0.201**	-0.253**	-0.303***	-0.272***	-0.286***
	(3.70%)		(0.076)	(0.080)	(0.081)	(0.102)	(0.096)	(0.101)	(0.103)
g_1	33.80%			(0.159)	(0.154)	(0.156)		(0.131)	(0.151)
	(21.50%)			(0.100)	(0.102)	(0.129)		(0.129)	(0.131)
DILUITION	20.70%			0.009	0.036	-0.036		-0.052	-0.031
	(16.20%)			(0.127)	(0.130)	(0.165)		(0.163)	(0.168)
PARTICIPATION	13.80%			0.057	0.068	0.216		0.088	0.09
	(10.00%)			(0.378)	(0.381)	(0.483)		(0.489)	(0.492)
MOMENTUM	7.79%				0.395	0.397			0.305
	(5.50%)				(0.408)	(0.518)			(0.524)
AGE	2.69				0.001	-0.002			-0.002
	(2.74)				(0.002)	(0.002)			(0.002)
SIZE	17.66				0.004	-0.002			-0.000
	(17.44)				(0.009)	(0.012)			(0.012)
Intercept		-0.329***	-0.433***	-0.393***	-0.549***	-0.323	-0.361***	-0.323**	-0.369
		(0.088)	(0.093)	(0.116)	(-0.190)	(0.240)	(0.114)	(0.148)	(0.246)
AdjR^2 (%)		16.36	19.96	19.81	19.00	12.29	11.63	10.71	9.88
F-Value		9.65***	7.41***	5.45***	4.25***	2.94***	4.38***	3.16***	2.52***
V.I.F. (average)		1.03	1.453	1.448	1.663	1.663	1.432	1.433	1.653

The table contains the results of OLS regressions our European sample of 184 IPOs using White's heteroscedasticity-consistent standard errors. The dependent variable is Buy-and-Hold Abnormal Returns (at 3 and 5 years). Mean and median values (between brackets) of independent variables are reported in column (1). The variables are defined Table 1. V.I.F. is the Variance Inflation Factor. */**/*** denote significance at the 90%/95%/99% confidence levels.

2.8 Conclusions

IPOs can be valued using a variety of methods, but a DCF calculation is usually involved. According to official IPO prospectuses, the vast majority of firms going public in continental Europe are priced using the DCF method and/or multiples of comparable firms. We focus on those IPOs priced using DCF, and reverse-engineer the model to infer the growth rates implied by offer prices. We find that IPO firms are typically priced on the basis of high growth expectations. The cash flow of the "average" IPO firm is expected to grow by a factor of about one-third annually over five years. These ex-ante implied growth rates are not sustained by ex-post realisations: the actual CAGR of cash flows are much lower than expected. We also compare IPO prices with "fair value" estimates obtained by using actual ex-post cash flows in our reverse-DCF model, and find that the median IPO firm is overvalued at the offering by 74%.

As pointed out by Loughran and Ritter (1995), the extraordinary growth rates of some recent IPOs can justify such excessive valuation levels as long as most investors believe they have identified the next Microsoft. However, investors seem to be systematically overoptimistic in their assessments. As a consequence, nearly all IPOs are valued too highly. The expected growth rates implicit in IPOs prices are so high that it would be difficult for most IPO firms to meet them. Smaller and younger firms are particularly exposed to upward bias, perhaps because future cash flows are easier to predict for more mature companies (with more available information). High levels of income and high levels of debt also induce estimation errors due to unmatched growth expectations. In addition to these fundamentals, market demand for shares is a determinant of estimation errors. Firms with a high positive difference between the market and book values of their equity at the IPO are priced on growth rates that are at least partially overestimated. Last, a high initial underpricing is correlated with high estimation errors and also predicts negative long-run performance. In the long run, we find evidence of a negative market reaction to the disclosure of cash flows lower than expected.

We expect this research to be of interest to both financial academics and practitioners. From an academic perspective, this study addresses the issue of over-optimism and provides empirical evidence for systematic overvaluation by underwriters. This paper also contributes to the literature on IPO pricing by proposing a reverse-engineered DCF model to estimate the expected growth rates implied by offered prices. From the perspective of investors, this study improves our understanding of the helpfulness and limitations of underwriters' estimates, and more generally, of the determinants of IPO valuations.

2.9 References

Berkman, H., Bradbury, M., & Ferguson, J. (2000). The accuracy of price-earnings and discounted cash flow methods of ipo equity valuation. *Journal of International Financial Management and Accounting*, *11*, 71–83.

Brav, A., & Gompers, P. (1997). Myth or reality? the long-run underperformance of initial public offerings: evidence from venture and nonventure capital-backed companies. *Journal of Finance*, *52*, 1791–1821.

Cassia, L., Paleari, S., & Vismara, S. (2004). The valuation of firms listed on the nuovo mercato: the peer comparables approach. *Advances in Financial Economics*, *10*, 113–129.

Cassia, L., & Vismara, S. (2009). Valuation accuracy and infinity horizon forecast: empirical evidence from europe. *Journal of International Financial Management and Accounting*, *20*(2), 135–165.

Claus, J., & Thomas, J. (2001). Equity risk premium as low as three percent? evidence from analysts' earnings forecasts for domestic and international stocks. *Journal of Finance*, *56*, 1629–1666.

Courteau, L., Kao, J., & Richardson, G. (2001). Equity valuation employing the ideal versus ad hoc terminal value expressions. *Contemporary Accounting Research*, *18*, 625–661.

Damodaran, A. (2006). *Damodaran on valuation: security analysis for investment & corporate finance*. John Wiley and Sons, New York.

Daske, H. (2006). Economic benefits of adopting ifrs or us-gaap - have the expected costs of equity capital really decreased? *Journal of Business, Finance, and Accounting*, *33*, 329–373.

Deloof, M., De Maeseneire, W., & Inghelbrecht, K. (2009). How do investment banks value ipos? *Journal of Business Finance and Accounting*, *36*(1-2), 130–160.

Derrien, F. (2005). IPO pricing in hot market conditions: who leaves money on the table? *Journal of Finance*, *60*, 487–521.

Derrien, F. (2007). Currying favor to win ipo mandates. In *AFA 2007 chicago meetings paper*.

Dhaliwal, D., Krull, L., Li, O., & Moser, W. (2005). Dividend taxes and implied cost of capital. *Journal of Accounting Research*, *43*, 675–715.

Easton, P. (2004). PE rations, peg rations, and estimating the implied expected rate of return on equity capital. *Accounting Review*, *79*, 73–95.

Easton, P. D., & Sommers, G. A. (2007). Effect of analysts' optimism on estimates of the expected rate of return implied by earnings forecasts. *Journal of Accounting Research*, *45*(5), 983–1016.

Feltham, G., & Ohlson, J. A. (1995). Valuation and clean surplus accounting for operating and financial activities. *Contemporary Accounting Research*, *11*, 689–731.

Francis, J., Khurana, I., & Periera, R. (2005). Disclosure incentives and effects on cost of capital around the world. *Accounting Review*, *80*, 1125–1163.

Francis, J., LaFond, R., Olsson, P., & Schipper, K. (2004). Costs of equity and earnings attributes. *Accounting Review*, *79*, 967–1011.

Francis, J., Olsson, P., & Oswald, D. (2000). Comparing the accuracy and explainability of dividend, free cash flow, and abnormal earnings equity value estimates. *Journal of Accounting Research*, *38*(1), 45–70.

Friedlan, J. (1994). Accounting choices by issuers of initial public offerings. *Contemporary Accounting Research*, *11*, 1–32.

Gode, D., & Mohanram, P. (2003). Inferring the cost of capital using the ohlson-juettner model. *Review of Accounting Studies*, *8*, 399–431.

Hail, L., & Leuz, C. (2006). International differences in the cost of equity capital: do legal institutions and securities regulation matter? *Journal of Accounting Research*, *44*, 437–483.

Hanley, K. (1993). The underpricing of initial public offerings and the partial adjustment phenomenon. *Journal of Financial Economics*, *34*, 231–250.

Hege, U., Palomino, F., & Schwienbacher, A. (2009). Venture capital performance: the disparity between europe and the united states. *Finance*, *30*(1), 7–50.

Hribar, P., & Jenkins, N. (2004). The effect of accounting restatements on earnings revisions and the estimated cost of capital. *Review of Accounting Studies*, *9*, 337–356.

Jagannathan, R., & Gao, Y. R. (2005). Are ipos underpriced? a closer examination. In *EFMA 2005 conference proceedings*.

Jenkinson, T., Morrison, A., & Wilhelm, W. (2006). Why are european ipos so rarely prices outside the indicative price range? *Journal of Financial Economics*, *80*, 185–209.

Kerins, F., Kutsuna, K., & Smith, R. (2007). Why are ipos underpriced? evidence from japan's hybrid auction-method offerings. *Journal of Financial Economics*, *85*, 637–666.

Kim, M., & Ritter, J. R. (1999). Valuing ipos. *Journal of Financial Economics*, *53*, 409–437.

Kraus, T., & Burghof, H. P. (2003). *Post-ipo performance and the exit of venture capitalists*. Working Paper, Universitat Munchen.

Loughran, T., & Ritter, J. R. (2002). Why don't issuers get upset about leaving money on the table in ipos. *Review of Financial Studies*, *15*, 413–443.

Loughran, T., & Ritter, J. (1995). The new issue puzzle. *Journal of Finance*, *50*, 23–51.

Mauboussin, M., & Johnson, P. (1997). Competitive advantage period: the neglected value driver. *Financial Management*, *26*, 67–74.

Megginson, W. L., & Weiss, K. A. (1991). Venture capitalist certification in initial public offerings. *Journal of Finance*, *46*, 879–903.

Ohlson, J. A. (1995). Earnings, book values, and dividends in equity valuations. *Contemporary Accounting Research*, *11*, 661–687.

Ohlson, J. A. (2009). Accounting data and value: the basic results. *Contemporary Accounting Review*, *26*, 231–259.

Ohlson, J., & Gao, Z. (2006). *Earnings, earnings growth, and value*. Now Publishers Inc.

Ohlson, J., & Juettner-Nauroth, B. (2005). Expected eps and eps growth as determinants of value. *Review of Accounting Studies*, *10*, 349–365.

Paleari, S., Ritter, J. R., & Vismara, S. (2008). *Explaining the simultaneous consolidation and fragmentation of europe's stock markets*. Working Paper, University of Florida.

Penman, S. (2007). *Financial statement analysis and security valuation (3rd ed.)* McGraw-Hill, New York.

Purnanandam, A., & Swaminathan, B. (2004). Are ipos really underpricied? *Review of Financial Studies*, *17*, 811–848.

Rindermann, G. (2004). The performance of venture-backed ipos on europe's new stock markets: evidence from france, germany and the uk. *Advances in Financial Economics*, *10*, 231–294.

Ritter, J., & Warr, R. (2002). The decline of inflation and the bull market of 1982-1999. *Journal of Financial and Quantitative Analysis*, *37*, 29–61.

Roosenboom, P. G. J. (2007). How do underwriters value ipos? an empirical analysis of the french ipo market. *Contemporary Accounting Research*, *24*(4), 1217–1243.

Stein, J. (1989). Efficient capital markets, inefficient firms: a model of myopic corporate behaviour. *Quarterly Journal of Economics*, *104*, 655–669.

Teoh, S. H., Welch, I., & Wong, T. J. (1998). Earnings management and the long-run market performance of initial public offerings. *Journal of Finance*, *53*, 1935–1974.

Thomas, J. K. (2007). Discussion of how do underwriters value ipos? an empirical analysis of the french ipo market. *Contemporary Accounting Research*, *24*(4), 1245–1254.

2.10 Appendix

2.10.1 Sensitivity analysis of the reverse-DCF model

As reported in Table 2.3, some valuation information ($WACC$, T, g_2) is only published in the IPO prospectuses of 68 to 72 firms. As a robustness check, a sensitivity analysis was performed with different assumptions for these variables, and similar results were obtained. The variables whose definitions had the greatest impact on g1 estimates are those involving the second (long-term) period: g_2 and T. However, in this ex-post analysis neither variable can be assumed to be cross-sectional variant (see footnote 3).

TABLE 2.9
Sensitivity analisys of implied growth rates

$g_2 \vert T$	5	6	7
2	35.24	28.46	24.06
	(22.98)	*(19.72)*	*(17.44)*
2.5	33.85	27.38	23.19
	(21.49)	*(18.70)*	*(16.77)*
3	32.36	26.23	22.26
	(20.41)	*(17.74)*	*(15.87)*

Table 2.9 reports the average and median values (in *italics*) of short-term implied growth rates estimated by applying Equation (2.8) with various values of g_2 and T to our sample of 184 IPOs. Assuming higher long-term growth rates (g_2) or periods (T) reduces the implied short-term growth estimates (g_1). However, this fact does not change the main results of our analysis.

As further robustness check, we calculated the implied growth rates (replicating part of Table 2.4) after assuming an infinite period of extra growth ($g \equiv g_1 \equiv g_2$). In this case Equation (2.7) can be rearranged as follows:

$$p_{IPO} = \frac{FCFF_{IPO}}{NSH_{pre}} \left[\sum_{t=1}^{\infty} \left(\frac{1+g}{1+WACC} \right)^t \right] - \frac{D_{IPO}}{NSH_{pre}}$$

As the resulting estimates no longer refer to the "short-term" implied growth rate but rather a constant implied growth rate, g is predictably lower than previous g_1 estimates. Based on actual IPO prices, it appears that underwriters expect the average firm to grow annually at a constant rate of 5%. 5 years after the IPO, however, the average $CAGR$ of cash flow is only 1.8% (Panel A and B of Table 2.10).

TABLE 2.10
Implied growth rates assuming an infinite period of extra growth

	Average	25^{th}	50^{th} (median)	75^{th}	Aggregate	St. Dev.
Panel A. Estimates (constant implied growth rate)						
g_1 POP	4.83	0.99	6.35	10.16		8.11
g_1 Offer	4.98	0.85	6.66	10.1		8.05
g_1 1st Day	5.43	1.18	7.1	10.66		7.86
Panel B. Estimation errors						
EE_3 POP	-278.75	-43.31	97.18	337.86	-125.68	7,066
EE_3 Offer	-167.64	-39.81	99.03	358.15	-130.42	7,005
EE_3 1st Day	-169.68	-39.75	99.01	352.17	-146.14	7,001
EE_5 POP	-0.36	-191.56	6.73	157.5	-9.92	2,204
EE_5 Offer	-59.09	-198.26	-0.44	157.39	-6.24	2,272
EE_5 1st Day	-63.07	-176.67	2.66	156.93	2.37	2,249

2.10.2 Correlation Matrix

Correlations amongst dependent variables are reported in Table 2.11. Significant correlations (99% confidence level) are indicated in bold type.

TABLE 2.11
Correlation Matrix

	VARIABLE	1	2	3	4	5	6	7
1	EE5	1						
2	EE3	**0.95**	1					
3	g1	0.16	0.13	1				
4	B2M	**-0.49**	**-0.48**	**-0.34**	1			
5	LEVERAGE	0.14	0.11	-0.23	0.17	1		
6	UNDERPRICING	0.02	0.05	0.12	**0.48**	**-0.25**	1	
7	D_VC	0.05	0.01	0.11	0.05	-0.01	0.15	1
8	D_BUBBLE	0.10	0.06	0.18	-0.16	**-0.28**	0.03	-0.09
9	MOMENTUM	-0.11	-0.09	-0.06	0.01	0.06	-0.05	0.14
10	SECTOR ER	0.02	0.03	0.03	0.02	-0.07	0.06	0.02
11	PARTICIPATION	-0.01	0.00	**-0.24**	0.21	**0.25**	0.02	0.09
12	DILUITION	0.01	0.00	0.04	-0.13	**-0.25**	0.01	-0.01
13	INCOME	0.00	-0.01	-0.08	0.16	-0.06	0.13	-0.02
14	SIZE	0.01	-0.01	-0.15	0.14	0.22	0.02	-0.07
15	AGE	**-0.26**	**-0.27**	**-0.27**	**0.27**	0.17	-0.06	-0.04

	VARIABLE	8	9	10	11	12	13	14
8	D_BUBBLE	1						
9	MOMENTUM	**-0.65**	1					
10	SECTOR ER	-0.05	0.17	1				
11	PARTICIPATION	-0.16	0.13	0.04	1			
12	DILUITION	0.14	-0.18	0.06	-0.2	1		
13	INCOME	0.06	-0.1	0.01	0.04	-0.03	1	
14	SIZE	-0.04	-0.05	0.00	0.12	-0.08	**0.82**	1
15	AGE	-0.15	-0.02	0.02	0.09	-0.05	0.09	0.10

Chapter 3

Are hyper-growth firms inherently different? Evidence from a sample of fast-grown European enterprises

Abstract. High-growth firms deserve increasing attention from researchers, as they account for the largest amount of new job generation and contribute to wealth and general economic development. However, although it's easy to conceive that firms rapidly growing hundreds of times their original size are far different from "usual" high-growth firms, literature has never explicitly investigated hyper growth as a different phenomenon with its own distinctive characteristics. This study tries to fill this gap by focusing on the factors distinguishing a sample of European hyper-growth firms from their lower-growth counterparts. Such firms are found to be younger, more involved in M&A and listing activities, to raise higher levels of debt, with a lower solvency and to rely more (in relative terms) upon investments in fixed assets. The affiliation to a parent company as long as a larger availability of (idle) slack resources are also found to play a distinctive role in distinguishing hyper growth firms.

Keywords: Hyper-growth, High-growth, Firm growth, Distinctive Features.

JEL Classifications: M10, M13, L21

3.1 Introduction

Powerful conceptual tools to describe firm evolution, like the corporate life cycle or stage-of-growth models, suggest that firms evolve through similarly structured and consequential stages (e.g. Miller & Friesen, 1984) starting as young, small and simple, and along a predictable path of transformation becoming older, larger and in general more complex. Moreover, a recurring aspect of such models is that growth is assumed to take place mainly in an early stage of a firm's life, during which time it happens at growing rates, slowing down during firm's maturity. Hence, one might think that all firms experience growth and that high growth is the norm, at least for a few, over a firm's life. However, this is not always the case; many firms may stagnate for a long period before experiencing a surge in sales growth, while others may not experience growth at all. In an extensive review of the literature on firm growth, Davidsson, Achtenhagen, and Naldi (2007) remarked that most firms start, live and die small, never embarking on a significant growth trajectory (cf. Aldrich, 1999; Reynolds & White, 1997). According to Barringer, Jones, and Neubaum (2005), only a few of the new ventures started each year in the US grow enough to evolve into large firms and also within the entrepreneurship literature, there are plenty of examples of entrepreneurs who realize little to no growth in their firms (Gimeno, Folta, Cooper, & Woo, 1997). So, high growth would be better conceived as the result of sustainable entrepreneurial activity rather than as a rite of passage.

High-growth firms, however, deserve a relevant role in the "real-word" economy: many scholars have proved that these firms create employment, wealth, and economic growth. For example, in the US, the "gazelles" (i.e., firms in the highest percentiles of the growth rate distribution) account for the largest part of the total increase in the employment rate, although they represent only a very small share of all companies (D. Birch, 1987). So, "it is not surprising that rapid growth is seen as the business equivalent of a birdie, a touchdown, or a home run on the field of dreams" (Nicholls-Nixon, 2005).

According to Fischer and Reuber (2003), despite (young) rapid-growth firms are a phenomenon attracting increasing attention from external resource providers, public policy advisors and firm owners and managers (cf. Huang & Brown, 1999), only a very small subset of the entrepreneurship research has initially focused on these abnormally successful firms and we are still far from an extensive comprehension of the unique characteristics and processes that they may possess. This is even more true for hyper-growth firms, which are largely excluded from academic research: "a very surprisingly conclusion is that despite its economic upside potential, growth research has focused predominantly on 'normal' to 'high' growth rates ... while overlooking formidably high growth or hyper-growth firms" (Markman & Gartner, 2002).

Although there is great inadequacy with respect to the literature on hyper growth, we have found some articles that have dealt with it unconsciously, by considering rapid or high growth (Hambrick & Crozier, 1985). However, even given these works, what we know about this phenomenon remains very limited, especially in the context of Europe, as the few existing studies on this subject are mainly confined to the US.

Our study addresses this gap by focusing on the factors distinguishing hyper-growth (or extraordinary-growth) firms in Europe in order to suggest policies to foster growth in this context. Though the reasons for success are likely to be idiosyncratic and difficult to codify and transfer, we believe that a structural extraordinary growth is not a mere contingent result

of circumstances but rather the result of choices and intentions. Thus, understanding its determinants may unveil "the key to success". In order to address this question, a sample 307 of hyper-growth firms has been developed from a large longitudinal dataset of European firms active between 1998 and 2006. As explained in the following paragraphs, because a general definition of hyper-growth is lacking in the literature, more than investigating the general phenomenon of hyper-growth, this article investigates a specific example of hyper-growth firms. The prototypical hyper-growth firm of interest is the one that experiences an extraordinary growth in sales over a short time, which should at least to some extent be accompanied by the accumulation of employees and assets so that organizational and managerial complexity increases with growth. As such, it has been coined a concept of hyper growth that is absolute rather than relative (i.e. it does not merely refers to a certain percentile of the growth rate distribution without considering absolute growth in size): a hyper growth firm has been defined as a company that grows (according to EU codification) from small (turnover lower than 10 mln €) to large (turnover higher than 50 mln €) over a short period of time (five years) and exhibit high growth in each period of this time frame (turnover growth higher than 20%). This also implies that the growth process is structural. Besides analyzing their characteristics, we have tested their uniqueness with respect to a matched control sample of firms growing at a normal pace. Findings show that such firms are younger (1) and more involved in merger and acquisition (M&A) (2) and listing (3) activities; moreover, they raise higher levels of debt (4) with a lower solvency (5) and rely more (in relative terms) upon investments in fixed assets (6). The affiliation to a parent company (7) as long as a larger availability of (idle) slack resources (8) are also found to play a distinctive role in distinguishing hyper growth firms..

The remainder of the paper is organized as follows. Section 3.2 briefly reviews the puzzling phenomenon of hyper-growth firms. Section 3.3 describes the hypotheses and the sample selection criteria. Section 3.4 highlights and discusses the main findings. Conclusions follow.

3.2 Literature review

According to Fischer and Reuber (2003), past research on rapid growth firms as a phenomenon has been intermittent, and the attitude toward them is somewhat ambivalent. Since the seminal contribution of Birch (1979), who coined the term "gazelles" to define firms in the highest growth percentiles, much research has been conducted over recent years on the value of fast-growing firms to the economy as well as their job generating potential[1]. However, at first, scholarly journals devoted to entrepreneurship and management have paid little attention to such firms; on the contrary, there are multiple reasons why they deserve consideration in their own right (Fischer, Reuber, Hababou, Johnson, & Lee, 1997).

First, as already stated, rapid-growth firms are job creators, so ensuring that they prosper rather than stumble is of considerable economic importance. This has been the focus of the articles that first adopted rapid growth as their major focus of inquiry; this literature

[1]Birch's gazelles are not necessarily small and young firms; in fact, no general agreement on their definition has emerged in the empirical literature. Following the initial contribution of Birch, many works have focused on the employment contributions of gazelles; Henrekson and Johansson (2008) offer an extensive interpretation of the empirical results of this strand of literature. Among the main conclusions, gazelles are found to generate a disproportionately large share of new net jobs as compared to non-high-growth firms, and on average, they are younger and smaller than other firms, even if young age more than smaller size is associated with rapid growth.

has consistently doubted the benefits of rapid growth and has investigated the actions and characteristics to cope with such growth as strictly intertwined with problems related to people, processes and resources that could undermine high-growth organizations (e.g. Kotter & Sathe, 1978; Hambrick & Crozier, 1985; Fombrum & Wally, 1989; Feeser & Willard, 1990; Willard, Krueger, & Feeser, 1992)[2]. Different organizational life cycles call for different managerial priorities (Smith, Mitchell, & Summer, 1985): entering a high-growth stage might create numerous problems and challenges (e.g. Greiner, 1972; Shuman & Seeger, 1986), which in turn require radical transformations that bring intense turmoil to a firm.

Second, by understanding high-growth firms, researchers may better understand the features involved with growth and success in general[3]. Factors influencing growth in small firms have usually been understood in terms of three main categories: the entrepreneur, the firm and the strategy (cf. Storey, 1994,). In such a framework, many factors have been found to be particularly associated with high-growth firms; however, an extensive review of them is beyond the scope of this paragraph. Only as examples, characteristics of entrepreneurs who lead fast-growth firms have included: the need for significant experience at mid-management level (Teach, Tarpley, & Schwartz, 1986), the misconception of the benefit of previous start-up experience (Chambers, Hart, & Denison, 1988), future orientations with regard to gathering information (Ginn & Sexton, 1989), and a willingness to become involved in situations with uncertain outcomes (Sexton & Ginn, 1990). High-growth firms are usually young, small and characterized by strategic planning and strategic orientation (Barringer, Jones, & Lewis, 1998), adaptability, flexibility and creativity (Lohmann, 1998), venture capital backing (Timmons & Bygrave, 1986), high level of R&D (McGee & Dowling, 1994) and innovation (Christensen & Bower, 1996).

Scholars have also been interested in contrasting the characteristics of high-growth firms with those of their slow-growth counterparts for discerning whether they are distinctive and unique with respect to those of their low-growth counterparts (e.g. Siegel, Siegel, & MacMillan, 1993; Cooper, Gimeno-Gascon, & Woo, 1994; Littunen & Tohmo, 2003; Moreno & Casillas, 2007, p. only to name a few). This question is fundamental if we want to understand if rapid-growth firms are a distinctive phenomenon or simply the result of contingencies. Overall, Barringer et al. (2005) suggest that the literature on rapid growth firms has become rather rich and mature, though previous reviews have concluded that it was very fragmented and immature (cf. Delmar, Davidsson, & Gartner, 2003; Wiklund, 1998). In particular, they state that rapid growth is not a random chance or event but is associated with specific firm attributes, behaviors, strategies and decisions that are critical in a firm's ability to achieve and sustain rapid-growth.

However, high-growth firms do not always appear to be of the same genius: their heterogeneity or homogeneity is still matter of discussion. Some evidence suggests that their paths to sustainable high growth are heterogeneous and that they are uniquely affected by their journey. Despite this, those that achieve success become more alike than different in terms of style, strategy and their set of skills and characteristics (Chan, Bhargava, & Street, 2006).

[2]After these studies, there has been a tail-off of interest pertaining to this topic; however, this strand of research has not been given up completely as the recent studies of Arbaugh and Camp (2000) and Nicholls-Nixon (2005) show.

[3]It is interesting to note that this stream of research suffers from a noticeable "halo effect", as it address the benefits of rapid growth without fully discussing the potential pitfalls involved (Barringer et al., 2005).

Until the denunciation of Markman and Gartner (2002), literature has never explicitly mentioned or investigated hyper growth as a phenomenon with its own distinctive characteristics, although it is easy to conceive that firms rapidly growing hundreds of times their original size are very different from high-growth firms usually found in the literature. Really, a closer look at the growth literature has revealed that some articles have already dealt with this topic but unconsciously, mixing hyper-growth up with just high-growth; this means that researchers have already investigated samples of hyper-growing firms but conceiving (and naming) them only as high-growth firms and not as something structurally different. The clearest examples are those articles that, as Markman and Gartner, have investigated the so-called "Inc. Firms". Since 1982, a periodical dedicated to the interests of small and growing enterprises named Inc. Magazine has annually ranked the 500 fastest-growing private companies of the US based on the last five years of sales growth[4]. Such firms are clearly an example of extraordinary-growth, as their growth rates range from some hundreds to many thousands percent. However, even if these articles study clear examples of extraordinary growth, they are few in number and are focused on quite different topics. Therefore, rather than cumulative findings, we can only draw from the literature some limited insights mainly confined to the US experience and to a specific sample of hyper-growth firms.

For example, being able to sustain rapid growth and high performance, which is the entrepreneur's impossible dream, depends on many factors, and it seems to be the exception rather than the rule (Nicholls-Nixon, 2005), as such literature suggests. Markman and Gartner (2002) investigated the relationship between extraordinary growth and profitability by examining a sample of Inc. 500 firms from 1992 to 1996 (559% to 31,000% growth rate. They found that hyper growth in term of sales and employees is unrelated to firm profitability, and it is likely to place strains on a firm's ability to operate efficiently and effectively. Their findings are not significantly different from those of previous studies; research conducted by McCann and Cornelius (1985) and Shuman and Seeger (1986) shows no statistical correlation between firm growth and financial performance for a sample of Inc. 100 and Inc. 500 firms, respectively.

Other authors have focused on problems that could jeopardize the health of the firm, especially if they show an extraordinary growth path. Investigating a sub-sample of Inc. 100 firms, Hambrick and Crozier (1985) identified four fundamental challenges that hyper-growth firms must address: instant size, which produces disaffected employees and gaps in the skills and systems required to manage growth; a sense of infallibility, which makes entrepreneurs less willing to change their strategies and behavior even as competitive conditions change; internal turmoil associated with quickly integrating new people into an organization; and extraordinary resources needed to meet the demands of rapid growth, which is typically cash-starving. Though every challenge calls for its own response, some overarching solutions put in place by successful firms have been identified; such firms anticipate and understand the incredible metamorphosis that they are undergoing and manage it consciously by balancing the past (i.e., values and techniques that allowed their growth) with the future (i.e., by bringing people, system and processes in line with the new demands of the expanding organization). Fombrum and Wally (1989) studied a sample of firms drawn from Forbes Magazine and Inc. Magazine of the years 1984 to 1985

[4]In fact, until 1981, the sample included only the 100 fastest-growing firms (Inc. 100), while in 2007, it was expanded to include 5,000 firms (Inc. 5,000).

(95 firms with an average annual growth rate of 159%); they investigated some contradictory pulls that management is required to balance that are exacerbated in extraordinary-growth firms, including bureaucratization versus decentralization, environment versus strategy and quality versus cost versus innovation. Willard et al. (1992) studied a sample of 155 high-tech manufacturing firms from the Inc. 100 between 1985 and 1990 (average five-year CAGR higher than 151%); they tested the conventional wisdom that rapidly growing firms quickly outgrow the founder's managerial capacity, namely, that unless the founder is replaced or supplemented by professional management, performance tends to stagnate or decline rapidly. Overall, no significant differences in performance were found between founder-managed and professionally managed firms, so it seems that the founders of these extraordinary-growth firms have been able to adapt to the increasing complexity of rapid growth without sacrificing performance or losing control.

Researchers consistently find that rapidly growing firms are more likely to engage in strategic planning than are their slow-growth counterparts (Shuman, Shaw, & Sussman, 1985; Bracker, Keats, & Pearson, 1988; Woo, Cooper, Dunkelberg, Daellenbach, & Dennis, 1989); in light of these findings, some studies have been conducted on the Inc. Firms to investigate their strategy-making processes. Shuman et al. and Shuman and Seeger (1986) identified four main areas that determine the strategic planning of such firms, namely, management planning and posture, type of planning process, planning areas and how planning is organized inside the firm. Instead of focusing on the strategy-making process, Enseley, Amason, and Markman (2003) sought to determine to what extent the strategy of hyper-growth firms really matters; using contingency theory, they modeled the interaction among strategy, environmental dynamism and firm performance across a sample of hyper-growth firms. Their findings highlight that the link between performance and strategy for such firms is moderated by the rate of environmental change. Feeser and Willard (1990) aimed to explain differences in performance levels between high- and low-growth firms operating in the computer industry by comparing firm founding strategies. Even though they discussed their work in terms of high growth, by taking a subset of Inc. 100, they in fact were investigating hyper growth, as their sample's average five-year CAGR of 62.5% demonstrates. Their results indicated that compared to their low-growth counterparts, high-growth firms are more likely to have products, markets or technologies closely related to those of their founders' incubator organizations, are more likely to have been started by large teams and are more likely to derive significant revenues from non-domestic markets. No significance was found for being the first to market or for being active in acquisitions.

Finally, Levesque and MacCrimmon (1999) explored the determinants of firm growth by developing an analytical model of entrepreneurial growth to be tested using the Inc. 500 firms from 1991 to 1997; three key phenomena were found as having a diminishing effect on future sales growth, namely, increases in hiring, increases in profitability and aging.

Even if the "Inc. Firms" are clearly an example of extraordinary-growth, they are not fully representative of such phenomenon. However, as a general definition of hyper growth is still lacking, it is not easy to clearly find other articles that have dealt with it in different terms. One way to overcome this problem is to review the high-growth literature, especially those articles that investigate firms showing extremely high growth rates (i.e., comparable to the Inc. Firms). Fischer et al. (1997), Barringer and Jones (2004) and Barringer et al. (2005) are examples of

such articles. In order to understand how owners and top management team members socially construct time so as to facilitate rapid growth, Fischer et al. examined firms with an average annual growth in revenues over five years higher than 100% (which means an overall growth higher than 3000%). Their findings suggest that the social construction of time should not be regarded as a by-product of growth but rather that shared time frames should be managed in an active, tacitly understood manner. Their study supports the view that a key task in strategic management is creating and maintaining systems of shared meaning that facilitate organized patterns of action directed toward certain goals, which in this case would be rapid growth. By dealing with the managerial capacity problem of high-growth firms (i.e., that a firm's ability to grow is directly related to its ability to improve managerial capacity in order to administer the growth itself), Barringer and Jones clearly investigated hyper growth, as their firms show a three-year CAGR higher than 80% (or near 500% across the entire period). Their results show that hyper-growth firms use different management techniques to lessen the impact of managerial capacity problems and enhance a firm's growth. Besides, these organizational practices and policies are not implemented in a single step but rather as a collection of initiatives that aim at socializing new employees, motivating managers and overcoming adverse selection and moral hazard. Finally, Barringer et al. compared rapid- and slow-growth companies through using a model of four major areas that presumably differentiate rapid growth from slow-growth firms, namely, founder characteristics, firm attributes, business practices, and human resource management (HRM) practices. Even though they explicitly discussed rapid growth, they actually investigated hyper growth, as the three-year compound annual growth rate for such firms ranged from 80% to 897% with an average of 166.32% (close to 1800% across the entire period). They found that the founders of rapid-growth firms are better educated, have a more compelling "entrepreneurial story" and have a higher industry experience; regarding firm attributes, rapid-growth firms turned out to have a stronger commitment to growth, to be more involved in inter-organizational relationships and to rely more on a growth-oriented mission statement. Regarding business practices, rapid-growth firms emerge as adding more unique value and having a deeper level of customer knowledge than slow-growth firms. Finally, with regard to HRM practices, firms gave evidence of emphasizing training, employee development, financial incentives, and stock options to a greater extent than their slow-growth counterparts.

Even though we have just shown that there exist some articles that have indirectly addressed hyper growth, what we know about this phenomenon is still very limited; this leaves a great space for future research to specifically address this topic and our study tries to add to the existing literature by identifying some of the distinctive features of European hyper-growth firms.

3.3 Methodology

3.3.1 Hypotheses

The aim of this study is not to identify the determinants of hyper growth, but rather to determine the differences that may exist between hyper-growth firms and their lower-growth counterparts. It is likely that some factors that foster growth can be found in any path of growth, regardless of its shape, but in this case, we look at what distinguish hyper growth.

This is all the more important when it comes to designing the methodology that best suits our goal (Davidsson & Wiklund, 2000), especially as to the nature of the dependent variable to use (dichotomic versus continuous), and the type of statistical model to apply (binary outcome model versus regression analysis).

In keeping with previous studies (Wiklund 1998), this paper addresses both internal and external characteristics to explain the differences between hyper-growth and non-hyper-growth firms. When identifying the explanatory variables, we focused on those that prior studies have demonstrated as having some predictive power; however, we have also been severely constrained by the data available in our starting dataset (i.e., ORBIS), which was mainly confined to accounting information. To overcome this problem, we have tried to enrich our sample with other publicly available information (e.g. company websites) or data taken from several different sources.

Resulting variables include firm's age, ownership structure, route to growth (organic vs. acquisitions), firm's resources (both financial and physical) and investment propensity. A brief description of our expectations regarding these variables is given in the following paragraphs.

Age. For decades, firm age has been considered a determinant of firm growth. There is abundant evidence that firm growth rates are negatively related to firm age and age has also been found as the variable with the highest (negative) impact on firm growth among all other variables (Davidsson, Kirchhoff, Hatemi, & Gustavsson, 2002). These results are also consistent with the entrepreneurship literature, which tends to assume a negative relationship between firm age and entrepreneurial orientation (Lumpkin & Dess, 1996), which in turn affects firm growth. Because rapid growth is one fascinating type of the emergence phenomenon (Gartner, Bird, & Starr, 1992) and because emergence has been characterized as constitutive of entrepreneurship (Katz & Gartner, 1988), we expect that a firm's "entrepreneurial orientation" is a major factor in explaining extraordinary growth, and this in turn should have a direct impact on firm age. Furthermore, young firms are also more flexible and have developed fewer rigid routines than older firms; this allows them to discover and exploit growth opportunities more easily than older firms.

(1) Hyper-growth firms are expected to be younger than their low-growth counterparts.

Ownership structure. Implications of ownership on growth are mixed in literature. It seems that independent firms are more flexible, whereas firms affiliated with a group have access to a larger variety of resources, since they can fall back on their parent company (Barney, 1991; Variyam & Kraybill, 1993). So, it is possible that the increased flexibility related to independence leads to a higher likelihood of identifying opportunities but a lower probability of exploiting them due to a lack of resources and vice versa. This may be exacerbated by higher incidences of professional management in a dependent firm, which may offer higher skills to manage growth but lower entrepreneurial drive with respect to the owners or managers of independent firms, who appear to suffer from the opposite situation. Links to parent or holding companies afford firms a wider range of external contacts, allowing them to be more aware of and understand market needs, dynamics and opportunities. In addition, a greater need to justify business plans to parent companies is likely to force dependent firms to engage more extensively in market research and engage more directly with their customers (O'Regan,

Ghobadian, & Gallear, 2006); all this should affect growth in a positive manner. However, given the importance of quarterly and annual results, many group-owned firms are less likely to engage in risky and/or longer-term projects, as they may be required to deliver a performance objective to their parent that is typically based on financial criteria (Ghemawat & Khanna, 1998; Dierickx & Cool, 1989). Finally, it should also be noted that the ownership effect may play different roles in different industries. (Almus & Nerlinger, 1999).

(2) The ownership effects on hyper growth are mixed.

Routes to growth. The distinction between organic growth and growth through acquisitions has been widely ignored in previous research (Delmar et al., 2003). However, this distinction deserves more scrutiny, as the drivers and effects of the two forms of growth are likely to have different managerial implications (Penrose, 1959). There are some advantages of external over organic growth for firms wishing to attain rapid growth. First, mergers and acquisitions are far more rapid processes of growth; moreover, external growth does not present set-up problems, since productive and technological competences are already present. In addition, it does not widen market boundaries but rather captures some of the growth opportunities of its competitors. Finally, findings show that high-growth firms find ways to reach their growth goals, regardless of environmental conditions, increasing the amount of acquisition-based growth in hard times while the majority of other firms seem to swing up and down with the development of the economy in general (Davidsson & Delmar, 1997). In addition, M&A processes require skills and resources that not all organizations are able to manage; however, this does not seem to be our case due to the rather large size of the sample at the beginning of the growth trajectory (t_0).

(3) Hyper-growth firms are expected to rely more on M&A processes to foster growth.

Financial resources (debt). The financial literature has pointed at the provision of external debt and equity capital as a very important factor in promoting small-firm growth (Becchetti & Trovato, 2002), and entrepreneurial high-growth firms have been characterized as capable of raising funds to finance their growth decisions (Harrison, Love, & McMillan, 2004). Brown, Davidsson, and Wiklund (2001) upheld that entrepreneurial-oriented firms are also growth-oriented and that they focus more on opportunities than on the efficient use of their resources. Moreover, as growth requires substantial financial resources, hyper-growth firms are typically expected to be cash starved.

(4) Hyper-growth firms are expected to incur higher levels of debt.

(5) Hyper-growth firms are expected to be less focused on their solvency capacities.

Financial resources (equity). Hyper-growth firms are characterized by large current and future investments, high leverage, and high growth, so the opportunity to tap public markets for funds should be particularly appealing for them (Pagano, Panetta, & Zingales, 1998). Besides the mere capital raising, by undergoing an IPO, firms may obtain other advantages that could foster rapid growth, such as, for example, enhanced prestige and credibility with all the stakeholders (Stoughton & Zechner, 1998) or a lower cost and a higher supply of external finance (Rajan, 1992; Pagano et al.).

(6) Hyper-growth firms are expected to be more involved in listing activities.

Slack resources. The slack resources argument proposes that slack resources influence performance because slack provides that cushion of actual or potential resources that allows an organization to adapt successfully to internal pressures for change as well as to initiate changes in strategy (George, 2005). Slack enhances experimentation and risk-taking (Nohria & Gulati, 1996), may insulate the firm from exogenous shocks (Thompson, 1967), and provides more flexibility for managers to develop strategic options - managerial discretion - (Bourgeois, 1981). This argument is consistent with the combination of entrepreneurial and resource-based views of the firm (Penrose, 1959; Wernerfelt, 1984; Barney, 1991). The resources-based view of the firm suggests that a firm can be seen as a set of resources and that business growth can be explained through the availability of idle resources. Such idle resources arise as a consequence of their indivisibility, which forces the firm to acquire larger quantities than it actually requires. If a firm is entrepreneurial, the existence of these resources promotes firm growth (Penrose). It seems reasonable to say that the indivisibility of assets, at least proportionately, has more implications on smaller firms, as the ones considered in this article, than on their larger counterparts.

(7) Hyper-growth firms are expected to have a higher availability of slack resources.

Investment propensity. Even without discussing in detail the role of specific investments, such as R&D or marketing initiatives, on firm growth as others have already done (e.g. Cohen & Levinthal, 1990; Lieberman, 1989; Mosakowski, 1993), it may be interesting to investigate the investment behavior of hyper-growth firms with respect to their lower-growth counterparts. Even if the former are expected to invest more than the latter in absolute terms, since the growth of sales is at least partially accompanied by the accumulation of assets, it is not clear whether this dynamic also occurs in relative terms.

(8) The investment propensity of hyper-growth firms is unclear ex-ante.

3.3.2 Sample

As financial data on young, privately held companies remain largely undisclosed, there are many challenges in identifying and selecting extraordinary-growth entrepreneurial firms (Markman & Gartner, 2002). In order to overcome this problem, the first step of our empirical study has been to build an extensive database of European firms. Data were gathered from ORBIS, a global database that has information on more than 40 million companies all over the world[5].

In building our own dataset, we imposed some collection criteria: (1) years from 1998 to 2006 are covered; (2) firms must belong to the European area, which is defined as EU25 plus Norway, Switzerland and Iceland;[6] (3) turnover of the last available year should be higher than 10 million Euros; and finally, (4) some industries of low interest from an entrepreneurial perspective are excluded, including agriculture, hunting and forestry, fishing, mining and quarrying, financial

[5]ORBIS includes over 18 million European companies from 46 countries. Contents are sourced from over 40 different information providers (IPs), all experts in their regions or disciplines. In addition to descriptive information and company financials, ORBIS contains further detail such as news, market research, ratings, country reports, scanned reports, ownership information and M&A data.

[6]EU25 includes Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, the Netherlands and the United Kingdom.

intermediation, insurance and pension funding, public administration, defense and compulsory social security.

The criteria that we imposed reflect our intention of focusing on the European area and anticipate our intentions of comparing hyper-growth firms with other firms that also started small but have grown large enough to no longer be considered small firms[7] by the last available turnover year at the latest. As a result, our sample includes 243,465 firms.

According to Cooney and Malinen (2004), part of the difficulty in achieving consensus regarding high-growth firms originates from the inability to find a settled definition of what constitutes firm growth. This question leads to other definitional quandaries, including the definition of "fast growth" versus "high growth", as the two are different in meaning: the former relating to time (i.e., speed of growth), while the latter to quantity. Moreover, both cannot leave out of consideration the definition of the time period over which growth should occur. Such considerations hold, exacerbated, when considering hyper growth, for which a definition is even lacking, as this phenomenon has not been explicitly addressed by the literature. As a result, more than investigating the general phenomenon of hyper-growth, this article investigates a specific example of hyper-growth firms.

The prototypical hyper-growth firm that we have in mind is one that experiences extraordinary growth in sales over a short time, which should at least to some extent be accompanied by the accumulation of employees and assets so that organizational and managerial complexity increases with growth. As such, we have coined a concept of hyper growth that is absolute rather than relative (i.e. a certain percentile of the growth rate distribution), as it includes both rapid growth (i.e., time) and high growth (i.e., absolute growth). We define a hyper growth SME is as a company that grows from small to large over a short period of time and for which this growth process is structural. As such, we consider the following selection criteria for identifying a hyper-growth firm:

1. We use a five-year period to study extraordinary growth. As our data cover 1998 to 2006, we have analyzed 5 different cohorts (i.e., 1998-2002, 1999-2003, 2000-2004, 2001-2005, 2002-2006) to sort out the hyper-growth firms. In each cohort, we refer to the first year as t_0 and to the last year as t_4.
2. The firm should be small-sized at t_0 (i.e., firm's turnover should be lower than 10 €mln), but it should be large at t_4 (i.e., turnover should be higher than 50 €mln).
3. The growth rate of sales for each period between t_0 and t_4 should be at least 20%.

We have based our definition of growth on sales growth; though growth is a multi-faceted phenomenon that can be measured with a range of indicators, there is growing consensus that if only one indicator is used and the study has a cross-industry design, sales growth is the preferred choice, as all commercial firms must have sales to survive (Davidsson et al., 2007; Ardishvili, Cardozo, Harmon, & Vadakath, 1998; Hoy, McDougall, & D'Souza, 1992; Weinzimmer, Nystron, & Freeman, 1998; Wiklund, 1998). It is the most general of alternatives, as it is the increase

[7]The turnover threshold for a firm to be considered as a small firm has been defined by the EU commission as 10 €mln (Recommendation 2003/361/EC). In particular "medium-sized enterprises consist of enterprises which employ fewer than 250 persons and which have either an annual turnover not exceeding 50 €mln , or an annual balance sheet total not exceeding 43 €mln. Small enterprises are defined as enterprises which employ fewer than 50 persons and whose annual turnover or annual balance sheet total does not exceed 10 €mln" (Commission, 2003, p.14-15).

in sales that necessitates an increase in assets and employees, and this results in rising profits or market share (Flamholtz, 1986). Moreover, this is also the indicator best matched with the theory in question.

We have chosen the thresholds fixed by the European Commission (i.e., 10 €mln and 50 €mln for small and large firms, respectively) as we are focusing on the EU. Since we investigate growth as a structural condition and not as a merely contingent result of circumstances, we have imposed a minimum yearly growth rate. In our mind, hyper growth proceeds at an extraordinary breath-taking rate during which the firm cannot stumble, even for a short period. The value chosen is not random but rather corresponds to the threshold commonly adopted in the literature to define high growth. Thus, we require that our firms be at least high-growth firms over the entire time frame. Even if there is no agreement on the definition of rapid growth, many times the recent literature defines a firm as a high-growth firm if it shows a sales growth rate of at least 20% for three or more consecutive years (Fischer & Reuber, 2003; Nicholls-Nixon, 2005; O'Regan et al., 2006; Sims & O'Regan, 2006). Some authors extend this period to five years; an illustrative example is that of D. Birch (1979), who identified "gazelles" as growth-orientated companies that have achieved a minimum sales CAGR of 20% over the previous five years. Moreover, as our work originates from the seminal contributions of the so-called "Inc. Articles" in which growth is measured over a five-year horizon, this interval appears as the most appropriate for making comparisons with other studies. Finally, in this way, we avoid modeling growth as one giant leap (Davidsson & Wiklund, 2000), and we also do not make our calculations overly sensitive to stochastic variation (Weinzimmer et al., 1998).

As the aim of our study is to clarify the peculiarities of hyper-growth firms in the EU, a comparable control sample of non hyper-growing firms has also been developed. To make this comparison meaningful, the firms in this second sample have been matched with those of the main sample in terms of countries, industries and cohorts; this means that for each cohort in the main sample, there is a corresponding cohort in the control sample made up by the same number of firms in terms of both industry and geographic area. This control sample has been built through a stratified random sampling starting from the same population from which the main sample had been drawn, excluding those firms previously defined as hyper-growth firms (243,118 firms).

For this sample, additional criteria have been imposed: (1) firms should be small at t_0 (i.e., turnover should be lower than 10 €mln); (2) they cannot go bankrupt over the period under investigation; and (3) they must cross the turnover threshold of 10 €mln at some point over the period under study.

In this way, we can compare hyper-growth firms with other firms that also start small and experience growth (becoming at least mid companies) but not to the same extent as hyper-growth firms. Detailed information about the representativeness of the control sample is given in Appendix.

3.4 Results and discussion

3.4.1 Features of hyper-growth firms

According to the previously mentioned criteria, starting from the entire sample of 243,465 European firms, only 307 have been defined as hyper-growth firms (0.13%); they are characterized by a five-year CAGR of sales ranging from a minimum of 51.21% to a maximum of 1,502.05%, with a mean of 138.80% (95.92% median). These figures become even more astonishing if we translate them over the entire period, as the average firm shows a grow rate close to 61,000% (1,373% median).

Table 3.1 on the following page shows the sample distribution of hyper-growth firms by geographic area (Panel A), industry (Panel B) and cohort (Panel C)[8]. Almost half of the sample is located in the Mediterranean Area, about a quarter of it comes from the British Isles, and the rest is split among the remaining three areas. As high-growth firms are usually found in dynamic and growing environments (Hoy et al., 1992), we expected that Eastern and Central Europe would be better represented, as they show a higher GDP growth over the period under investigation respect to the other countries.

Four industries account for more than 85% of hyper-growth firms: Wholesale and retail trade (26.38%), Real estate and business activities (24.10%), Manufacturing (20.85%) and Transport, storage and communication (14.33%). The contribution of other industries is quite marginal; however, although Health and social work and Education account for only 0.98% and 0.33%, respectively, their relative shares are significant considering the kind of industry that they are. All in all, the distribution does not vary much over time. The breakdown of the sample by both industry and country is reported in Table 3.6 in Appendix (Section 3.7.1). Table 3.1 also reports information about the M&A and listing activities ($M\&A\_D$ and $LIST\_D$ variables) of hyper-growth firms as well as their ownership structure (SUB_D variable). As all the previous variables are dummies, the table reports their frequency (%), either in absolute terms (i.e., with respect to the total sample of hyper-growth firms) or relative terms (i.e., with respect to the total number of hyper-growth firms that show that characteristic).

First, we wonder whether hyper-growth firms grow only organically or also through merger and acquisition (M&A) processes: 13.68% of the entire sample, i.e., 42 firms out of 307, show at least one M&A operation during the growth period . Since we are studying a group of SMEs, this number is quite high. Panel A stratifies M&A activity by geographic area; it is interesting to notice that firms located in Eastern Europe tend to grow organically, while almost 30% of hyper growth in Northern Europe is linked to external growth. The M&A activity of hyper-growth firms in the Mediterranean Area is below the average of the entire sample, even though it accounts for 29.27% of the total M&A activity. Finally, in both the British Isles and Central Europe, nearly one in five firms use M&A activity to grow. Most hyper-growth firms in Health and social work (66.67%) grow through M&A activity; on the other hand, firms in the Education or Hotels and restaurants industries grow only organically. In the Construction

[8]To put the figures in a readable form, we have grouped countries into five areas: Northern Europe (Denmark, Finland, Iceland, Norway and Sweden), British Isles (Ireland and United Kingdom), Mediterranean Area (France, Greece, Italy, Malta, Portugal and Spain), Central Europe (Austria, Belgium, Czech Republic, Germany, Luxembourg, Netherlands and Switzerland) and Eastern Europe (Estonia, Hungary, Lithuania, Latvia, Poland, Slovakia and Slovenia). Industries are defined according to their 2-digit NACE code.

TABLE 3.1
Features of hyper-growth firms (1)

	Hyper-growth Firms		M&A_D		LIST_D		SUB_D	
	No. Firms	%	Abs. Share	Rel. Share	Abs. Share	Rel. Share	Abs. Share	Rel. Share
Whole sample	307	100	13.68	100	10.75	100	53.09	100
Panel A. Geographic Area								
Northern Europe	35	11.40	28.57	23.81	14.29	15.15	34.29	7.36
British Isles	70	22.80	18.57	30.95	20.00	42.42	51.43	22.09
Mediterranean Area	143	46.58	8.39	28.57	3.50	15.15	58.74	51.53
Central Europe	34	11.07	20.59	16.67	26.47	27.27	55.88	11.66
Eastern Europe	25	8.14	0.00	0.00	0.00	0.00	48.00	7.36
Panel B. Industry								
Manufacturing	64	20.85	12.5	19.05	12.50	24.24	59.38	23.31
Utilities	10	3.26	10.00	2.38	0.00	0.00	80.00	4.91
Construction	15	4.89	6.67	2.38	0.00	0.00	33.33	3.07
Wholesale and retail trade	81	26.38	2.47	4.76	0.00	0.00	49.38	24.54
Hotels and restaurants	5	1.63	0.00	0.00	20.00	3.03	60.00	1.84
Transport, storage and communication	44	14.33	27.27	28.57	20.45	27.27	56.82	15.34
Real estate and business activities	74	24.10	18.92	33.33	17.57	39.39	50.00	22.7
Education	1	0.33	0.00	0.00	0.00	0.00	0.00	0.00
Health and social work	3	0.98	66.67	4.76	0.00	0.00	33.33	0.61
Other community and social activities	10	3.26	20.00	4.76	20.00	6.06	60.00	3.68
Panel C. Cohort								
1998-2002	64	20.85	26.56	40.48	14.06	27.27	51.56	20.25
1999-2003	46	14.98	8.70	9.52	6.52	9.09	60.87	17.18
2000-2004	63	20.52	4.76	7.14	6.35	12.12	52.38	20.25
2001-2005	60	19.54	11.67	16.67	10.00	18.18	58.33	21.47
2002-2006	74	24.10	14.86	26.19	14.86	33.33	45.95	20.86

This table reports some features of the sample of hyper-growth firms (307 firms) either for the full sample or by geographic area, industry and cohort. Countries are grouped into five areas: Northern Europe (Denmark, Finland, Iceland, Norway and Sweden), British Isles (Ireland and United Kingdom), Mediterranean Area (France, Greece, Italy, Malta, Portugal and Spain), Central Europe (Austria, Belgium, Czech Republic, Germany, Luxembourg, Netherlands and Switzerland) and Eastern Europe (Estonia, Hungary, Lithuania, Latvia, Poland, Slovakia and Slovenia). Industries are defined according to their 2-digit NACE code. M&A_D, LIST_D and, SUB_D are all dummy variables equal to 1 if the firm has been respectively involved in M&A activities, listing activities or if it is a subsidiary; 0, otherwise. For such variables, the table reports both the absolute share of firms, which is defined as the number of firms featuring a positive value for that dummy over the total number of hyper-growth firms, and the relative share, which is defined as the number of firms featuring a positive value for that dummy with respect to the total number of hyper-growth firms showing the same characteristic.

or Wholesale and retail trade industries, M&A activity is marginal, while Manufacturing or utilities industries show that the absolute share of firms engaged in such activities is close to the average. In all the remaining industries, a relevant share of firms employs external growth, as shown in Table 3.1.

Hyper growth is undoubtedly cash-starving, and hence, firms experiencing it must be able to acquire the resources that they need from the financial systems (i.e., banks or markets). One way of doing so could involve being listed on a financial market; more than 10% of the sample, 33 firms out of 307, exploited the listing option prior to or during the path of growth (t_0) for raising capital needed to growth. Manufacturing, Transport, storage and communication and, Real estate and business activities are the industries in which listing activities are most adopted. Alternatively, five out of the ten industries, including Utility, Construction, Wholesale and retail trade, Education, and Health and social work, do not show listed firms. A closer look at the data reveals that 13 firms have gone public prior to the upsurge of growth (t_0) while 20 have gone public afterward. These firms account for 4.23% and 6.51% of the entire sample, respectively.

Finally, the ownership structure of hyper-growth firms was investigated by analyzing whether they were subsidiaries of other firms or not. A discretionary approach has been adopted: a firm has been assessed as a subsidiary only when there was an evident link to and control by another firm, which might, for example, supply resources to the controlled one. So, a relationship involving a mere equity participation has been considered as not sufficient for assessing a firm as a subsidiary. Surprisingly, more than half of the firms (53.09%) result subsidiaries of other firms. Overall, no major differences have been found by industry, geographic area or period, except for the Education industry, which shows no subsidiaries. This figure is extremely high and in fact disputes the benefits of being an independent firm rather than a controlled one; a closer look at the implications of this finding will be considered below.

Panel A of Table 3.2 on the next page reports some descriptive statistics of the sample. The average firm in the sample is quite young as it is found to be 8 years old at the beginning of the growth period (t_0); however, this value is not quite representative, as it is skewed by the presence of a few very old firms. The median value of age is three years, and 75% of hyper-growth firms are no more than eight years old. A closer look at the cumulative distribution function of age reveals that about 10% of hyper-growth firms are pure start-ups (founded at t_0), whereas nearly 30% are start-ups (less than one year at t_0), and half are still at early stage (less than two years old at t_0). However, at the same time, 10% of the firms are older than 16 years. These figures confirm that hyper-growth firms are generally young firms, although growth could arise in an advance phase of the corporate life cycle. Sample breakdown by geographic area and cohort shows that there are no major deviations from the general findings (firms of central and Eastern Europe are in median slightly younger than those of other areas and firms of the first cohort are slightly older than those in other cohorts). This is not the same across industries: Construction, Education and, Health and social work show older median firms than the rest of the sample. This is probably due to some idiosyncratic features of these industries, such as the relevance of reputation and experience. However, overall, these findings are consistent with those of Markman and Gartner (2002), who found extraordinary-growth firms to be very young.

The Time-for-Transition variable indicates how many years a firm takes to shift from small

TABLE 3.2
Features of hyper-growth firms (2)

	Average	25th	Median	75th	SD
Panel A. Descriptive Statistics					
Sales cagr (%)	138.8	72.1	95.92	1.42	1.57
Age (t_0)	8.00	1.00	3.00	8.00	16.62
Time for Transition	3.37	3.00	4.00	4.00	0.85
Size (t_0)	5.77	3.49	6.20	8.16	2.87
Panel B. Key Financials (M€)					
Total Assets$_{04}$	85.70	13.64	31.34	82.42	189.66
Fixed Assets$_{04}$	46.82	1.09	7.08	39.22	110.71
Equity$_{04}$	23.01	1.26	3.62	19.02	77.08
Debt$_{04}$	62.69	10.76	22.93	53.47	128.63
Sales$_{04}$	57.66	30.11	37.30	60.24	65.71
Ebitda$_{04}$	3.17	0.41	1.94	5.70	15.13
Ebit$_{04}$	-0.44	-0.06	1.12	3.41	18.32
Income$_{04}$	-1.80	-0.38	0.57	2.03	18.78
Cash Flow$_{04}$	1.81	0.18	1.33	4.40	16.90
Investments$_{14}$	19.54	0.38	3.32	15.6	47.73
Panel C. Financial Ratios (%)					
ROE$_{04}$	-88.66	-1.23	19.01	46.75	15.37
ROI$_{04}$	0.97	-3.19	4.52	10.75	0.20
Leverage$_{04}$	16.15	1.36	3.87	9.96	81.98
Ebitda/Debt$_{04}$	10.57	1.51	11.15	20.76	0.34
Asset Turnover$_{04}$	2.64	0.66	1.43	2.71	4.62
Investments/Total Assets$_{14}$	13.96	2.40	9.05	23.16	0.14

This table reports the descriptive statistics of some variables for the sample of hyper-growth firms (307 firms). Age is measured as the calendar year at t_0 minus the calendar year of founding. Time-for-transition is defined as the number of years a firm takes to shift from the small to large size category. Size is defined in terms of total sales. The Investments variable is investments in fixed assets; Leverage is defined as the ratio of Financial Debt to Equity. Asset Turnover is the ratio of Sales to Total assets. All the financial variables are average values over the period t_0 to t_4, except for Investments in Fixed Assets and the ratio Investment to Total Assets, which refer to the period t_1 to t_4 as the value at t0 is missing.

to large (i.e., how many years the firm takes to cross the turnover threshold of 50 €mln). Mean and median values are quite similar at 3.37 and 4 years, respectively, suggesting that most of them take the entire period under study to move from small to large. Only a few firms (4.23%) take a year to do so, which indicates an exceptional path of growth even among hyper-growth firms, as they will continue to grow at a rate of at least 20%, as necessitated by the criteria that we imposed. There does not seem to be any specificity when looking at the different geographic areas or industries; looking at cohorts, only the first cohort (1998-2002) takes in median four years to overcome the threshold of large firm, while the other cohorts are closer to three years.

Finally, firms are not extremely small when they begin to experience growth (t_0), as their mean size is close to 6 €mln in sales; this seems to suggest that they already possess, to a certain extent, some skills and capabilities to manage the subsequent growth.

Panel B of Table 3.2 reports descriptive statistics for the average values over the growth period t_0 to t_4 of the main firm financials; looking at it, it is quite easy to see that many of them are positively skewed by the presence of outliers, and so median rather than mean values seems more appropriate for giving a concise description . These same considerations also hold for the financial ratios reported in Panel C. Table 3.3 highlights the median values of these items in each period (from t_0 to t_4) and the corresponding CAGR.

The median firm starts with a turnover of 6.2 million euro, overcomes the turnover threshold

TABLE 3.3
Hyper-growth firm financials over the growth period

	t_0	t_1	t_2	t_3	t_4	CAGR
Panel A. Key Financials (M€)						
Sales	6.2	16.88	31.71	53.06	81.38	95.92
Ebitda	0.08	0.63	1.43	2.85	5.9	91.21
Ebit	0.03	0.35	0.79	1.64	3.44	78.1
Income	0.01	0.12	0.38	0.92	1.72	78.6
Total Assets	6.85	15.81	27.68	39.76	57.47	64.51
Fixed Assets	1.37	2.85	4.76	7.98	12.55	54.8
Equity	0.85	1.79	3.33	4.95	8.35	61.81
Debt	5.26	11.58	19.25	30.81	39.33	67.02
Cashflow	0.07	0.44	0.99	1.99	4	86.27
Investments	-	1.12	1.73	2.03	2.25	17.91
Panel B. Financial Ratios (%)						
Roe	8.97	17.94	21.33	21.61	28.25	n.s.
Roi	0.58	3.21	4.71	5.29	6.96	n.s.
Leverage	2.84	3.49	3.32	3.62	2.97	n.s.
Ebitda/Debt	2.68	8.36	10.57	12.02	14.34	n.s.
Asset Turnover	0.85	1.17	1.37	1.53	1.64	n.s.
Investment/Fixed Assets	-	9.15	7.31	6.74	4.56	n.s.

This table reports the median value of some financial items for each year from t0 to t4 constituting the growth period. Also, the median CAGR over the period is reported. Asset Turnover is the ratio of Sales to Total assets. The Investments variable is investments in fixed assets; Leverage is defined as the ratio of Financial Debt to Equity. Because the starting values of financial ratios could be negative, the computation of CAGR does not make sense for many observations, and so it is not reported. This does not hold for Leverage; however, due to its swinging trend, the related CAGR computation is not significant.

to be considered a large firm by the third year (t_3) and ends its growth path with 81.38 €mln of sales. In other words, the median firm shows a compound annual growth rate of 90.35%. This figure is not surprising since we are studying hyper-growth firms. It is quite interesting to notice that the starting size is not so far from that of a mid-sized company (10 €mln), so it is reasonable to posit that such firms start to grow in a phase in which they already possess some of the managerial skills needed to manage growth. Although it could be expected that such growth may impact, at least temporarily, firm efficiency (despite the role played by economies of scale), this is not the case. On the contrary, the operating performance, measured by Ebit or Ebitda, grows at quite the same rate as sales at 91.21% and 78.10%, respectively. A similar figure is observed for profits at 78.60%. Also the main balance-sheet items show high growth, with the median CAGR ranging from a minimum of 55% for Equity to a maximum of 67% for Debt. Even though the median of total assets rises less than sales, its strong increase (64.51% median CAGR) confirms our hypothesis that growth in sales is accompanied by an accumulation of assets. Although hyper growth is undoubtedly cash-starving, the median firm manages to improve its ability to generate liquidity considerably as the median Cash Flow (defined as Net Income plus Amortization and Depreciation) grows significantly over the period (that is, 86.27% CAGR); however, Investments in fixed assets show a poor trend if compared with those of the other financials, with a median CAGR close to 18%.

Also profitability measures are very interesting[9]. The shareholders of the median firm fulfil their dreams since the average Roe over the growth period is in median close to 19% (see

[9]Because starting values of financial ratios could be negative, the computation of CAGR doesn't make sense for many observations, and thus, it is not reported. This does not hold for leverage; however, due to its oscillating trend, CAGR here is not significant.

Table 3.2 on page 52 - Panel C); however, the median value of the average (t_0-t_4) Roi even if it is positive, is much lower at 4.52%. However, both of these figures show an increasing trend over the period. The discrepancy between the two values could be strictly linked to the high recourse to financial gearing, as the high median value of leverage over the period under study strongly suggests. This also means that the median firm is quite successful in raising debts. The median leverage does not show a constant growth: rather, starting at a level of 2.84, it shows a swinging trend that reaches a peak of 3.62 after three years and then fall sharply to 2.97 at the end of the growth period. As a proxy for firm solvency, the Ebitda to Debt ratio shows that though the median firm is expanding very rapidly, it also manages to improve its ability to face debts, as its median values moves from 2.68% at t_0 to 14.34% at t_4. The trend of the Asset Turnover ratio is also very interesting: over the growth period the median firm of the sample is capable of nearly doubling its efficiency in the use of resources as the rotation index goes from 0.85 to 1.41. If we assume, as it will be better explained further, that this ratio is a proxy of the slack (phisical) resources available to the firm at a certain point in time, it is clear that such firms grows pushed by and leveraging on the availability of idle resources. The only ratio showing a decreasing trend is Investments to TotalAssets; it seems that the median hyper-growth firm makes heavy investments only in the first years but then exploits them in order to grow without continuing to invest a great deal of money.

3.4.2 Distinctive characteristics of hyper growth firms

Given the nature of our objective (and hypotheses), we have used a binary outcome linear model in both probit and logit specifications[10] to simultaneously test all the aforementioned hypotheses and to analyze how the independent variables related to them describe hyper-growth firms vs. other firms. The model is specified as follows:

$$\begin{aligned} P(Y=1|X) = \mathcal{F}\big(&\beta\_[AGE], \beta\_[SUB\_D], \beta\_[M\&A\_D], \beta\_[LIST\_D], \beta\_[LEV], \beta\_[SOLV], \\ &\beta\_[ROT\_BEG], \beta\_[ROT\_END], \beta\_[INV], \beta\_[IND], \beta\_[GEO], \\ &\beta\_[COHORT], \beta\_[GDP\_BEG], \beta\_[GDP\_GROWTH]\big) \end{aligned} \tag{3.1}$$

where Y is a dummy variable equal to 1 if the firm has experienced extraordinary growth, 0 otherwise; X is the set of observations (main sample plus control sample); AGE is the firm's age at t_0; SUB_D is a dummy equal to one if the firm is a subsidiary, 0 otherwise; $M\&A\_D$ is a dummy variable equal to 1 if the firm has been involved in M&A activity over the period of growth, 0 otherwise; $LIST\_D$ is a dummy equal to 1 if the firm went public prior to or during the period investigated, 0 otherwise (it is also decomposed in two other dummies that are $LIST\_BEFORE$ and $LIST\_DURING$ that are equal to 1 when the firm goes public prior than or after t_0 respectively); LEV is the mean leverage measured as the average ratio of FinancialDebt to Equity over the period, and it is a proxy of a firm's ability to raise debt capital; $SOLV$ is defined as the average ratio of Ebitda to FinancialDebt over the period, and it is a proxy of a firm's solvency; INV is defined as the average value over the period of the ratio

[10] Even though probit and logit models are different in their respective mathematical definitions, there is no economic justification for using one rather than the other. As a consequence, we present estimates for both specifications.

TABLE 3.4
Comparison of main and control samples

	Main Sample	Control Sample	Test on differences
Panel A. Descriptive Statistics			
Age (t_0)	3.00	8.00	8.13***
Size_t0 (M€)	6.20	6.29	0.36
Sales CAGR (%)	95.90	20.10	-17.11***
M&A_D	42.00	6.00	-5.41***
LIST_D	33.00	5.00	-4.69***
SUB_D	164.00	146.00	-1.45
Panel B. Key Financials (M€)			
Total Assets$_{04}$	31.47	6.77	-13.55***
Fixed Assets$_{04}$	7.11	1.59	-7.29***
Equity$_{04}$	3.63	1.62	-6.35***
Debt$_{04}$	22.95	4.19	-14.30***
Sales$_{04}$	37.33	9.72	-20.39***
Ebitda$_{04}$	1.93	0.53	-7.43***
Ebit$_{04}$	1.12	0.33	-5.75***
Income$_{04}$	0.56	0.21	-4.27***
Cash Flow$_{04}$	0.38	0.3	-6.07***
Investments$_{14}$	3.31	0.33	-9.81***
Panel C. Financial Ratios (%)			
ROE$_{04}$	19.01	14.11	-1.17
ROI$_{04}$	4.52	5.47	1.66*
Leverage$_{04}$	3.87	2.28	-4.24***
Ebitda/Debt$_{04}$	11.14	13.93	3.62***
Asset Turnover$_0$	0.85	1.41	4.44***
Asset Turnover$_4$	1.64	1.52	-1.85*
Investment/Total Assets$_{14}$	9.05	5.35	-4.44***

This table reports the median values of the main variables describing both the sample of hyper-growth firms (307 firms) and its matched control sample. The two samples are also compared through median comparison test (Mann-Whitney); */**/*** denote significance at the 90%/95%/99% confidence levels. Age is measured as the calendar year at t_0 minus the calendar year of founding. Size is defined in terms of total sales. M&A_D, LIST_D and, SUB_D are all dummy variables equal to 1 if the firm has been respectively involved in M&A activities, listing activities or if it is a subsidiary; 0, otherwise. For such variables, the table reports observed frequencies (and the corresponding z-stat that the differences in frequencies are different than 0). Asset Turnover is the ratio of Sales to Total assets. The Investments variable is defined as investments in fixed assets; Leverage is defined as the ratio of Financial Debt to Equity. All financial variables are average value over the period t_0 to t_4, except for Investments in Fixed assets and the ratio Investment to Total Assets, which refer to the period t_1 to t_4 as the value at t_0 is missing, and Asset Turnover which refer to t_1 and t_4 separately.

between Investments in Fixed Assets and Total Assets, and it is a proxy of a firm's investment intensity. ROT_BEG is defined as the asset turnover index at t_0 while ROT_END is the same variable at t_4. As suggested by Moreno and Casillas (2007) the asset turnover (ratio of firm sales divided by total assets) is used to ascertain the firm level of efficiency in the use of resources and is therefore a suitable indicator of the amount of slack resources in the firm, in such a way that the greater the turnover, the higher the level of efficiency of the assets and, as a consequence, the lower the amount of idle resources. Finally we also add some dummies to control for industries (IND), countries (GEO), and cohorts ($COHORT$); firm's country GDP at t_0 (GDP_BEG) and its growth over the observed period t_0-t_4(GDP_GROWTH) are also included.

Table 3.4 provides some descriptive statistics about the characteristics of the control sample with respect to those of the main sample. Panel A shows that the median firm in the control sample is quite older than its counterpart in the control sample (8 vs. 3 years). This reinforces our assumption that hyper-growth firms are generally very young. In the control sample,

both M&A and listing activities are very low; only six firms (2%) pursue external growth, and only five firms (1.6%) go public prior to or during the growth period under investigation. Nevertheless, the number of subsidiaries across the two samples is comparable (164 vs. 146 firms). And, as expected by sample criteria, the median CAGR of sales for the two samples over the period is quite different at 95.9% (main sample)versus 20.1% (control sample), while the median size at t_0 is strictly comparable at 6.20 versus 6.29 €mln of sales for respectively the main and control sample. However, the pace of growth for the control sample is noteworthy, as it is close to the rate usually associated to high-growth firms (20%).

Panel B of the same table (3.4) reports the median values of the main firm financials over the period t_0 to t_4. Overall, they show that these values for firms in the control sample are far smaller than those for the hyper-growth firms; in fact, all the median values are much lower. The explanation of these figures is obvious given the way we built the samples, and further detail is unnecessary. Instead, a detailed comparison of the median values of the financial ratios is much more useful, as shown in Panel C.

The average ROI is in median quite similar across the two samples, as it is 4.52% for the main sample and 5.47% for the control sample, despite the higher median ROE for hyper-growth firms (19.01% versus 14.11%, respectively). This could be consistent with higher recourse to financial gearing, given the difference in the median leverage over the period for such firms (3.87 for hyper-growth firms and 2.28 for control firms). In this comparison, we should remember that the median profitability measures for hyper-growth firms are quite low during the first years of growth (Table 3.2), which lowers the average values of the entire period. As a results, the difference between the two sample is not statistically significant over the whole period. The median firm in the control sample is also characterized by better solvency, as proxied by the Ebitda to Debt ratio: 11.14% for the main sample vs. 13.90% for the control sample. The opposite relation characterises the dotation of slack resources at the beginning of the growth period, which is inversely related to the Asset Turnover ratio (0.85 vs. 1.41); however this difference is no more significant at the end of the period (t_4). Finally, the median Investments to Total Assets ratio for hyper-growth firms is higher than for the firms in the control sample.

Estimates for the model expressed by Equation (3.1) are reported in Table 3.5 on the next page. To test our hypotheses, we employ several different specifications. Both probit (*a* columns) and logit (*b* columns) estimates are provided. Models (1) and (4) include all the selected variables without distinguishing the timing of the IPO, while model (2), (3) and (5) discern whether a firm has gone public before or during the growth period under investigation, that is, before or after t_0. To strengthen our analysis, we also tested the previous models by only using the sub-sample of independent firms, as they are much interesting from an entrepreneurial perspective. Specifically, models (1), (2) and (3) consider both independent firms and firms affiliated to a group, while models (4) and (5) consider only independent firms. Despite the presence of the subsidiary variable (SUB_D), this exercise makes sense, as such variable is not able, per sé, to fully capture the ownership effect. Thus, we excluded all subsidiaries from both the main and control samples. However, in this second case, the two samples are no more matched in terms of geographic areas, industries or cohorts, because this would result in the exclusion of too many observations, with a resulting loss of significance for many variables due to sample size. Overall, we did not find any significant difference in results. Table 3.8 in

TABLE 3.5
Features distinguishing hyper-growth firms

	Probit Estimates					Logit Estimates				
	Full Sample			Independent Companies		Full Sample			Independent Companies	
VARIABLES	(1a)	(2a)	(3a)	(4a)	(5a)	(1b)	(2b)	(3b)	(4b)	(5b)
AGE	-0.0189***	-0.0188***	-0.0183***	-0.0210***	-0.0210***	-0.0340***	-0.0338***	-0.0323***	-0.0380***	-0.0377***
	(0.00419)	*(0.00420)*	*(0.00423)*	*(0.00644)*	*(0.00644)*	*(0.00813)*	*(0.00820)*	*(0.00816)*	*(0.0118)*	*(0.0119)*
LIST_D	1.086***	-	-	1.398***	-	1.981***	-	-	2.514***	-
	(0.353)			*(0.438)*		*(0.651)*			*(0.816)*	
LIST_BEFORE	-	0.935**	0.997**	-	1.333***	-	1.629**	1.755**	-	2.362**
		(0.428)	*(0.428)*		*(0.515)*		*(0.785)*	*(0.791)*		*(0.958)*
LIST_DURING	-	1.309**	1.448***	-	1.499**	-	2.520**	2.790***	-	2.758**
		(0.527)	*(0.529)*		*(0.619)*		*(1.051)*	*(1.070)*		*(1.204)*
SUB_D	0.268**	0.269**	0.640***	-	-	0.460**	0.458**	1.114***	-	-
	(0.126)	*(0.127)*	*(0.167)*			*(0.213)*	*(0.214)*	*(0.291)*		
M&A_D	1.143***	1.133***	1.113***	1.640***	1.625***	2.023***	2.020***	2.033***	2.900***	2.887***
	(0.299)	*(0.300)*	*(0.297)*	*(0.437)*	*(0.440)*	*(0.551)*	*(0.554)*	*(0.556)*	*(0.859)*	*(0.859)*
LEV	0.00978***	0.00978***	0.00972***	0.0221**	0.0221**	0.0162***	0.0162***	0.0162***	0.0376**	0.0377**
	(0.00303)	*(0.00303)*	*(0.00303)*	*(0.00869)*	*(0.00869)*	*(0.00520)*	*(0.00519)*	*(0.00519)*	*(0.0153)*	*(0.0153)*
SOLV	-0.404**	-0.400**	-0.394**	-0.419	-0.413	-0.655**	-0.640**	-0.645**	-0.665	-0.645
	(0.171)	*(0.171)*	*(0.174)*	*(0.281)*	*(0.281)*	*(0.299)*	*(0.299)*	*(0.308)*	*(0.485)*	*(0.486)*
INV	3.462***	3.467***	3.483***	2.941***	2.950***	6.297***	6.313***	6.353***	5.223***	5.248***
	(0.566)	*(0.565)*	*(0.573)*	*(0.834)*	*(0.835)*	*(1.015)*	*(1.012)*	*(1.035)*	*(1.485)*	*(1.485)*
ROT_BEG	-0.0775**	-0.0773**	-0.0150	0.0237	0.0241	-0.257***	-0.258***	-0.134*	0.0163	0.0163
	(0.0348)	*(0.0348)*	*(0.0401)*	*(0.0449)*	*(0.0449)*	*(0.0768)*	*(0.0769)*	*(0.0809)*	*(0.0787)*	*(0.0787)*
ROT_END	0.0822***	0.0822***	0.0786***	0.0557***	0.0557***	0.312***	0.314***	0.303***	0.122**	0.123**
	(0.0171)	*(0.0171)*	*(0.0173)*	*(0.0188)*	*(0.0188)*	*(0.0667)*	*(0.0668)*	*(0.0696)*	*(0.0548)*	*(0.0550)*
SUB_D x ROT_BEG	-	-	-0.229***	-	-	-	-	-0.410***	-	-
			(0.0672)					*(0.127)*		
GDP_BEG	0.384*	0.380*	0.329*	0.504*	0.498	0.641*	0.631*	0.532	0.839*	0.829
	(0.197)	*(0.198)*	*(0.199)*	*(0.306)*	*(0.307)*	*(0.333)*	*(0.334)*	*(0.335)*	*(0.508)*	*(0.511)*
GDP_GROWTH	-1.673	-1.737	-2.322	2.589	2.505	-2.931	-3.042	-4.254	3.742	3.612
	(3.275)	*(3.279)*	*(3.320)*	*(4.959)*	*(4.974)*	*(5.498)*	*(5.503)*	*(5.604)*	*(8.139)*	*(8.155)*
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cohort Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.297	-0.296	-0.342	-1.096	-1.095	-0.741	-0.738	-0.844	-1.760	-1.768
	(0.681)	*(0.683)*	*(0.681)*	*(0.764)*	*(0.764)*	*(1.139)*	*(1.140)*	*(1.157)*	*(1.259)*	*(1.261)*
Observations	614	614	614	306	306	614	614	614	306	306
Pseudo R^2 (%)	20.29	20.33	21.75	28.89	28.91	21.85	21.92	23.31	29.29	29.31
LR χ^2	172.71***	173.08***	185.15***	122.26***	122.31***	186.02***	186.56***	198.40***	123.94***	124.02***

The table contains probit (*a* columns) and logit (*b* columns) estimates of model reported in equation (3.1) based on our sample of 614 European firms (including 307 hyper-growth firms). Both full sample (columns *1*, *2* and *3*) and only independent firm (columns *4* and *5*) are considered. Standard errors are in parentheses. The dependent variable is the dicothomic variable 'to be (or not) a hyper-growth firm'. Independent variables are defined in Section 3.4.2. *, **, and *** denote significance at the 90%, 95%, and 99% confidence levels, respectively.

Appendix (Section 3.7.3) reports pairwise correlation coefficients among independent variables: a close examination indicates that multicollinearity is not a major problem. As a confirmatory test, the Table reports also the variance inflation factors (V.I.F.) of independent variables: no one of them has a V.I.F. higher than 10, which is usually considered the threshold of attention for multicollinearity problems.

For what concerns the full sample (both independent and subsidiary firms), results are consistent regardless of the estimation model (probit vs. logit), and all the variables are found to play a role in extraordinary growth trajectories. First of all, our findings concur with the entrepreneurship literature by showing the significant influence of age on hyper growth, as the younger is the firm at the beginning of the growth period (t_0) the more likely it is that they will exhibit hyper growth (AGE is significantly - $p<0.01$ - and negatively related with the probability of being an hyper-growth firm). This is consistent with the idea that young firms are usually more innovative, proactive and risk-oriented than older firms, among other reasons because they are initiated with the purpose of taking advantage of new, previously unexploited opportunities (Shane and Venkataraman, 2000). Hence, Hypothesis (1) is supported.

Also the ownership structure appears to play a role in distinguishing hyper-growth firms from their counterparts, as the subsidiary dummy (SUB_D) has a corresponding positive beta coefficient ($p<0.05$ or $p<0.01$). High rates of intercompany links, such those that exist amongst parent and a daugther companies, may be related with higher growth because they affect the resource availability and access to markets (Delmar et al. 2006) regardless of the shape such relationships take (a business could be wholly or partially owned by another firm, or may have joint stock ownership with several other businesses and yet these relationships could extend across national boundaries). Collaborative relationships can assist a firm's growth also by providing access to managerial talent and intellectual capabilities. Given the resource limitations typical of smaller firms, these relationships are also considered to be essential to their successful internationalization (Barringer & Jones, 2004). The basis of this proposition is that larger firms have greater resources and durability, enabling them to bear the high entry costs associated with learning about and entering foreign markets (Becchetti & Trovato, 2002).

This result is also consistent with those related to the presence and exploitation of slack resources inside our firms. The hyper-growth sample is found to be characterized by a higher endowment of (idle) slack resources at the beginning of the time-window investigated as the beta coefficient of the Asset Turnover ratio at t_0 (ROT_BEG) shows a negative sign ($p<0.05$ probit, $p<0.01$ logit) supporting Hypothesis (7). With respect to financial resources, firm assets (and some of them more than others), are specific, less divisible and, hence, difficult to transfer to external uses. As the firm needs to put this type of slack resources to use, they foster the firm growth. As a result, the hyper-growth firms are found, at the end of the growth period (t_4), to be characterized by an higher efficiency and a lower presence of slack resources respect to their counterparts as shown by the positive sign ($p<0.01$) of the Asset Turnover ratio (ROT_END), suggesting that they have grown by increasing leveraging on these resources. Resource and capabilities based theories usually suggest that smaller firms tend to acquire more assets in higher quantities than they actually need in the short term because of their indivisibility; however, this couldn't be an explanation for the difference we found, as the firms of the two sample (main sample and control sample) are not significantly different in size at

the beginning of the growth period (as reported in Table 3.4 on page 55), due to the selection criteria we imposed (firms should be small firms at t_0 - turnover lower that 10 €mln). So this result could be related to the will of the firm, as stated from the field of entrepreneurship. In this sense, in the introduction of this article, we have suggested that structural hyper-growth should be seen as the result of a sustainable entrepreneurial effort and that it is something that should be strongly addressed; however, we could not control for this suggestion. Another explanation of the abundance of slack resources in hyper-growth firms could be explained by their ownership structure, in the sense that subsidiary firms could have a higher than optimal endowment of slack resources due to the fact that they rely on their parent companies. As the SUB_D dummy is not able to fully control, per sè, for such explanation, we have introduced an interaction variable ($SUB\_D \cdot ROT\_BEG$) of the subsidiary effect with the availably of slack resources at t_0 (columns 3). Results confirm our hypothesis as the ROT_BEG variable is no more significant per sè (at least in the probit estimates, while in logit ones it is only slightly significant - $p<0.1$); conversely, there is a strong significance of the corresponding interaction effect with SUB_D ($p<0.01$) and also the SUB_D dummy increases in significance ($p<0.01$). As a confirmatory result, when considering only the sample of independent firms (models 4 and 5), the ROT_BEG variable is no more significant.

Also, Hypothesis (3) is confirmed as M&A activity is found positively related ($p<0.01$) with hyper growth. In order to grow extraordinarily, a firm needs to massively increase its assets and organizational systems in such a short time period that external growth is often the preferred way to do so. Mergers and acquisitions are far more rapid processes of growth than internal growth, since they do not present set-up problems, as productive and technological competences are already present. Above all, in certain industries, it would be impossible to grow organically at hyper speed, since this would mean widening the market boundaries; hence, external growth assumes primary importance. However, a shortcoming of this result is that we are not able to control for the amount of growth that is pursued by acquisitions.

Going public is a significant ($p<0.01$) characteristic of paths with exceptional growth; in particular, regardless of model specification (2, 3 or 5), both going public before or during the growth period (i.e., before or after t_0) is a distinctive feature of hyper-growth firms ($p<0.01$ or $p<0.05$). This could mean that extraordinary-growth firms go public both to start growth or to continue fostering an already started path of growth. This is also a proof of a serious risk-taking, as they are very small until exhibiting growth (t_0), and because of this the great expenditures associated with listing may bring only modest financial capital in face of too many efforts. Going public enables firms to raise capital for growth through extraordinary finance operations, such as fusions, acquisitions and joint-ventures (Planell, 1995) that appear to play a major role in rapid-growth trajectories. Hence, listing can provide the opportunity to collect the resources needed to achieve growth objectives that otherwise would be limited by financial constraints (Carpenter & Petersen, 2002). Our findings thus seem to confirm Hypothesis (6); in addition, our results seem to show that hyper-growth European firms behave in a similar way to American firms, which use IPOs to finance subsequent investment and growth (Mikkelson, Partch, & Shah, 1997), rather than rebalance their accounts after a period of high investment and growth, as do other mature European companies (Pagano et al., 1998; Planell; Rydqvist & Hogbolm, 1995). This difference may reflect the more mature age of European IPOs because

also in the US, older firms are more likely to use raised funds to pay off debt rather than to finance growth (Mikkelson et al.). This explanation seems consistent with our results, as our sample of hyper-growth firms is very young and goes public before and during growth, probably in order to continue investing. However, future studies on the behavior of these firms after their growth path should clarify these dynamics.

With regards to financial structure, higher mean leverage ($p<0.01$) and lower mean solvency ($p<0.05$) are found to be associated with extraordinary paths of growth. This result seems consistent with the entrepreneurial approach to growth: hyper-growth firms require substantial financial resources and cannot grow in such a manner without running up considerable debt, as stated in Hypothesis (4). Moreover, the tension to growth of these firms shifts their focus more on searching for and exploiting growth opportunities than efficiently managing acquired financial resources (Stevenson & Jarillo, 1990; Baum, Locke, & Smith, 2001), forcing them to "skating on thin ice" (Hypothesis 5). It would also be interesting to investigate what happens to a firm's solvency after its growth period, as a lag may exist between raising and investing capital, on the one hand, and the returns provided by such capital, on the other hand.

Finally, a higher propensity to (relatively) invest in fixed assets appears to be a distinctive feature of hyper-growth firms. Every life cycle model states that in the growth phase, firms do need to invest, and hence, it is likely that both hyper-growth and non-hyper-growth firms invest to achieve growth. However, our results demonstrate another effect: in order to achieve extraordinary growth, a firm needs to invest more than others in relative terms.

Focusing only on independent firms we don't observe to many differences. Besides the already commented difference in the significance of the ROT_BEG variable related to slack resources, only firm's solvency ($SOLV$) is no longer significant and all the variables' coefficients maintain the same direction. This finding might be simply explained by the fact that independent firms face higher financial constraints than firms affiliated with a parent company, as they can rely only on their own strengths. As a result, they must pay more attention to the administration of their financial resources and, they should also rely more on external capital, mainly raised from the financial markets, as the regular access to debt that is required by a hyper-growth path is foreclosed to these firms, since they lack any type of financial guarantees. However, it should be clear that these estimates cannot be directly compared with the previous ones, as the samples are slightly different, and the change in the significance of some variables could be due to the shrinking of the sample. In any case, the direction of the coefficient estimates does not change, thus confirming the goodness of the previous findings.

3.5 Conclusions

Firm growth deserves increasing attention from researchers, since it creates employment, generates wealth and enhances general economic development. The social and economic development and the generation of new jobs depend on the entrepreneurial capacity to generate new business projects and ventures as well as on the existence of entrepreneurs and managers who are able to turn these nascent firms into solid organizations capable of withstanding international competition. So, the growth of SMEs serves as a critical topic within this framework, since it is the real engine of the world economy.

Although there exists an extensive previous research on firm growth, this paper provides some significant contributions. The first refers to a higher precision of the object to be explained. Although Markman and Gartner (2002) denounced the inadequacy and lack of serious research on hyper growth, we have found some articles that dealt with it marginally in terms of high-growth. However, even considering these works, what we know about this phenomenon is still very preliminary and, moreover, is confined mainly to US firms. Hence, this work, and this is the second main contribution, has addressed this gap in the literature by focusing on the features of European hyper-growth firms by the combination of both an internal and external perspectives; by bringing to light some of their distinctive characteristics, it is possible to suggest public policies that may foster economic growth and wealth. Although this paper brings some light into the differences between hyper-growth and non-hyper-growth firms, further investigations must be conducted to provide more insight into the phenomenon of firm growth.

We find that hyper-growth firms tend to be younger than their slow-growth counterparts. The strong negative relation between firm age and growth, widely evidenced by the entrepreneurship literature, is consistent with the idea that young firms are usually more innovative, proactive and risk-oriented than older firms (Shane & Venkataraman, 2000) and suggests that policy makers should focus their attention on those industries in which young firms are more likely to be found.

Both the ownership structure and the availability of slack resources have been found as factors that enable path of extraordinary growth. These two dimension are strictly linked; regardless of the shape of the relationships between parent and daughter companies, the former can assist the growth of the latter by providing access to managerial skills and capabilities, and to both tangible and intangible resources, in contrast with the resource limitations typical of small firms. In this sense, the affiliation with a parent company can help a firm to address and structure future growth, to settle the going public process or merger and acquisition activities. It can also influence firm's choices regarding the optimal financial structure or the endowment of resources. For example, the abundance of slack resources, which is a major factors explaining firm rapid growth, has been found as a factors characterizing only hyper-growth firms affiliated to a group.

In order to grow extraordinarily, hyper-growth firms must greatly increase their assets and organizational systems in such a short time period that external growth is often the favored way to do so. Policies should create a suitable environment to facilitate external growth, for example, by aiding in the diffusion of professional competences and by fostering the integration of different corporate cultures. Policy makers should encourage mergers and acquisitions in foreign countries as well, since these operations must be carried out in order to exploit growth opportunities, wherever they arise. Authorities should also be more flexible and sensitive to economic and strategic motivations behind such operations, rather than focusing on mere market power.

The decision to go public during the growth period is another distinctive feature of hyper-growth firms. In their effort to grow, hyper-growth firms raise funds through incurring substantial debt without paying too much attention to their solvency ability, thus supporting the entrepreneurial approach to growth suggested in literature Baum et al. (2001); Stevenson and Jarillo (1990). Entrepreneurs require money in order to bring their ambitions to life, so policies

should favor the development of efficient capital markets; the entrepreneurship literature clearly emphasizes how the presence of such systems encourages the entrepreneurial spirit by favoring the formation of new ventures, stimulating competition and promoting firm growth (cf. Rajan & Zingales, 1998; Beck & Levine, 2002; Demirguc-Kunt & Maksimovic, 2002). However, mainly due to information asymmetries, potential investors have in general little information on the entrepreneurial capabilities and growth opportunities of such firms; in fact, this could result in credit rationing (Jaffe & Russell, 1976). To remedy these market failures, political intervention should encourage relationships between banks and firms by offering incentives and grants for policies directed toward financing specific innovation and growth strategies.

Since firms that are willing to grow are often very risky and very small, raising debt might not be the best way of financing, since the risk premium would hamper good opportunities for growth. Becoming publicly listed allows firms access to a source of finance other than the banking system, which provides the opportunity to collect the resources needed to achieve growth objectives that would otherwise be limited by financial constraints (Carpenter & Petersen, 2002). In Continental Europe, unlike the US, few SMEs tap public markets for funds, and hence, policies should favor this choice through reduced bureaucratic delays and enhanced fiscal incentives. Also, third-party funding, such as venture capital and private equity operators, could finance entrepreneurial firms by providing the resources necessary to exploit growth opportunities. Policy makers should promote the emergence of such players, many of which are still underdeveloped in Europe.

Nevertheless, it should be noted that it is naive to conceive of the economy as populated by small firms that are all full of willingness and potential to grow if only the financial means were available. In fact, the issue is far more complex. As far as entrepreneurship is concerned, it is also important to look at the transformation of cultural and behavioral attitudes in many countries, particularly with respect rewarding propensity to risk and investment. Policy makers should encourage an entrepreneurial spirit as well as create an entrepreneurial environment in which firms can be created and developed. Education assumes a decisive role in fostering an entrepreneurial orientation that can bear the uncertainty linked to new ventures. Moreover, many countries are often reluctant to offer entrepreneurs who do not succeed a second chance; these countries should revise their bankruptcy regulatory framework in order to accept and foster risk-taking as well as to create an appropriate network capable of re-absorbing and quickly re-using the knowledge and experience gained from failure.

3.6 References

Aldrich, H. (1999). *Organizations evolving*. Sage Publications, Newbury Park, CA.

Almus, M., & Nerlinger, E. A. (1999). Growth of new technology-based firms: which factors matter? *Small Business Economics*, *13*(2), 141–154.

Arbaugh, J., & Camp, M. (2000). Managing growth transitions: theoretical perspectives and research directions. In D. Sexton, & H. Landstrom (Eds.), *Handbook of entrepreneurship* (pp. 308–328). Blackwell, Oxford.

Ardishvili, A., Cardozo, S., Harmon, S., & Vadakath, S. (1998). Towards a theory of new venture growth. In *Frontiers of entrepreneurship research*. Babson College-Kauffman Entrepreneurship Research Conference, Ghent, Belgium.

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, *17*(1), 99–119.

Barringer, B., & Jones, F. (2004). Achieving rapid growth: revisiting the managerial capacity problem. *Journal of Developmental Entrepreneurship*, *9*(1), 73–86.

Barringer, B., Jones, F., & Lewis, P. (1998). A qualitative study of the management practices of rapid-growth firms and how rapid growth firms mitigate the managerial capacity problem. *Journal of Developmental Entrepreurship*, *3*(2), 97–122.

Barringer, B., Jones, F., & Neubaum, D. (2005). A quantitative content analysis of the characteristics of rapid growth firms and their founders. *Journal of Business Venturing*, *20*(5), 663–687.

Baum, J., Locke, E., & Smith, K. (2001). A multidimensional model of venture growth. *Academy of Management Journal*, *44*(2), 292–303.

Becchetti, L., & Trovato, G. (2002). The determinants of growth for small and medium sized firms. the role of the availability of external finance. *Small Business Economics*, *19*(4), 291–306.

Beck, T., & Levine, R. (2002). Industry growth and capital allocation: does having a market- or bank-based system matter? *Journal of Financial Economics*, *64*(2), 147–180.

Birch, D. (1979). *The job generation process*.

Birch, D. (1987). *Job creation in america: how the smallest companies put the most people to work*. The Free Press, New York.

Bourgeois, L. J. (1981). On the measurement of organizational slack. *Academy of Management Review*, *6*(1), 29–39.

Bracker, J., Keats, B., & Pearson, J. (1988). Planning and financial performance among small firms in a growth industry. *Strategic Management Journal*, *9*(6), 591–603.

Brown, T., Davidsson, P., & Wiklund, J. (2001). An operationalization of stevenson's conceptualization of entrepreneurship as opportunity-based firm behaviour. *Strategic Management Journal*, *22*(10), 953–968.

Carpenter, R., & Petersen, B. (2002). Is the growth of small firms constrained by internal finance? *Review of Economics and Statistics*, *84*(2), 298–309.

Chambers, B., Hart, S., & Denison, D. (1988). Founding team experience and new firm performance. In B. Kirchhoff, W. Long, W. McMullan, K. Vesper, & W. Wetzel (Eds.), *Frontiers of entrepreneurship research* (pp. 106–118). Babson College. Wellesley, MA.

Chan, Y., Bhargava, N., & Street, C. (2006). Having arrived: the homogeneity of high-growth small firms. *Journal of Small Business Management*, *44*(3), 426–440.

Christensen, C. M., & Bower, J. L. (1996). Customer power, strategic investment, and the failure of leading firms. *Strategic Management Journal*, *17*(3), 197–218.

Cohen, W., & Levinthal, D. (1990). Absorptive capacity: a new perspective on learning and innovation. *Administrative Science Quarterly*, *35*(1), 128–152.

Commission, E. (2003). *The new sme definition: user guide and model declaration*.

Cooney, T., & Malinen, P. (2004). Firm growth as a research issue. In T. Cooney, & P. Malinen (Eds.), *New perspective on firm growth*. Turku-Finland.

Cooper, A., Gimeno-Gascon, F., & Woo, C. (1994). Initial human and financial capital predictors of new venture performance. *Journal of Business Venturing*, *9*(5), 371–395.

Davidsson, P., Achtenhagen, L., & Naldi, L. (2007). What do we know about small firm growth? In S. Parker (Ed.), *The life cycle of entrepreneurial ventures* (Vol. 3). International Handbook Series on Entrepreneurship. Springer.

Davidsson, P., & Delmar, F. (1997). High-growth firms: characteristics, job contribution, and method observations. In *Paper presented at the rent xi conference, mannheim, germany*.

Davidsson, P., Kirchhoff, B., Hatemi, J., & Gustavsson, H. (2002). Empirical analysis of business growth factors using swedish data. *Journal of Small Business Management*, *40*(4), 332–349.

Davidsson, P., & Wiklund, J. (2000). Conceptual and empirical challenges in the study of firm growth. In D. Sexton, & H. Landstrom (Eds.), *The blackwell handbook of entrepreneurship* (pp. 26–44). Wiley-Blackwell.

Delmar, F., Davidsson, P., & Gartner, W. (2003). Arriving at the high-growth firm. *Journal of Business Venturing*, *18*(2), 189–216.

Demirguc-Kunt, A., & Maksimovic, V. (2002). Funding growth in bankbased and market-based financial systems: evidence from firm-level data. *Journal of Financial Economics*, *65*(3), 337–363.

Dierickx, I., & Cool, K. (1989). Asset stock accumulation and the sustainability of competitive advantage. *Management Science*, *35*(12), 1504–1511.

Enseley, M., Amason, A., & Markman, G. (2003). Does the strategy of hyper-growth new ventures matter? In W. e. a. Bygrave (Ed.), *Frontiers of entrepreneurship research*. Arthur M. Blank Center for Entrepreneurship, Babson College. Wellesley, MA.

Feeser, H., & Willard, G. (1990). Founding strategy and performance: a comparison of high and low-growth high-tech firms. *Strategic Management Journal*, *11*(2), 87–98.

Fischer, E., & Reuber, A. (2003). Public support for rapid growth firms: a comparison of the views of founders, government policy makers and private sector resource providers. *Journal of Small Business Management*, *41*(4), 346–365.

Fischer, E., Reuber, A., Hababou, M., Johnson, W., & Lee, S. (1997). The role of socially constructed temporal perspectives in the emergence of rapid-growth firms. *Entrepreneurship Theory and Practice*, *22*(2), 13–30.

Flamholtz, E. (1986). *Managing the transition from an entrepreneurship to a professionally managed firm*. Jossey-Bass, San Francisco, CA.

Fombrum, C., & Wally, S. (1989). Structuring small firms for rapid growth. *Journal of Business Venturing*, *4*(2), 107–122.

Gartner, W., Bird, B., & Starr, J. (1992). Acting as if: differentiating entrepreneurial from organizational behavior. *Entrepreneurship Theory and Practice*, *16*(2), 13–31.

George, G. (2005). Slack resources and the performance of privately held firms. *Academy of Management Journal*, *48*(4), 661–676.

Ghemawat, P., & Khanna, T. (1998). The nature of diversified business groups: a research design and two case studies. *Journal of Industrial Economics*, *46*(1), 35–61.

Gimeno, J., Folta, T., Cooper, A., & Woo, C. (1997). Survival of the fittest? entrepreneurial human capital and the persistence of underperforming firms. *Administrative Science Quarterly*, *42*, 750–783.

Ginn, C., & Sexton, D. . . (1989). Growth: a vocational choice and psychological performance. In R. Brockhaus, N. Churchill, J. Katz, B. Kirchhoff, K. Vesper, & W. Wetzel (Eds.), *Frontiers of entrepreneurship research* (pp. 1–12). Babson College. Wellesley, MA.

Greiner, L. (1972). Evolution and revolution as organizations grow. *Harvard Business Review*, *50*(4), 37–46.

Hambrick, D., & Crozier, L. (1985). Stumblers and stars in the management of rapid growth. *Journal of Business Venturing*, *1*(1), 31–45.

Harrison, A., Love, I., & McMillan, M. (2004). Global capital flows and financing constraints. *Journal of Development Economics*, *75*(1), 269–281.

Henrekson, M., & Johansson, D. (2008). *Gazelles as job creators - a survey and interpretation of the evidence*. IFN Working Paper No. 733 (Forthcoming on Small Business Economics).

Hoy, F., McDougall, P., & D'Souza, D. (1992). Strategies and environments of high-growth firms. In D. Sexton, & J. Kasarda (Eds.), *The state of the art of entrepreneurship* (pp. 341–357). PWS-Kent, Boston.

Huang, X., & Brown, A. (1999). An analysis and classification of problems in small business. *International Small Business Journal*, *18*(1), 73–85.

Jaffe, D., & Russell, T. (1976). Imperfect information, uncertainty and credit rationing. *Quarterly Journal of Economics*, *90*(4), 651–666.

Katz, J., & Gartner, W. (1988). Properties of emerging organizations. *Academy of Management Review*, *13*(3), 429–441.

Kotter, J., & Sathe, V. (1978). Problems of human resource management in rapidly growing companies. *California Management Review*, *21*(2), 29–36.

Levesque, M., & MacCrimmon, K. (1999). A longitudinal model of growth for the inc. 500 firms. In P. Reynolds, W. Bygrave, S. Manigart, C. Mason, G. Meyer, H. Sapienza, & K. Shaver (Eds.), *Frontiers of entrepreneurship research*. Wellesley, MA: Arthur M. Blank Center for Entrepreneurship, Babson College.

Lieberman, M. (1989). The learning curve, technology barriers to entry, and competitive survival in the chemical processing industries. *Strategic Management Journal*, *10*(5), 431–447.

Littunen, H., & Tohmo, T. (2003). The high growth in new metal-based manufacturing and business service firms in finland. *Small Business Economics*, *21*(2), 187–200.

Lohmann, D. (1998). Strategies of high-growth firms in adverse public policy and economic environments. In P. Reynolds, D. B. William, N. M. Carter, S. Manigart, C. M. Mason, G. D. Meyer, & K. G. Shaver (Eds.), *Frontiers of entrepreneurship research* (pp. 16–29). Arthur M. Blank Centre for Entrepreneurship, Babson College. Wellesley, MA.

Lumpkin, G., & Dess, G. (1996). Clarifying the entrepreneurial orientation construct and liking it to performance. *Academy of Management Review*, *21*(1), 135–172.

Markman, G., & Gartner, W. (2002). Is extraordinary growth profitable? a study of inc. 500 high-growth companies. *Entrepreneurship Theory and Practice*, *27*(1), 65–75.

McCann, J., & Cornelius, W. (1985). Performance characteristics of small, rapidly growing firms: an examination of the inc. 100. In *Academy of management best paper proceedings 1985* (pp. 62–66).

McGee, J., & Dowling, M. (1994). Using cooperative r&d arrangements to leverage managerial experience: a study of technology intensive new ventures. *Journal of Business Venturing*, *9*(1), 33–48.

Mikkelson, W., Partch, M., & Shah, K. (1997). Ownership and operating performance of companies that go public. *Journal of Financial Economics*, *44*, 281–308.

Miller, D., & Friesen, P. (1984). A longitudinal study of the corporate life cycle. *Management Science*, *30*(10), 1161–1183.

Moreno, A., & Casillas, J. (2007). High growth smes versus non high-growth smes: a discriminating analysis. *Entrepreneurship and regional development*, *19*(1), 69–88.

Mosakowski, E. (1993). A resource-based perspective on the dynamic strategy-performance relationship: an empirical examination of the focus and differentiation strategies in entrepreneurial firms. *Journal of Management*, *19*(4), 819–839.

Nicholls-Nixon, C. (2005). Rapid growth and high performance: the entrepreneur' s impossible dream? *Academy of Management Executive*, *19*(1), 77–89.

Nohria, N., & Gulati, R. (1996). Is slack good or bad for innovation? *Academy of Management Journal*, *39*(5), 1245–1264.

O'Regan, N., Ghobadian, A., & Gallear, D. (2006). In search of the drivers of high growth in manufacturing smes. *Technovation*, *26*(1), 30–41.

Pagano, M., Panetta, F., & Zingales, L. (1998). Why do companies go public? an empirical analysis. *Journal of Finance*, *53*(1), 27–64.

Penrose, E. (1959). *The theory of the growth of the firm*. Oxford University Press, Oxford.

Planell, S. (1995). *Determinantes y efectos de la salida a bolsa en espana: un analisis empirico*. Working paper, Centro de Estudios Monetarios y Financieros, Spain.

Rajan, R., & Zingales, L. (1998). Financial dependence and growth. *The American Economic Review*, *88*(3), 559–586.

Rajan, R. (1992). Insiders and outsiders: the choice between informed and arm's-length debt. *Journal of Finance*, *47*(4), 1367–1400.

Reynolds, P., & White, S. (1997). *The entrepreneurial process: economic growth, men, women, and minorities*. Quorum Books, Westport, CT.

Rydqvist, K., & Hogbolm, K. (1995). Going public in the 1980s: evidence from sweden. *European Financial Management*, *1*(3), 287–315.

Sexton, D., & Ginn, C. (1990). The psychological aspects of rapid growth: trait intensities of the 1988 inc 500 founders and co-founders. In *Frontiers of entrepreneurship research*. Babson College. Wellesley, MA.

Shane, S., & Venkataraman, S. (2000). The promise of entrepreneurship as a field of research. *Academy of Management Review*, *25*(1), 217–226.

Shuman, J., & Seeger, J. (1986). The theory and practice of strategic management in smaller rapid growth firms. *American Journal of Small Business*, *11*(1), 7–18.

Shuman, J., Shaw, J., & Sussman, G. (1985). Strategic planning in smaller rapid growth companies. *Long Range Planning*, *18*(6), 48–53.

Siegel, R., Siegel, E., & MacMillan, I. (1993). Characteristics distinguishing high-growth ventures. *Journal of Business Venturing*, *8*(2), 169–180.

Sims, M., & O'Regan, N. (2006). In search of gazelles using a research dna model. *Technovation*, *26*(8), 943–954.

Smith, K., Mitchell, T., & Summer, C. (1985). Top level management priorities in different stages of the organizational life cycle. *Academy of Management Journal*, *28*(4), 799–820.

Stevenson, H., & Jarillo, J. (1990). A paradigm of entrepreneurship: entrepreneurial management. *Strategic Management Journal*, *11*(5), 17–27.

Storey, D. (1994,). *Understanding the small firm sector*. Routledge, London.

Stoughton, N., & Zechner, J. (1998). IPO-mechanisms, monitoring and ownership structure. *Journal of Financial Economics*, *49*(1), 45–77.

Teach, R., Tarpley, F., & Schwartz, R. (1986). Software venture team. In R. Ronstadt, J. Hornaday, R. Peterson, & K. Vesper (Eds.), *Frontiers of entrepreneurship research* (pp. 546–562). Babson College. Wellesley, MA.

Thompson, J. (1967). *Organizations in action*. New York: McGraw-Hill.

Timmons, J. A., & Bygrave, W. (1986). Venture capital's role in financing innovation for economic growth. *Journal of Business Venturing*, *1*(2), 161–176.

Variyam, J., & Kraybill, D. (1993). Small firm's choice of business strategies. *Southern Economic Journal*, *60*(1), 136–146.

Weinzimmer, L., Nystron, P., & Freeman, S. (1998). Measuring organizational growth: issues, consequences and guidelines. *Journal of Management*, *24*(2), 235–262.

Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal*, *5*(2), 171–180.

Wiklund, J. (1998). Small firm growth and performance: entrepreneurship and beyond (PhD thesis, Jonkoping International Business School, 1998).

Willard, G., Krueger, D., & Feeser, H. (1992). In order to grow, must the founder go: a comparison of performance between founder and non-founder managed high-growth manufacturing firms. *Journal of Business Venturing*, *7*(3), 181–194.

Woo, C., Cooper, A., Dunkelberg, W., Daellenbach, U., & Dennis, W. (1989). Determinants of growth for small and large entrepreneurial start-ups. In R. Brockhaus, N. Churchill, J. Katz, B. Kirchoff, K. Vesper, & W. Wetzel (Eds.), *Frontiers of entrepreneurship research* (pp. 134–147). Arthur M. Blank Center for Entrepreneurship, Babson College. Wellesley, MA.

3.7 Appendix

3.7.1 Sample breakdown by industry and geographic area

The breakdown of the sample by both industry and country is reported in Table 3.6, and it shows that the share of each industry depends considerably, as expected, by the geographic area considered, reflecting some specificities of the different countries. For example, Manufacturing is the main industry in Central Europe, while in the British Isles, the Real estate and business industry accounts for nearly twice the activities as Manufacturing or Trade. The Construction

TABLE 3.6
Breakdown of the sample of hyper-growth firms by industry and country

	Geographic Area					
Industry	Northern Europe	British Isles	Mediterranean Area	Central Europe	Eastern Europe	All Countries
Manufacturing	0.33	3.58	9.12	4.23	3.58	20.85
Utility	0.33	-	2.28	0.65	-	3.26
Construction	0.65	0.33	3.91	-	-	4.89
Wholesale and retail trade	3.58	3.91	12.38	2.28	4.23	26.38
Hotels and restaurants	0.33	1.3	-	-	-	1.63
Transport, storage and communication	2.28	3.58	6.51	1.63	0.33	14.33
Real estate	3.26	7.17	11.4	2.28	-	24.1
Education	0.33	-	-	-	-	0.33
Health and social work	0.33	0.33	0.33	-	-	0.98
Other social activities	-	2.61	0.65	-	-	3.26

Percent values are reported. Countries are grouped into five areas: Northern Europe (Denmark, Finland, Iceland, Norway and Sweden), British Isles (Ireland and United Kingdom), Mediterranean Area (France, Greece, Italy, Malta, Portugal and Spain), Central Europe (Austria, Belgium, Czech Republic, Germany, Luxembourg, Netherlands and Switzerland) and Eastern Europe (Estonia, Hungary, Lithuania, Latvia, Poland, Slovakia and Slovenia). Industries are defined according to their 2-digit NACE code.

and Utility industries are located almost exclusively in the Mediterranean Area. The Hotels and restaurants industry is present only in the British Isles and Northern Europe; these areas are also the only ones that show hyper-growth firms in the Education industry. No Health and social work firms are found in Central and Eastern Europe, while Other social activities are present only in the British Isles and the Mediterranean Area.

3.7.2 Representativeness of the control sample

In building our control sample, we checked whether it was representative of the population to which it belongs, that is made by all the possible casual extractions of control samples that could be retrieved on the basis of the aforementioned criteria using the dataset of all the European firms as a starting point. For this purpose, we tested the hypothesis that no differences exist between the two in terms of mean and median values of the key financials[11]; however, this comparison cannot be done directly, as both the population (that is, the set of all possible casual extractions of control samples) and in turn the distribution of its characteristics are unknown a priori.

To overcome these problems, a bootstrap procedure was adopted to build the approximate distribution of both the sample mean and median of each key financial. After this step, the mean and median values of each variable of the control sample were tested and found not to be statistically different with respect to their counterparts in the population (which were defined for each financial as the expected values of the approximate distribution of the sample mean and median of that financial). For each key financial, the p-values for the previous hypothesis were computed on the basis of the following expression:

[11]For each firm and each key financial, we have considered the average value over the period t_0-t_4. Only Sales, Ebitda, Ebit, Income, Total Assets, Fixed Assets and, Equity have been considered, as all the other key financials can be derived from these. Other than Age, all the remaining variables used in this study have been collected only for the main and control sample as they were not available in our starting dataset (ORBIS); therefore, they are not included in this robustness check.

TABLE 3.7
Representativeness of the control sample (*P-values*)

	Age (t_0)	Sales	Ebitda	Ebit	Income	Total Assets	Fixed Assets	Equity
P-value								
Mean	0.363	0.836	0.943	0.748	0.548	0.957	0.806	0.457
Median	0.419	0.406	0.986	0.662	0.122	**0.008**	**0.002**	**0.006**

The table shows p-values for the hypothesis of equal mean and median for the main key financials between the control sample and the population from which it is extracted, computed through a bootstrap procedure according to Equation (3.2). Except Age, all variables are defined as the average value over the period t_0 to t_4. Significant values ($p<0.1$) are reported in bold.

$$p_{value} = \frac{\sum_{i=1}^{n} I\left(\left|\vartheta_i - \bar{\vartheta}\right| > \left|\vartheta_{cc} - \bar{\vartheta}\right|\right)}{N} \tag{3.2}$$

where: N is the number of resamplings (10,000); $I(.)$ is a function taking value 1 when its argument is true, 0, otherwise; ϑ_i is the value of the statistic (that is, mean or median) for each resampling; $\bar{\vartheta}$ is the expected value of the statistic calculated on the approximate distribution (which is thus the approximate value of the statistic for the population); and ϑ_{cc} is the value of the statistic for the control sample. Results are shown in Table 3.7. We found the control sample representative in terms of mean values of the population to which it belongs; that is, the above hypothesis cannot be rejected since the p-values are never lower than 0.1. This is also true with respect to median values, except for Equity, Total and Fixed assets, as these values for the control sample we investigated are slightly greater ,p-values lower than 0.01). This bias could be due to the fact that in our initial dataset, some of the smaller firms had some missing values for certain financial variables, and thus, were not eligible for inclusion in the control sample. However, we believe that this result does not invalidate our findings: if we found differences between hyper-growth and other firms, since the latter are quite larger than expected, we should expect that these differences would still hold (if not more so) for smaller firms.

3.7.3 Correlation matrix

Correlations amongst dependent variables are reported in Table 3.8 on the next page.

TABLE 3.8
Pairwise correlation coefficients and variance inflation factors (V.I.F.) for independent variables

			Pairwise correlation coefficients												
		V.I.F.	1	2	3	4	5	6	7	8	9	10	11	12	13
1	AGE	1.07	1												
2	LIST_D	1.49	0.064	1											
3	LIST_BEFORE	(1.19)	0.026	**0.637**	1										
4	LIST_AFTER	(1.32)	0.060	**0.751**	-0.032	1									
5	SUB_D	1.18	**-0.128**	**-0.217**	**-0.144**	**-0.158**	1								
6	M&A_D	1.40	0.082	**0.504**	**0.295**	**0.401**	**-0.134**	1							
7	LEV	1.01	-0.048	-0.037	-0.023	-0.029	-0.026	-0.042	1						
8	SOLV	1.09	**0.112**	**-0.201**	**-0.107**	**-0.169**	-0.058	**-0.127**	-0.047	1					
9	INV	1.11	-0.033	**0.152**	0.087	**0.123**	0.082	**0.218**	-0.044	0.014	1				
10	GDP_BEG	1.44	0.075	**0.114**	0.085	0.076	**0.105**	0.049	0.041	-0.102	-0.046	1			
11	GDP_GROWTH	1.49	-0.084	**-0.157**	-0.089	**-0.128**	**-0.111**	-0.089	-0.020	**0.112**	0.041	**-0.547**	1		
12	ROT_BEG	1.24	-0.089	**-0.132**	-0.067	**-0.114**	**-0.191**	**-0.121**	-0.029	0.086	**-0.168**	-0.103	**0.170**	1	
13	ROT_END	1.12	-0.069	-0.060	-0.031	-0.052	-0.044	-0.069	0.001	-0.041	**-0.118**	-0.020	0.038	**0.314**	1

The table reports pairwise correlation coefficients and variance inflation factors (V.I.F.) for the independent variables adopted in the model described by Equation (3.1). Variables are defined in Section 3.4.2. Dummies related to industries, countries and cohorts are excluded. Significant correlations (99% confidence level) are indicated in bold type. V.I.F. for *LIST_BEFORE* and *LIST_DURING* is reported between brackets as is computed with the omission of the corresponding collinear variable *LIST_D* (no significant differences are related to the V.I.F. of the other variables in this different specification).

Chapter 4

The moderating role of industry maturity over business growth factors. The case of the Italian manufacturing industry

Abstract. This paper investigates the relationship between firm growth and the stage of the industry life cycle in the Italian manufacturing industry. Based on the data of nearly 20,000 firms, we replicate previous research about business growth factors while adjusting for the moderating role of industry maturity. Consistent with such research, analysis of data is done with multiple regressions where a growth index is the dependent variable. The problem of assessing the degree of maturity of the several Italian manufacturing industries is faced through a modified application of the Fuzzy Industry Maturity Grid. "The stylized facts" that firm size and age have a negative effect on firm growth are confirmed. We also find evidence of a positive impact of group affiliation, internationalization, and geographic agglomeration. Finally, consistently with the nature of the competition, we found industry maturity to be both negatively related to firm growth and to impact on the relevant growth factors. Findings are confirmed after controlling for heteroskedasticity, bad leverage points and non normality of data.

Keywords: Firm growth, Growth determinants, Industry maturity, Manufacturing industry.

JEL Classifications: L25, L60, M10

4.1 Introduction

While in the middle of the 20th century large textiles, steel and car industries were symbols of national economic muscle, since then, at least in the OECD area, these industries have experienced strong structural crises and have increasingly restructured with production shifting to other countries and new industries (Fukasaku, 1998). This has been the case also for Italy. In the last years there has been a clear difference between the trends of the service and manufacturing industries: while the former has shown a continuous path of growth it has not been the same for the latter. However, this difference should not be read, a priori, as negative: as suggested by Bazen and Thirlwall (1989), both a positive and a negative de-industrialization exist. The former originates from the process of development of the economic structure of a country, which is manifested by an increase in demand for services by consumers, or by an increase in the share of services which are used in the production of other goods. In contrast, the latter is a symptom of a loss of competitiveness of the manufacturing industry, which is contrasted with a decline in the number of employees in order to adapt the resources to demand and increase the productivity of the factors. In the first case the de-industrialisation matches the process of growth of the economy toward a path of full employment, where the industrial sector, after the expansion phase typical of the take-off period of an economy, leaves step to services. In the second one, the de-industrialisation is a symptom of the difficulties of the economic system to keep pace with the competitiveness of other (usually emerging) countries, and therefore is associated with an increase in unemployment and a process of growth slow, if not negative (Rowthorn & Wells, 1987).

This second case is the one that best represents the evolution of the Italian economy in the last years. As highlighted by some recent works (e.g. Faini & Sapir, 2005; Barba Navaretti, Bugamelli, Faini, Schivardi, & Tucci, 2007), in the last years the Italian productive structure has been focused on 'traditional' labour intensive goods, which require a low intensity of human capital and a high adoption of unskilled workers[1]. This has translated in a low propensity to innovation and in a higher exposure (respect to the other European players) to the competition of emerging countries. As a result, the productive structure of Italy has been one of the main driver of the economic decline of the country. Manufacturing activities have gradually lost their attractiveness and their ability to be the economic engine of the country: the decline of many incumbent firms, along with the decreasing birth rate of new firms and the employment contraction (not totally due to labor-capital substitution processes) are, sure enough, signals of the structural difficulties they are experiencing.

From an industry life cycle (ILC) perspective this trend should be read as a continuous shift of the manufacturing industry toward the maturity phase. In such context, firms (and markets) are characterized by many common traits and external factors highly influence industry evolution: limited technical improvement opportunities (McGahan, Argyres, & Baum, 2004; Foster, 1986; Abernathy & Utterback, 1978), saturated markets (Gera & Mang, 1997; Anand & Singh, 1997; Baden-Fuller, 1989), product commoditization (Auster, 1992; Grant, 2002),

[1] According to Giovannetti and Quintieri (2007), the average share of this traditional industries on the value added of the entire manufacturing has been close to 14%, the double of the European Union and three times respect to Germany, France and UK, as these ones have adapted the structure of their comparative advantages to the changing international conditions.

increased competition and regulation (Grant; Klepper, 1996; Smallwood, 1973), social and demographic trends (M. E. Porter, 1980) are examples of the main features recognized by the literature to such phase. From an industrial organization perspective, which stresses the role of market or industry structure in determining firm conduct and performance (e.g. M. E. Porter, 1981; Clarke, 1985), mature industries are slightly attractive competitive arenas. However, as suggested by the newer resource based perspective, which stresses the importance of firm specific characteristics (Barney, 1991; Grant, 1991), the greater the power exerted by a firm's external environment, the more likely it is that the development of internal resources will provide a secure foundation for the firm's long-term strategy. Consistently with this view, some recent evidence (Cassia, Fattore, & Paleari, 2006) suggests that also in mature industries, where business opportunities shrink, it is possible to find emerging firms able to sustain paths of growth and development. These firms pushed by a growing competition move countertendency respect to their environment and are forced to rejuvenate in order to survive. This leads to reflect about the possibility that some common factors could exist behind their observed behaviors. Many efforts among practitioners and academics have given increasing importance to understanding what factors in business firms underlie the differences in their growth rates; however, despite previous research has already focused on manufacturing firms, finding consistent relationship from nation to nation (Davidsson, Kirchhoff, Hatemi, & Gustavsson, 2002), nobody has investigated empirically the moderating role that the ILC could play on growth factors and on growth itself. We believe that such a question is worth of investigation as environmental factors, beyond the mere industry characteristics, are getting increasing importance because of the increasing attention paid by researcher to contingencies and interaction effects amongst growth factors (Dobbs & Hamilton, 2007). Moreover, the manufacturing industry still plays an important role in the Italian economy as it employs a fifth of the total workforce and is responsible for nearly a fifth of the country Gross Domestic Product. Really, it has an even greater role, as it shapes the backbone of the national economy and it is responsible of many activities afferent to other industries. So it is important to take care of it.

In the light of these considerations, the aim of this work is to investigate empirically the impact that the level of industry maturity has over growth as well as how it influences the contribution of the main business growth determinants. We are not aware of other studies with such a focus before this one. To address this issue this article focuses on the Italian manufacturing industry that has progressively matured between 1995-2005, experiencing a strong structural crisis. We replicate previous research about business growth factors in manufacturing industries while adjusting for the moderating role of industry maturity. Consistent with such research, analysis of data is done with multiple regressions where a growth index is the dependent variable. The problem of assessing the degree of maturity of the several Italian manufacturing industries is faced through a modified application of the Fuzzy Industry Maturity Grid (FIMG - Tay, Tham, & Ho David, 1992).

Results suggest some relevant considerations about industry maturity. Instead of being a dichotomous condition, industry maturity seems to be a continuous connotation with increasing level of intensity: we cannot observe only industries with a high or low connotation of maturity as it is increasingly distributed among the various activities. So instead of mature or non mature clusters of industries, the best definition is that of clusters more or less mature than others.

Manufacture of textiles, leather and related products (DB and DC industries according to the 1-digit Ateco codification) upstands among the most mature industries while the manufacture of basic metals, fabricated metals and other non-metallic mineral products (DI and DJ industries) could be found amongst the most mature. A sample of firms taken from these industries has been selected for testing our hypotheses. Robust regressions techniques have been adopted for dealing with heteroskedasticity, non-normality, and bad leverage points affecting residuals. Econometric results confirm previous findings about business growth factors. Age and size are found to be negatively related to firm growth while the affiliation to a group (as both parent or daughter) is found to have a positive impact on it. Population density of the area where the firm resides is found to be positively related to growth, confirming past findings about the goodness of agglomeration. Also industry- and location-specific dummies are found to discriminate growth among firms. Positive effects on growth rates are also found with respect to some proxies of the internationalization of the firm. Moreover, we also found evidence that industry maturity affects both firm growth and business growth factors. As expected from the nature of the competition, struggling in mature industries is statistically and negatively related to growth. Effects of firm size and age are increased in mature context as the corresponding interaction terms with the maturity dummy are found to be positively related to growth. This is consistent with the nature of mature industries, where bigger and older firms are more able to sustain and implement the processes at the base of competition. Despite the affiliation to a group could be expected to play an important role in mature industries, its corresponding moderated effect is found negatively related to growth. An explanation could be that independent firms, as not swamped in settled routines, can better identify the signals of decline and grasp the emerging opportunities.

This work is hence structured as follows: Section 4.2 reviews the theoretical framework related to firm growth factors and industry maturity. Section 4.3 investigates the maturity structure of the Italian manufacturing industry while Section 4.4 discuss the econometric model and sample. Results and discussion follows.

4.2 Theoretical framework

According to Dobbs and Hamilton (2007) the large number of conceptual frameworks which have attempted to capture aspects of small business growth may be divided into six broad groups: stochastic, descriptive, evolutionary, resource-based, learning and, deterministic. In the deterministic approach, which is the perspective adopted in this article and the one that continue to dominate the literature, the objective is to identify a stable set of explanatory variables, that can explain a major proportion of the observed variation in business growth rates. This is the converse of the stochastic approach, developed mainly in the field of economics, which stems from Gibrat's (1931) "Law of Proportionate Effect" and suggests that there is a so large number of factors that affect growth, none of which exerting a major influence, that together act randomly on the size of firms. Following the review of Storey (1994,), the evidence about growth factors is usually arranged in three categories: the entrepreneur, the strategy and the firm, with the latter being the point of interest in this article. Past findings has evidenced six factors of significance in such perspective: age and size, ownership, legal form, location and

sectoral affiliation are all systematically related to growth.

Especially the discussion of age and size as determinants of firm growth has a long tradition, following the formulation of Gibrat's law in 1931. This law states that the rate of growth of a firm is independent from its size at the beginning of the period, and that the probability of a given growth rate during a specific time interval is the same for any firm within the same industry. However, empirical studies typically do not find support for the independence of firm growth from size and age. Size is usually found negatively related to firm growth (Evans, 1987; Hall, 1987; Almus & Nerlinger, 1999; Wagner, 1995). A number of theoretical explanations have been provided for such a relationship. For example, Jovanovic (1982) proposes a theory of "noisy" selection where firm growth and survival are linked to the firm's size, age and initial production efficiency, implying that younger firms tend to growth faster than older ones. Other explanations consider the need for small businesses to achieve a minimum efficient scale (MES). Firms typically start small because their efficiency is low or they are constrained financially. However, these constraints are said to decrease following start-up and thus businesses attempt to attain MES for their operations (Smallbone & Wyer, 2000). Once this is achieved, businesses tend to grow less rapidly. More recently Cabral (2005) provides a model of firm growth where new small firms are more likely to experience a higher rate of growth because of sunk costs related to capacity and technology choices. The characteristic of age as a determinant of small business growth follows similar principles to those mentioned for "size" (Orser, Hogarth-Scott, & Riding, 2000). Like smaller firms, younger firms are said to grow more rapidly as they attempt to accumulate sufficient resources in order to be able to withstand unforeseen external shocks (Heinonen, Nummela, & Pukkinen, 2004; Smallbone & North, 1995; Smallbone & Wyer). However, a positive relationship between firm size and growth may be expected if a larger firm benefits from economies of scale, or between age and growth if an older firm benefits from reputation effects, both allowing businesses to earn a higher margin on sales (Glancey, 1998). Thus the potential for growth among more mature firms should not be underestimated.

Legal form is obviously another important factor linked to firm growth (Variyam & Kraybill, 1992; Harhoff, Stahl, & Woywode, 1998); among the several different forms, the limited liability form is the paramount one as it frees the owners from some types of liability due to the business operations; this in turn makes limited liability firms more willing to take risks since the owner' personal wealth is protected from excess losses (Almus & Nerlinger, 1999). Also the ownership structure matters. High rates of intercompany links may be related with higher growth regardless of the shape such relationships take: a business could be wholly or partially owned by another firm, or may have joint stock ownership with several other businesses and yet these relationship could extend across national boundaries. This affects the resource availability and access to markets thus is important to control for it (Davidsson et al., 2002).

It should be noted that it is sometimes difficult to determine what factors are truly 'external' and 'internal', respectively. Some factors attributed by Storey (1994,) and others (e.g. Davidsson et al., 2002) to the firm better coincide with the environment, i.e. industry and location. Other compilations (e.g. Smallbone & Wyer, 2000), have confirmed this idea, distinguishing the characteristics of the firm from environmental and industry specific factors. Such distinction emphasizes the question if internal factors rather than external forces largely determine the firm's growth. Taken together the sensible conclusion is that growth is to a considerable

extent a matter of willingness and skill, but that fundamental facilitators and obstacles in the environment cannot be disregarded, to the point that a number of models (e.g. the population ecology model Hannan & Freeman, 1977) present the environment as the central factor explaining organizational growth which is therefore a function of environmental/industry selection.

Despite firm's location is, regardless of its operationalization, a variable usually investigated in the deterministic approach, very little is known about the locational impact on firm growth, and this is not due to a lack of theories but rather the fact that locational aspects have been overlooked in these studies (Audretsch & Dohse, 2007). Several scholars have realized that there is urgent need for studying whether the economic and human capital characteristics of region influence the growth and survival of firms (Acs & Armington, 2004). Some locations are more conducive to firm growth, especially for industries where firms are bound to the local market (Davidsson, 1989). Marshall (1890) suggests that location within a geographically concentrated area results in greater firm efficiencies due to benefits from labor market pooling, the development of specialized intermediate goods and, knowledge externalities. Moreover rural areas have been reported to be at a disadvantage in providing financial capital to its firms (Green & McNamara, 1987) and similar inequities exist with human capital.

Also characteristics of the industry environment have been found to have significant influence on firm growth. Demand side variations for example, in the size, scope, and buoyancy of a firm's local market would be expected to affect a firm's opportunity for growth; the stage of the ILC may also create opportunities for firm's products and services to be adapted to new markets so that ventures competing in growth industries may have greater opportunities than ventures in mature markets (Koberg, Uhlenbruck, & Sarason, 1996). On the supply side, variations in the cost and availability of resources may also have an influence (Smallbone & Wyer, 2000). For example, periods of high demand conditions, such as industry growth, have significant impact on firm growth as the environment is munificent in available resources and mistakes are not costly as in less munificent environments (Gilbert, McDougall, & Audretsch, 2006). A key determinant behind these supply and demand side variations is the level of competition within the market place, which is strictly linked to the other characteristics of the industry environment such as dynamism, heterogeneity and price hostility that are significant influencers of the sales growth a firm could attain. Unfortunately, empirical studies which have attempted to test this proposition have typically used the number of competitors as their measure (Nickell, 1996). Thus, while the nature of the market place into which a firm sells may be a key influence upon a firm's growth potential, empirical proof is far from compelling.

The concluding remark of this short review about firm-level growth factors is that despite studies are no longer short in supply, a coherent picture is not easy to distil from the evidence. Since the review of Gibb and Davies (1990), who concluded that the body of evidence then available was inadequate, our knowledge remains fragmented and still lacks an integrative theory (Dobbs & Hamilton, 2007). Davidsson, Achtenhagen, and Naldi (2007) uphold that it is probably the case that every theoretically reasonable suggestion for a growth determinant has been shown to have the predicted impact in some context and argue that the problem is to develop better knowledge about the relative and combined effects of the many predictors under different circumstances. One way to deal with this problem is to give up ambitions of approaching full explanation but instead enhance our understanding of the interplay among

a smaller set of specific factors. The existence of contingencies and interaction effects also points at where research on firm growth stands today. Rather than assuming linear, additive effects research increasingly focuses on fit and combined effects (Dobbs & Hamilton). Following this conclusion our idea is to investigate how the contribution of the main growth factors traditionally found in literature changes in increasing conditions of industry maturity as well as how maturity itself influence the growth potential of incumbent firms. The concept of maturity grasp simultaneously many of the previous considerations related to the environment and the industry, due to its multidimensional conceptualization, and is gaining increasing importance due to the progressive decline of traditional industries in the developed countries so it represents an interesting environment where investigating firm growth.

Researchers and academics have engaged in extensive theorizing and conceptualization on stages of development theory about industry evolution: even if Klepper (1992) noticed that there have been various renditions of what actually constitutes the ILC, he also highlighted the accumulating evidence supporting the idea of a prototypical life cycle of industries. Four basic stages of evolution are commonly recognized from introduction (also called emergence or birth) to growth, maturity and finally decline. Associated with each stage are different technological, environmental and competitive conditions that influence firm performances. Along this path of evolution, maturity reflects the many elements characterizing the crisis that traditional manufacturing industries are today experiencing in many developed countries.

As usually described, during the evolution of an industry, when the potential customer base is close to total coverage, the growth of volume production starts to slow down and maturity begins; the trends of market demand are stable, mainly focused on product replacement and usually lower than economic growth. A stagnating market increases the buyer negotiation power: clients are more price-sensitive and their knowledge of the products is quite high after years of consumption. During maturity product innovation drops substantially, pushed by the emergence of a dominant design in the industry (Suarez & Utterback, 1995), and leaves space to process incremental innovation. Moreover, innovation spreads quickly in the industry and barriers to the diffusion of knowledge become weaker: products become more and more standardized and become near commodities. As a result, differentiation becomes very difficult and price competition becomes stronger; industry profitability shrinks and it arises the need to search for new client bases. Competition, and cooperation take on a complex form. Firms seek to reduce costs and capitalize on internal resources. Processes, technologies and resources are managed according to efficiency objectives, but often require investments that may not be easily paid back so some companies may shift some of the production overseas in order to gain competitive advantages. The main factors of the competitive process become increasingly based on, for example, scale economies, learning curves, and financial resources. However, it becomes increasingly difficult to achieve positive increases in productivity, because the products or services may have reached technological saturation and there is often overcapacity in the industry resulting from efforts to achieve economies of scale. The established firms, and especially the market leaders of the industry, will strive toward creating barriers for new entries into the industry. In these conditions, bigger firms may be more able to sustain and implement the innovative processes at the base of competition. While almost all industries sooner or later shift into the mature phase, not all of them go further into the phase of decline.

Nevertheless maturity can be prolonged for a long time, during which markets increasingly depend on external dynamics like, for example, demographics and national economic up and downturns. As a result, it is increasingly difficult for firms to sustain paths of growth, and this requires above average resources.

4.3 The maturity structure of the Italian manufacturing industry

The Italian manufacturing industry, as in every other developed country, is made by a wide range of different activities and even if they have progressively matured and restructured, they have not experienced the same level of crisis. Indeed, as we want to investigate the role of business growth factors in increasing conditions of maturity, we need to clarify and rank the activities that have experienced a more adverse evolution and have become most mature.

In this sense the literature is only slightly helpful: the ILC is normally defined in terms of changes in aggregate sales volume but, despite the apparent clarity, the volume-oriented criteria are difficult to apply in practice and additional research is needed to generate new criteria to ascertain the positioning along the life cycle (McGahan et al., 2004). As suggested by the literature the complexity of the phenomenon investigated requires a relative and multidimensional methodology that could handle at the same time the various aspects which characterize the evolution of an industry (Grant, 2002). Researchers and academicians have identified various parameters to determine specific stages in the attempt of combining more determinants rather than finding one common cause. This is true also considering the maturity stage, that has been investigated by many works (e.g. Baden-Fuller, 1989; Amin & Smith, 1990; Lieberman, 1990; Klepper, 1996; Gera & Mang, 1997, p. to name a few). However, such literature has been mainly descriptive and has not developed robust empirical tools to assess the positioning of an industry over the life cycle.

In the attempt to follow a purely quantitative approach for ranking the several manufacturing industry according to their level of maturity, a set of nine macroeconomic variables able to handle the different aspects of industry evolution has been retrieved from the literature: industrial production, value added, industry turnover, prices, number of firms, employment (measured as both person employed and FTE)[2], imports, exports. The combined analysis of the whole set of indicator, and not the evaluation of single signals, helps to get an overall picture of the level of maturity characterizing each industry.

Panel A of Table 4.1 on the facing page lists these variables and their expected behavior over the maturity phase. First an explorative analysis is conduced to get an idea of the overall level of maturity characterizing each industry, then a better ranking is provided by recurring to a modified application of the FIMG. The time window investigated is 1995-2005 and industries are defined according to the 1-digit Ateco 2002 codification[3] (14 industries), which is a good trade-off between the possibility to analyze the trend of a specific industry (e.g. food or textile), without going too deep in submarkets or niches, whose trends could be quite different from those of the industry they belong to (Sutton, 1998). Notation and definition of industries is

[2]Only for Employment we have adopted two different variables, because of the structure of data taken from Eurostat (the European statistical office). Further information can be found in the footnotes of Table 4.1

[3]The Ateco 2002 codification receipts the NACE revision 1.1.

TABLE 4.1
Definition and notation of the main macroeconomic variables and industries

Panel A. Definition of variables for industry ranking.

Variable	Index (Source)	Trend along maturity phase (References)
Industrial Production	Industrial production index adjusted by working days (Eurostat)	*Decreasing*. The demand saturation and/or the increasing market share held by foreign producers determine a contraction of the output of the industry (Amin & Smith, 1990; Jovanovic & MacDonald, 1994; Filson & Songsamphant, 2005).
Turnover	Annual turnover index (Eurostat)	*Decreasing*. Output and prices contraction involve a reduction in the total turnover of the industry (Tan & Lewis, 1994).
Value Added	Value added at factor cost (Eurostat)	*Decreasing*. The growing competition inside the industry and the output contraction determine a reduction of the value added produced by the industry (Patton, 1959; Levitt, 1965; Smallwood, 1973).
Price	Domestic output price index (Eurostat)	*Decreasing*. The high degree of internal rivalry shifts the competition on the price side (Patton, 1959; Mueller & Tilton, 1969; Grant, 2002).
No. Firms	Number of enterprises (Eurostat)	*Decreasing*. The number of firms that exit the industry exceeds the number of those entering, leading to a reduction in the total number of active firms (Levitt, 1965; Jovanovic & MacDonald, 1994; Klepper, 1996)
Employment	No. of person employed (Eurostat); No. of employees in full time equivalent (Eurostat)	*Decreasing*. The reduced number of new entries accompanied by the exit of the less efficient firms involve a contraction of the industry employment (Barba Navaretti, 2000).
Exports	Annual exports index (Istat)	*Decreasing*. The reducing number of incumbent firms and the growing competition of foreign firms involve a reduction in the ability of the industry to export (Wells, 1972; Corcoran, 1990).
Imports	Annual imports index (Istat)	*Increasing*. The number of firms that exit the industry exceeds the number of those entering, leading to a reduction in the total number of active firms (Wells, 1972; Amin & Smith, 1990; Grant, 2002)

Panel B. Industry classification by Ateco 2002 codes (1st digit)

Notation	Description
D	Manufacturing
DA	Manufacture of food products, beverages and tobacco
DB	Manufacture of textiles and textile products
DC	Manufacture of leather and leather products
DD	Manufacture of wood and wood products
DE	Manufacture of pulp, paper and paper products; publishing and printing
DF	Manufacture of coke, refined petroleum products and nuclear fuel
DG	Manufacture of chemicals, chemical products and man-made fibres
DH	Manufacture of rubber and plastic products
DI	Manufacture of other non-metallic mineral products
DJ	Manufacture of basic metals and fabricated metal products
DK	Manufacture of machinery and equipment n.e.c.
DL	Manufacture of electrical and optical equipment
DM	Manufacture of transport equipment
DN	Manufacturing n.e.c.

Panel A of this table reports the indexes (and related sources) that have been used to measure the trend of the reported macroeconomic variables. Base period of the indexes is the year. Time coverage is 1995-2005. Data is scaled by considering Index_{1995}=100. The expected trend of each variable along the maturity phase is also discussed. because of the structure of data taken from Eurostat two indexes are considered for the employment: *Number of employees* and *Number of persons employed*. The former is defined as those persons who work for an employer and who have a contract of employment and receive compensation in the form of wages, salaries, fees, gratuities, piecework pay or remuneration in kind; the latter is defined as the total number of persons who work in the observation unit (inclusive of working proprietors, partners working regularly in the unit and unpaid family workers), as well as persons who work outside the unit who belong to it and are paid by it (e.g. sales representatives, delivery personnel, repair and maintenance teams). As the two definition could have quite different trend in the same industries, both are considered. Panel B lists the notation and definition of industries in the Italian manufacturing industry according to the 1-digit Ateco 2002 code.

TABLE 4.2
Trend of the main macroeconomic variables (1995-2005)

Industry	No. Signals	Turnover	Value Added	Price	No. Firms	Person Employed	Employees (FTE)	Exports	Imports
D	n.s.	2.53	1.77	1.61	-0.53	-0.37	-0.35	4.01	5.17
DA	1	2.90	2.65	*M* 1.44	0.58	0.56	0.97	5.38	3.59
DB	9	*M*-0.01	*M* -1.13	*M* 1.24	*M*-2.96	*M*-3.25	*M*-4.06	*M* 1.92	*M* 5.95
DC	8	*M*-0.21	*M* -0.31	1.78	*M*-2.33	*M*-2.95	*M*-3.75	*M* 1.94	*M* 7.10
DD	3	3.55	3.23	*M* 1.00	*M*-1.22	0.25	-0.04	*M* 2.47	4.30
DE	5	*M* 2.14	2.37	*M* 1.32	0.23	*M*-0.40	*M*-0.91	*M* 3.77	2.22
DF	3	5.24	*M* 0.33	3.58	-0.11	*M*-3.82	*M*-3.79	11.65	3.40
DG	4	*M* 2.16	*M* 0.57	1.85	0.23	*M*-0.85	0.32	6.50	*M* 5.67
DH	2	2.79	2.14	*M* 0.92	-0.48	0.78	0.91	4.60	*M* 5.33
DI	1	4.77	3.64	2.45	-0.05	0.27	-0.30	*M* 1.82	4.19
DJ	0	3.27	3.03	1.81	0.94	1.42	0.81	5.59	4.38
DK	2	*M* 2.44	2.49	*M* 1.38	0.46	0.58	0.51	4.08	5.12
DL	8	*M* 1.28	*M* 1.12	*M* 0.72	*M*-0.63	*M*-0.87	*M*-0.56	*M* 3.17	4.35
DM	5	2.62	*M* 0.23	*M* 1.40	1.32	*M*-1.60	1.74	4.32	*M* 7.25
DN	5	*M* 1.57	2.87	1.64	*M*-1.47	0.11	*M*-0.50	*M* 1.63	*M* 6.49

Industries are defined according to the first digit NACE 2002 code. Data are beta coefficient of the OLS model fitted, for each variable and industry, on the time series 1995-2005 (1995=100). Variables are definted in Table 4.1. Source for raw data are Eurostat and Istat. M indicates that for that industry the trend of the considered variable is a signal of maturity.

given in Table 4.1 Panel B. The trend of each variable is defined as the beta coefficient of the OLS model fitted over the corresponding time series for the ten year period 1995-2005 (1995=100, for making beta comparables amongst industries). With such an operationalization we use information not only from the first and last period of observation but also from the middle years, avoiding to miss fine-grained fluctuations, important especially in the case of high variation from a period to another (and if data is heteroskedastic). Source for raw data are Eurostat (the statistical office of the European communities) and Istat (the Italian national statistical institute).

Maturity is not an intrinsic condition of an industry, but it is strictly linked to the evolution of the context to which an industry belongs to. So an easy way to get a signal of maturity is not to look at the trend of a variable per se, but to compare it to that of its economic context (Gera & Mang, 1997); in this work the whole Italian manufacturing industry is assumed as the reference context, as we have previously discussed its general shift toward maturity and because we want to identify the most mature industries in it. The previous considerations translate in Equation (4.1) according to which for each variable j, a signal of maturity for the industry i ($M_{i,j}$=1) stems from the comparison of the trend of that variable for that industry ($\beta_{i,j}$) with the trend of that variable for the entire manufacturing industry ($\beta_{m,j}$). This comparison is made on the basis of the expected behavior of the variable j over the maturity phase (as described by Table 4.1):

$$M_{i,j} = \begin{cases} 1 \quad if \quad \beta_{i,j} < \beta_{m,j} \quad \text{except Imports} \\ 1 \quad if \quad \beta_{i,j} > \beta_{m,j} \quad \text{for Imports} \\ 0 \quad else \end{cases} \tag{4.1}$$

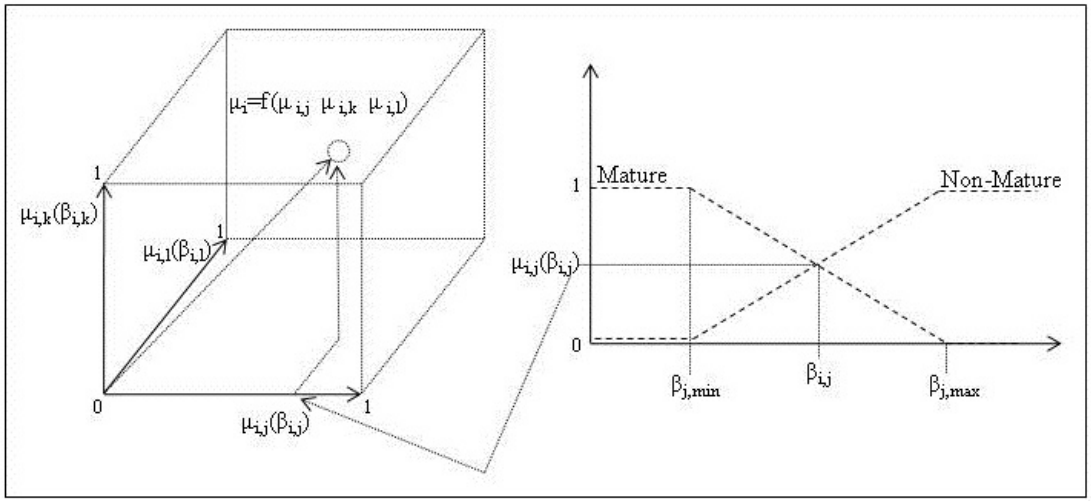
Table 4.2 reports estimates of $\beta_{i,j}$ coefficients for each industry i and variable j,; values

involving the occurrence of a signal of maturity are pointed out by the letter M. What clearly emerges from this simple analysis is that instead of a dichotomous condition, industry maturity seems to be a continuous connotation with increasing level of intensity: we cannot observe only industries with a high or low number of maturity signals as these are increasingly distributed among the various activities. In this sense, it would be better to talk of cluster of industries more or less mature than others than of cluster of industries mature or not. Manufacture of textiles, leather and related products (DB and DC industries) are found as the most mature industries; at the opposite, manufacture of basic metals, fabricated metals and other non-metallic mineral products (DI and DJ industries) are those with the lowest connotation of maturity. Despite the adjacency (from a product perspective) of the industries identified on both the two sides is a signal of the rationale of the results obtained, this approach is unable to clearly discriminate the level of maturity amongst industries. For example, two industries could have a similar number of maturity signals, whose trends could be however quite different. Or again, one industry could have only a few number of maturity signals, whose trends could be instead very poor. So a better ranking of industries respect to their connotation of maturity has been retrieved through a modified implementation of the Fuzzy Industry Maturity Grid (FIMG), first proposed by Tay et al. (1992).

The original IMG was a framework developed by the Cambridge University for discerning the signals of maturity of an economic sector or industry which has been subsequently reformulated in its fuzzy implementation. The baseline idea of the model is that the overall degree of maturity of an industry is the synthesized outcome of the maturity of its distinctive characteristics, which represents an ordered continuum whereby transitions of judgment from "developing" to "mature" could be modeled. In this way, the concept of maturity can be conceptually collapsed onto that of an hypercube whose dimensions represent each the grade of compatibility of the characteristics investigated with the concept of maturity. Overall, this cube defines a spatial volume containing all the possible state of assessment an industry can have respect to the state of maturity. By determining the positioning of each characteristics along its corresponding dimension, the position of the industry may be located within the cube and the overall level of maturity assessed. The norm (i.e. the length) of the vector linking the edge of the cube (the one where the level of compatibility of all the characteristics with the concept of maturity is minimum) to the point representing the industry within the cube could be then considered a measure of the level of maturity of an industry. Fuzzy sets play a fundamental role in such model. Because industry characteristics are not crisp and cannot be precisely described as either "mature" or "developing", it arises the problem of how to assess their compatibility with the concept of maturity. With fuzzy sets, the parametric value describing a characteristic can be related through a membership function to a membership grade (ranging between 0 and 1) that represents the grade of compatibility of that parameter with the concept investigated (i.e. "mature").

The characteristics that we consider in order to assess the level of maturity are the macroeconomic variables previously described in Table 4.1. In previous applications of the FIMG the membership function was a discrete function: the degree of maturity of a characteristic was assessed by qualitative evaluation of domain's experts along a 9-point linguistic scale whose items were directly related to membership grades, with a linear decreasing relationship between

FIGURE 4.1
Exemplification of the FIMG as reformulated in the article



This figure exemplify the rationale of the FIMG as implemented in the article. By a membership function (the dot-line on the right side signed as *Mature*), it is possible for an industry i and a characteristic j describing that industry, to translate the parameter describing that characteristic ($\beta_{i,j}$, e.g. the trend of Imports) in a corresponding membership grade ($\mu_{i,j}$) describing its compatibility with the concept of maturity. Hence, membership grades can be used to asses the position (μ_i) of the industry investigated in a hyper-cube which defines a spatial volume containing all the possible state of assessment an industry can have respect to the condition of maturity. The norm of the vector [0,μ_i] is then the estimation of the level of maturity intrinsic to the industry i.

the two. Because in our case valuations are based on quantitative trends, we have developed a linear, continuous membership function that ranges from 0 (minimum compatibility with the concept of maturity) to 1 (maximum compatibility). The corresponding abscissae delimiting the function in [0,1] are the maximum ($\beta_{j,max}$) and the minimum ($\beta_{j,min}$)values of β for the considered characteristic. So, the function linearly increases from [0,$\beta_{j,max}$] to [1,$\beta_{j,min}$] if maturity is emphasized by a decreasing trend of the variable and vice versa in the opposite case. The mathematical expression is given in the following Equation (4.2)[4] and membership grade are provided in Panel A of Table 4.3 on the facing page. A graphical exemplification of the procedure is given in Figure 4.1.

$$\mu_{i,j} = \begin{cases} 0, & \beta_{i,j} \geq \beta_{j,max} \\ m_j \cdot \beta_{i,j} + q_j, & \beta_{j,max} \leq \beta_{i,j} \leq \beta_{j,min} \\ 1, & \beta_{i,j} \leq \beta_{j,min} \end{cases} \tag{4.2}$$

where:

$$q_j = \frac{\beta_{j,max} \cdot (1-0)}{\beta_{j,max} - \beta_{j,min}},\ m_j = \frac{(0-1)}{\beta_{j,max} - \beta_{j,min}},\ \beta_{j,max} = Max_j\left(\beta_{i,j}\right),\ \beta_{j,min} = Min_j\left(\beta_{i,j}\right)$$

After the estimation of the membership grades, the diagnoses of the industry is assessed by mapping the position of these values into the hypercube and by simply compute the norm of the resulting vector. Really, a slightly different aggregation function is preferred, because it allows to incorporate hypotheses for the weighting of and compensation among the characteristics.

[4]The formula applies to all the variables except *Imports*. β_{max} and β_{min} should be exchanged when considering Imports, as the expected trend of all the variables over the maturity phase is decreasing except than for this variable.

TABLE 4.3
Membership grades and degrees for maturity for industries and characteristics

Panel A. Membership grades ($\mu_{i,j}$)

Industry	Industrial Production	Turnover	Value Added	Price	No. Firms	Person Employed	Employees (FTE)	Exports	Imports
DA	0.129	0.429	0.208	0.747	0.173	0.163	0.132	0.625	0.272
DB	0.653	0.962	1.000	0.817	1.000	0.893	1.000	0.971	0.742
DC	1.000	1.000	0.828	0.629	0.852	0.834	0.947	0.969	0.970
DD	0.000	0.311	0.085	0.902	0.594	0.223	0.306	0.916	0.414
DE	0.128	0.570	0.267	0.791	0.256	0.347	0.457	0.786	0.000
DF	0.296	0.000	0.695	0.000	0.334	1.000	0.954	0.000	0.235
DG	0.311	0.565	0.644	0.606	0.254	0.433	0.245	0.513	0.686
DH	0.310	0.450	0.314	0.929	0.422	0.123	0.142	0.703	0.619
DI	0.178	0.087	0.000	0.394	0.320	0.220	0.352	0.981	0.393
DJ	0.279	0.361	0.128	0.617	0.089	0.000	0.159	0.605	0.430
DK	0.302	0.514	0.241	0.769	0.201	0.160	0.211	0.756	0.577
DL	0.733	0.727	0.529	1.000	0.457	0.437	0.395	0.846	0.424
DM	0.550	0.481	0.715	0.762	0.000	0.576	0.000	0.732	1.000
DN	0.238	0.674	0.161	0.676	0.653	0.250	0.385	1.000	0.849

Panel B. Results of the aggregation function, as function of γ

Industry	γ=1	γ=7/8	γ=6/8	γ=5/8	γ=4/8	γ=3/8	γ=2/8	γ=1/8	γ=0
DA	0.320	0.296	0.272	0.248	0.225	0.201	0.177	0.153	0.129
DB	0.893	0.863	0.833	0.803	0.773	0.743	0.713	0.683	0.653
DC	0.892	0.859	0.826	0.793	0.760	0.727	0.694	0.662	0.629
DD	0.417	0.365	0.313	0.261	0.208	0.156	0.104	0.052	0.000
DE	0.400	0.350	0.300	0.250	0.200	0.150	0.100	0.050	0.000
DF	0.390	0.342	0.293	0.244	0.195	0.146	0.098	0.049	0.000
DG	0.473	0.444	0.416	0.387	0.359	0.330	0.302	0.273	0.245
DH	0.446	0.405	0.365	0.325	0.284	0.244	0.203	0.163	0.123
DI	0.325	0.284	0.244	0.203	0.162	0.122	0.081	0.041	0.000
DJ	0.297	0.259	0.222	0.185	0.148	0.111	0.074	0.037	0.000
DK	0.415	0.383	0.351	0.319	0.287	0.255	0.224	0.192	0.160
DL	0.616	0.589	0.561	0.534	0.506	0.478	0.451	0.423	0.395
DM	0.535	0.468	0.401	0.334	0.267	0.201	0.134	0.067	0.000
DN	0.543	0.495	0.448	0.400	0.352	0.304	0.257	0.209	0.161

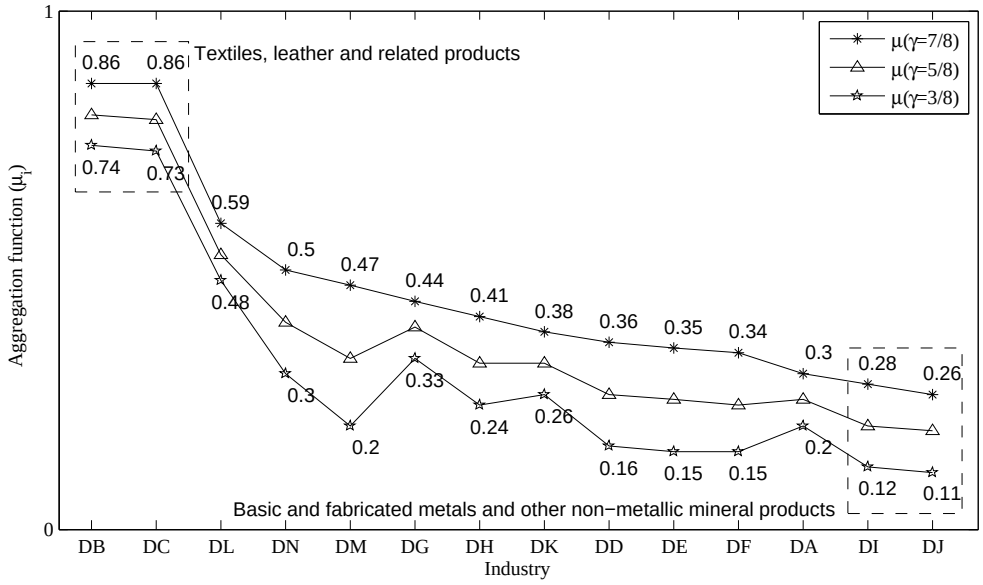
Panel A. reports for each industry i and characteristic j the corresponding membership grades ($\mu_{i,j}$) that reflects the level compatibility with the concept of maturity. Values range between 0 (minimum compatibility) and 1 (maximum compatibility). The membership function is described by Equation (4.2). Notation and definition of variables is given in Table 4.1. Panel B reports (as function of γ) results of the aggregation function as defined in Equation (4.3) and discussed in Section 4.3. This values reflect the overall level of maturity of each industry i. Values range between 0 (minimum compatibility) and 1 (maximum compatibility).

The formula suggested by Tay et al. (1992) is adopted and reported in Equation (4.3):

$$\mu_i = \gamma \left(\frac{1}{\sum \delta_j} \sum_{j=1}^{n} \delta_j \cdot \mu_{i,j} \right) + (1-\gamma)\, Min_{j=1}^{n} \left(\mu_{i,j} \right) \tag{4.3}$$

where μ_i is the overall degree of compatibility of the industry i with the concept of maturity, δ_j is the weight associated to the characteristic j and γ is the level of compensation among all the characteristics; all the variables of Equation (4.3) range between [0,1]. The weights of the characteristics (δ_j) reflect their relative importance in influencing the maturity outcome. We believe that in our case there are no ex-ante consideration for weighting differently the various dimensions: the same weight, equal to the inverse of number of characteristics, is adopted (1/9). The compensatory aspect (γ) accounts for the mutual effect among the characteristics which

FIGURE 4.2
Results of FIMG approach as function of γ



This figure plot the results of the aggregation function expressed by Equation 4.3 by admitting three different level of compensation (γ) among characteristics: 7/8, 5/8 and 3/8. Values summarize the overall compatibility with the state of maturity of each industry, and range between 0 (minimum compatibility) and 1 (minimum compatibility).

affect the overall judgment. It produces an aggregated value somewhere between the minimum (γ=0) and the weighted average (γ=1) of the membership grades. By applying the γ model the degree of maturity can be finally computed.

Results, as function of γ, are given in Table 4.3 Panel B. Full compensation (γ=1) is probably not a fully meaningful hypothesis as it is not conceptually true to believe that a quite poor trend in a variable could be completely compensated by positive trend of the remaining variables; the same consideration, with an opposite impact, holds for null compensation (γ=0). The best interpretation is so obtained by looking at intermediate values of γ; an easy representation of results in this sense is offered by Figure 4.2, which plots the results of the aggregation function.

From both Table 4.3 and (more clearly) Figure 4.2, maturity emerges again as a connotation increasingly distributed among the several manufacturing industries; despite of the level of compensation admitted among variables (γ) the two industries previously found as the most mature (DB and DC) continue to up stand in the ranking with membership values very close to 1 (full compatibility with the concept of maturity), and the same two industries previously found as the less mature (DI and DJ) are found at the bottom of the ranking (lowest compatibility with the concept of maturity).

4.4 Model and data

4.4.1 Econometric Model

The deterministic approach assumes, on the contrary of the stochastic approach expressed by Gibrat's Law, that differences in the rates of growth across firms depend on a set of observable characteristics. Empirical tests against the Gibrat's Law are so usually based on

a regression of the rate of growth at the beginning of period on size and eventually on firm- and environment-specific variables which are expected to affect firm growth. The variables investigated in this work are those essentially found in other studies regarding business growth factors in manufacturing industries (e.g. Davidsson et al., 2002; Becchetti & Trovato, 2002) and have been previously discussed in Section 4.2: size, age, ownership structure, industry and location. Moreover we also control for the moderating role of industry maturity on such factors and also for the impact of maturity on growth. We in fact believe that the ILC strictly influence the behavior of incumbent firms, as outlined in the introductory paragraphs. In order to test for these suggestions, starting from the analysis of the maturity structure of the Italian manufacturing industries, we have focused on the firms belonging to the most and less mature industries. Despite it is no easy to get a clear picture of the ranking of industries, with no doubt two clusters emerge as the most and less mature: DB and DC (which are respectively made by two, DB17 and DB18, and one, DC19, sub-industries) on the one hand and DI and DJ (which are respectively made by one, DI26, and two, DJ27, DJ28, sub-industries) on the other. By testing usual growth models only on the firms belonging to the most mature industries would give us some suggestions about the contribution of the variables of interest in the most mature settings. However, it would not be clear to what extent the relations estimated on such a sample are specific to mature industries or, on the contrary, if they are generally true for all the manufacturing firms, even those competing in less mature context. In other words we wouldn't be able to discern what is, if exists, the marginal change of the impact of these determinants as the industry progressively matures.

Our cross-sectional estimate for the determinants of growth entails the following specification (Equation 4.4a and 4.4b):

$$GROWTH = \alpha_0 + \alpha_1[MATURE] + \sum_i \beta_i[X] + \sum_j \beta_j[X] \cdot [MATURE] + \sum_{l=1}^{m-2} \beta_l[INDUSTRY] + \sum_{k=1}^{n-1} \beta_k[AREA] \tag{4.4a}$$

$$\beta_i[X] = \beta_{i,1}[SIZE] + \beta_{i,2}[AGE] + \beta_{i,3}[AGE] \cdot [SIZE] + \beta_{i,4}[INDEPENDENT] + \beta_{i,5}[FRGNOWN] + \beta_{i,6}[FRGNSUB] + \beta_{i,7}[DENSITY] \tag{4.4b}$$

where *GROWTH* is defined as the difference in the log of firm sales between 2000-2005 for the i-th firm[5], *SIZE* is the logarithm of firm's sales, *AGE* is the log of one plus firm age, *INDEPENDENT* is a dummy equal to 1 for firms not affiliated to a group (0 else), *FRGNOWN*

[5]Despite business growth could be operationalized in many different ways, we have based our definition of growth on sales growth. Though growth is a multi-faceted phenomenon that can be measured with a range of indicators, there is growing consensus that if only one indicator is used and the study has a cross-industry design, sales growth is the preferred choice, as all commercial firms must have sales to survive (Davidsson et al., 2007; Ardishvili, Cardozo, Harmon, & Vadakath, 1998; Hoy, McDougall, & D'Souza, 1992; Weinzimmer, Nystron, & Freeman, 1998; Wiklund, 1998). It is the most general of alternatives, as it is the increase in sales that necessitates an increase in assets and employees, and this results in rising profits or market share (Flamholtz, 1986).

is a dummy equal to 1 for firms with (at least) a foreign industrial company amongst their relevant shareholders (0 else) while *FRGNSUB* is a dummy equal to 1 for firms with at least one relevant participation in an industrial foreign company (0 else), *DENSITY* is population density (thousand people/km^2) of the region where the firm is located, *INDUSTRY* are *m-2* industry dummies based on ATECO 2002 2-digit classification (m=1,...,6)[6], *AREA* are *n-1* macroarea dummies (n=1,..,5) for firms located respectively in North-East, North-West, Centre, South and Insular areas and, finally, *MATURE* is dummy for firms operating in the cluster of industries most mature (DB and DC). All the independent variables refer to year 2000. Given the large number of observations in the database, the regression is able to handle the large number of independent variables we have designated.

Growth determinants are investigated over a five years period because previous research has usually focus on growth period ranging mainly from three to five years. The wider the time window considered, the lower the variance in firm growth rates that could be explained by firm-level characteristics as other external (macroeconomic) variables play a greater role; moreover by imposing large temporal windows we reduce sample size, as a greater number of firms are expected to fail. As the maturity context here investigated is related to the period 1995-2005, we have chosen to start from the middle point of this frame (2000) for investigating growth. In this way we also increase the number of firms whose accounting data is known as for the previous years data for many firms is missing.

4.4.2 Sample

Our sample of firms has been retrieved from the AIDA-Bureau van Dijk database, which is a large dataset that contain mainly accounting information for some thousands of Italian firms amongst all the economic sectors. As in Davidsson et al. (2002) our unit of analysis is the business, or the legal entity, which may consists of one or more establishment and may be either independent or majority owned by a parent company. This choice is related to the fact that a focus on both the establishment or the enterprise definitions (the overall ownership organization) as the organizational unit puts in place some pitfalls (see Davidsson et al., 2002 for a related discussion). We have only imposed two selection criteria on the whole set of firms included in the AIDA database:

1. the firms' main activity should pertain to the previously selected cluster of industries: DB and DC as the mature industries (which are made in turn by the DB17, DB18 and DC19 subindustries) and the DI and DJ as the non mature ones (which are made in turn by the DI26, DJ27 and DJ28 subindustries) [30,617 firms];
2. data should be available for the year 2000 [20,114 firms].
3. data should be available for the year 2005 [19,810 firms].

The resulting sample is made up by 19,810 firms; respect to the sample available for the year 2000 (20,114 firms), only 304 (1.5%) firms have been excluded because the correspondig data miss for the last year investigated (2005) as it has not been collected in the database and not because the corresponding firms have gone bankrupcy (so such firms are still defined as

[6]Due to multicollinearity problems an industry from both the mature and not mature cluster should be excluded.

TABLE 4.4
Comparison between sample and census data

Panel A. Representativeness by industry and legal form

Industry	Italian firms				Sample		
	No. Firms	L. L. (No.)	L. L. (%)	% of Census (L.L.)	No. Firms	% of Census (L.L.)	% of Sample
DB	73344	13929	18.99	30.45	3732	26.79	18.84
DC	22808	4869	21.35	10.64	1345	27.62	6.79
DI	26796	6399	23.88	13.99	3142	49.10	15.86
DJ	99170	20547	20.72	44.92	11591	56.41	58.51
Overall	222118	45744	20.59	100.00	19810	43.31	100.00

Panel B. Comparison by industry and size class (only limited liability firms) (percent values)

Industry	Small		Medium		Large	
	Census	Sample	Census	Sample	Census	Sample
DB	70.98	78.24	24.72	12.22	4.30	9.54
DC	67.34	81.34	29.53	12.27	3.12	6.39
DI	72.01	83.00	23.66	10.41	4.33	6.59
DJ	71.06	83.40	25.44	10.78	3.49	5.81
Overall	70.77	82.23	25.41	11.10	3.82	6.68

Panel C. Comparison by industry and geographic area (only limited liability firms) (percent values)

Industry	North-West		Noth-Est		Central		South		Insular	
	Census	Sample	Census	Sample	Census	Sample	Census	Sample	Census	Sample
DB	32.20	43.84	19.99	21.20	27.92	26.47	18.68	8.09	1.21	0.40
DC	10.35	10.71	22.55	29.89	45.33	48.77	21.24	10.41	0.53	0.22
DI	20.97	23.97	26.80	31.89	22.91	21.16	19.49	15.34	9.83	7.64
DJ	44.13	46.21	27.22	30.79	13.74	11.58	11.64	8.98	3.27	2.44
Overall	33.66	39.82	24.46	29.10	22.70	18.43	15.90	9.92	3.27	2.73

This table compares, for the selected industries, our sample with the entire population of Italian firms (census data). Census data is provided by the Italian Statistical Institute (Istat) and is taken from the Economic Census made in the year 2001. Sample description refers to year 2000. Industries are defined according the 1-digit Ateco 2002 code (see industry definition in Table 4.1). *Small*, *Medium* and *Large* size classes refer respectively to firm with less than 50 employees, less than 100 employees and more than 100 employees.

'active' at the end of the period). This result could be due to the fact that firms that went bankrupcy over the period have been subsequently pulled out from the dataset and are no more available to users. In this sense, despite of the potential relevance of a survivorship bias, we cannot control for it. What could matter most is the selection bias that could affect our sample respect to the whole population of Italian firms involved in the industries considered. First of all we should evidence that our sample is made almost by limited liability firms; this is related to the nature of our starting dataset (Aida-Bureau Van Dijk), which get accessed to data mainly from annual report that are compulsory and publicly available in Italy only for firms which such legal form, while data for the other firms is not easily available. So we cannot control for such a selection bias. Table 4.4 compares our sample with whole population of Italian firms in the considered industries, as described by the results of the Economic Census made by the Italian Statistical Institute (Istat) in order to clarify the representativeness of our sample. Despite the economic census refers to the year 2001 while sample description refers to year 2000 we think that such comparison still make sense. By census data, the limited liability firms in account for nearly the 21% of the whole population, with no major differences among industries. This is not the same when considering the distribution of firms across industries: the higher number of

TABLE 4.5
Descriptive features of the sample (2000) (percent values except *)

	Sample	Mature	Non Mature	Small	Medium	Large
No. Observation*	19.810	5.077	14.733	16.289	2.198	1.323
Small	82.23	79.06	83.32	-	-	-
Medium	11.10	12.23	10.70	-	-	-
Large	6.68	8.71	5.98	-	-	-
Independent	83.64	81.68	84.32	89.61	70.61	31.90
Parent	6.37	8.49	5.63	4.19	12.15	23.58
Daughter	5.86	5.50	5.98	4.73	9.33	13.91
Parent and Daughter	4.13	4.33	4.07	1.47	7.92	30.61
Foreign Ownership	1.39	1.46	1.37	0.66	1.96	9.45
Foreign Subsidiary	3.48	4.88	3.00	1.30	6.05	26.08
Mature	25.63	-	-	24.64	28.25	33.41
Non Mature	74.37	-	-	75.36	71.75	66.59
North West	39.82	35.06	41.46	39.11	41.54	45.80
North Est	29.10	23.50	31.03	28.78	29.89	31.67
Central	18.43	32.38	13.62	18.95	17.65	13.30
South	9.92	8.71	10.34	10.34	8.37	7.33
Insular	2.73	0.35	3.55	2.82	2.55	1.89

This table reports the main descriptive features of the sample of firms investigated (19810) at year 2000. All values are observed frequencies (%) of the corresponding variables in the (sub)sample considered (full sample, sample by industry, sample by size class). *Small*, *Medium* and *Large* refer respectively to firm with less than 50 employees, less than 100 employees and more than 100 employees. *Independent* refers to firms not affiliated to a group, *Parent* to firms affiliated to an industrial group as parent companies, *Daughter* to firms affiliated to an industrial group as daughter companies, *Parent and Daughter* to firms affiliated to an industrial group as both parent and daughter companies. *Foreign Ownership* refers to firms which have (at least) a foreign industrial company amongst its relevant shareholders; *Foreign Subsidiary* refers to firms having (at least) a relevant participation in a foreign subsiary. *Mature* and *Non-Mature* discriminate between firms competing in a mature industry (DB, DC) or in a non-mature one (DI, DJ) (1-digit Ateco 2002 code).

firms is found in the DJ industry (44.92%) followed by the DB industry (30.45%), while the two remaining industries (DC and DI) represent only a small share of the population (10.64% and 13.99% respectively). Our sample represents overall nearly a half of the census firms (43.31%), but again with distinctions among industries; as a result, in our sample mature industries are quite under-represented (18,84% vs. 30.45% and 6.79% vs. 10.64% for DB and DC respectively) in favor of the non-mature ones (15.86% vs. 13.99% and 58.51% vs. 44.92% for DI and DJ industries respectively). By considering only limited liability firms, Panel B and C of the same table compare our sample with census data by size class and geographic area. No major differences are found except for the fact that mid-companies are slightly under-represented (11.10% vs. 25.41%) in favor of both their small and large counterparts.

Table 4.5 reports the main descriptive features of the sample investigated (also by maturity cluster and size class). Our sample reflects the main characteristics of the Italian productive structure as firms are mainly small (82.23%), independent (i.e. not affiliated to a group) and located in the north of the country (the North-West and North-East account to near the 70% of the sample). Only a small share of firms are affiliated to an industrial group as parent company (6.37%), as daughter companies (5.86%) or both (4.13%). Again, only a few of the firms has (at least) a relevant (industrial) foreign shareholder in its ownership structure (*Foreign Ownership*, 1.39%) or, in turn, has a relevant participation in a foreign (industrial) company (*Foreign Subsidiary*, 3.48%). Finally, as already reported, the share of firms competing in mature industries is quite smaller than those competing in non-mature industries (25.63% vs. 74.37%).

Industry breakdown by maturity cluster does not reveal any major difference, except that the share of firms located in Central Italy is nearly the double, reflecting the historical involment of this area in activities related to the textile and leather products. The breakdown of the sample by size class reveals instead some (expected) differences among firms. First, mid firms and especially large firms are more likely to be part of a group, as the share of independent firms is found to drop substantially; in the same way a higher number of firms are found in the *Foreign Ownership* or *Foreign Subsidiary* categories (especially for the large ones). Finally, the larger the size, the higher the share of firms located in the north of the country; as this part of the country is the most developed, larger firms are more likely to find here a better environment in terms of services, structures, and institutions that their size requires.

Table 4.6 on the next page reports the distribution of some relevant quantitative variables, some of which employed in the estimation of the model reported by Equation 4.4 (full sample in Panel A and by industry and size class in Panel B). Some variable are quite skewed so a better description is assessed through median values. The inspection of the table shows that both industry and size matter. First of all, firm competing in mature industries are found to purse lower growth rates and to be less profitable, confirming our assumption that the competition highly increases in that phase of the life cycle, due to both the internal and external evolution of the industry. Moreover, such firms show a financial structure highly skewed toward debt capital, which increases their riskiness and probably reflects the high-financial needs related to the rules of the competition (e.g. high capacity due to economies of scales on the one hand and low profitability, due to product commoditization and price competition, on the other one). From a size perspective, as largely found in the growth literature, small firms show both higher growth rates and profitability, as well as a younger age.

4.5 Econometric findings on business growth factors

Estimates for the model in Equation (4.4) are reported in Table 4.7 on page 92 and refer to the overall sample of firms (in both mature and non-mature industries) in order to evaluate the moderating effects that industry maturity plays on traditional business growth factors. Pairwise correlation coefficients are reported in Table 4.8 in Appendix (Section 4.8.1).

Column (1) reports estimates obtained by traditional OLS regression, while subsequent columns (2-6) report estimates obtained by other several robust regression techniques. These estimates are adopted because traditional tests to validate OLS assumptions (bottom of column 1) has revealed that both data and residuals are affected by some problems. First, the assumptions of normality and homoskedasticity of residuals are both rejected on the basis of the Shapiro-Wilk W test for normal data ($p<0.01$) and Breusch-Pagan/Cook-Weisberg test for heteroskedasticity ($p<0.05$). Specifically the distribution of residual is a pure leptokurtic distribution as it has a higher peak and heavier tails than the normal distribution but not skewness. We also found evidence of the presence of a high number of outliers, and especially bad leverage points (1070) as computed on the basis of the Cook's D measure of influence[7]. These results are quite relevant for the interpretation of OLS estimates. Outliers makes confidence interval stretched (this is the case of good leverage points) but can also bias the parameter estimates (this is the case

[7]The cutoff value usually considered for an observation to be considered a bad leverage point is: Cooks'D> 4/No. Obs

TABLE 4.6
Distribution of the relevant quantitative variables

Panel A. Distribution of the relevant quantitative variables (full sample)

	No. Obs	Average	25th	Median	75th	SD
Growth	19810	-0.039	-0.321	0.061	0.373	0.994
Size	19810	8.21	7.46	8.04	8.82	1.14
Age	19810	2.88	2.48	3.00	3.33	0.70
Leverage	19810	4.89	0.00	0.20	3.80	85.91
Roe (%)	19810	4.26	0.51	6.21	18.05	686.25
Roi (%)	19810	7.19	3.24	5.84	9.78	8.76
Area Density	19810	0.18	0.17	0.17	0.19	0.03
Region Density	19810	0.20	0.13	0.18	0.29	0.10
Employees	14872	64.41	9.00	19.00	39.00	2165.45

Panel B. Distribution of the relevant quantitative variables by industry and and size class

	Sample	Mature	Non-Mature	Small	Medium	Large
Growth	-0.04	0.01	-0.06	0.05	-0.51	-0.31
	0.06	*-0.02*	*0.09*	*0.08*	*-0.03*	*0.05*
Size	8.21	8.34	8.16	7.87	9.33	10.45
	8.04	*8.23*	*7.98*	*7.84*	*9.34*	*10.33*
Age	2.88	3.09	2.81	2.83	3.01	3.27
	3.00	*3.09*	*2.94*	*2.94*	*3.18*	*3.33*
Leverage	4.89	9.88	3.16	4.74	3.39	9.16
	0.20	*4.16*	*0.00*	*0.12*	*0.69*	*0.05*
Roe (%)	4.26	10.47	2.12	10.93	4.39	-77.94
	6.21	*5.64*	*6.41*	*6.65*	*5.01*	*4.20*
Roi (%)	7.19	6.68	7.36	7.41	6.52	5.55
	5.84	*5.53*	*5.95*	*5.98*	*5.49*	*4.79*
Area Density	0.18	0.21	0.18	0.18	0.19	0.19
	0.17	*0.19*	*0.17*	*0.17*	*0.17*	*0.17*
Region Density	0.20	0.24	0.18	0.20	0.20	0.20
	0.18	*0.21*	*0.18*	*0.18*	*0.18*	*0.18*
Employees	64.41	45.65	73.89	17.51	69.54	521.94
	19.00	*19.00*	*19.00*	*15.00*	*67.00*	*171.00*

This table reports the distribution of the relevant quantitative variables for the sample of firms investigated (19810). All variables except *Growth* refer to year 2000 and are defined as follows: *Growth*: sales growth measured as logarithm of sales in 2005 minus logarithm of sales in 2000; *Age*: logarithm of 1+firm age; *Size*: logarithm of sales; *Leverage*: ratio of Equity to Debt; *Roe*: return on equity; *Roi*: return on investments; *Area Density*: inhabitants of the firm's geographic macroarea (th/km^2)(North-West, North-East, Central, South, Insular); *Region Density*: inhabitants of the firm's geographic region (th/km^2) (20 region). Panel A reports the number of observations and the distribution of variables, while Panel B only mean and median values (the latter in *italics*). *Small*, *Medium* and *Large* refer respectively to firm with less than 50 employees, less than 100 employess and more than 100 employees. DB and DC are the *Mature* industries while DI and DJ are the *non-mature* ones (1-digit Ateco 2002 code).

of bad leverage points). Because of non-normality of residuals the estimations of significance become impaired (except than for large sample thanks to the asymptotic properties of the OLS estimator). With heteroskedasticity the OLS estimator is no more the most efficient (but it does not cause OLS coefficient estimates to be biased nor inconsistent); moreover, it can cause the variance of the coefficients to be underestimated and, as such, both standard errors and confidence intervals become unreliable. When tests for these assumptions do not pass muster and outliers plague the model, robust regression or nonparametric regression analysis may provide a reliable alternative.

In the light of these considerations, we have adopted several robust estimating techniques that are (1) OLS with White-consistent robust standard errors, (2) Iteratively Reweighted Least Squares (IRLS), (3) Least Absolute Deviation (also known as L1 or Median regression), and (4) Least Absolute Deviation with bootstrapped standard errors[8]. The rationale of each model and the corresponding interpretations are now discussed. Column (1) reports estimates obtained by traditional OLS regression: as explained we cannot rely on them as coefficients could be biases due to the presence of bad leverage points and confidence intervals unreliable. Column (2) presents estimates of OLS with White-consistent standard errors: despite this correction is the most adopted in the literature, as it can deal with both heteroskedasticity and soft departures from the normality assumption, it is still not sufficient as it doesn't account for influential outliers. Coefficients are the same of the standard OLS model and continue to be potentially biased. Column (3) reports results obtained by an IRLS regression. This technique is robust to the presence of outliers and in particular to the bad leverage points; as such, coefficient estimates are more reliable than those of the traditional OLS model. We found that the signs of the coefficients (which are in this study more of interest than the pure values) are all the same of the previous models except than for $AGE \times MATURE$, $AGE \times SIZE \times MATURE$, $FRGNOWN \times MATURE$, $DENSITY \times MATURE$, thus confirming our fears about the potential impact of bad leverage points. However, unlike the previous case, we cannot rely on confidence intervals as residuals are still non-normal. When distributional normality and homoskedasticity assumptions are violated, many researchers resort to nonparametric bootstrapping methods. One advantage of bootstrapping is that some of the methods provide more accurate confidence intervals than the conventional asymptotic distribution approaches do. As Mooney and Duval (1993) have it, the percentile (Median) bootstrap method empirically proves to be the most accurate. Median regression estimates a constant and parameter estimates that predict the median. As our dependent variable ($GROWTH$) doesn't suffer of skewness, we shouldn't see any significant difference respect to IRLS coefficients estimates. However, the Median regression, is more exposed to influential outliers (bad leverage points) than IRLS. So before implementing a bootstrapped median regression we should compare the coefficients estimates of the former with those of the latter to be sure that a bias doesn't exist. This exactly what is found in column (4). At this point column (5) simply replies column (4) but introducing bootstrapped standard errors and confidence intervals; so reported significances of the coefficients are fully reliable as no more based on normal-assumptions but on the real, empirical distribution. As we want to focus only on significant business growth factors, columns (6) reports the estimates obtained

[8]Results are all based on Stata (V.10) routines. White-consistent estimates are obtained by `regress, robust`; IRLS regression is performed by `rreg`; Median regression by `qreg`. Bootstrapped standard errors (and related confidence intervals) are obtained by `bsqreg`.

TABLE 4.7
The determinants of firm growth (2000-2005)

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	OLS	White Consistent	IRLS	Median	BS Median	BS Median BWD
SIZE	-1.084***	-1.084***	-1.084***	-1.080***	-1.080***	-1.080***
	(0.021)	*(0.047)*	*(0.017)*	*(0.016)*	*(0.066)*	*(0.065)*
SIZE×MATURE	0.194***	0.194*	0.591***	0.581***	0.581***	0.615***
	(0.060)	*(0.106)*	*(0.047)*	*(0.045)*	*(0.094)*	*(0.093)*
AGE	-1.294***	-1.294***	-1.970***	-1.906***	-1.906***	-1.911***
	(0.062)	*(0.125)*	*(0.049)*	*(0.047)*	*(0.143)*	*(0.138)*
AGE×MATURE	-0.413**	-0.413	0.951***	0.862***	0.862***	0.958***
	(0.166)	*(0.279)*	*(0.130)*	*(0.125)*	*(0.225)*	*(0.222)*
AGE×SIZE	0.186***	0.186***	0.271***	0.263***	0.263***	0.263***
	(0.007)	*(0.016)*	*(0.006)*	*(0.006)*	*(0.019)*	*(0.018)*
AGE×SIZE×MATURE	0.013	0.013	-0.160***	-0.148***	-0.148***	-0.160***
	(0.020)	*(0.033)*	*(0.015)*	*(0.015)*	*(0.028)*	*(0.027)*
INDEPENDENT	-0.815***	-0.815***	-0.458***	-0.458***	-0.458***	-0.461***
	(0.022)	*(0.028)*	*(0.017)*	*(0.016)*	*(0.023)*	*(0.022)*
INDEPENDENT×MATURE	0.392***	0.392***	0.205***	0.230***	0.230***	0.233***
	(0.042)	*(0.049)*	*(0.033)*	*(0.032)*	*(0.031)*	*(0.029)*
FRGNOWN	0.296***	0.296***	0.094**	0.096**	0.096	0.136***
	(0.059)	*(0.075)*	*(0.046)*	*(0.045)*	*(0.066)*	*(0.049)*
FRGNOWN×MATURE	-0.105	-0.105	0.110	0.088	0.088	-
	(0.114)	*(0.110)*	*(0.089)*	*(0.085)*	*(0.102)*	
FRGNSUB	0.496***	0.496***	0.116***	0.154***	0.154***	0.127***
	(0.043)	*(0.061)*	*(0.034)*	*(0.032)*	*(0.036)*	*(0.025)*
FRGNSUB×MATURE	-0.327***	-0.327***	-0.023	-0.060	-0.060	-
	(0.075)	*(0.079)*	*(0.058)*	*(0.056)*	*(0.054)*	
DENSITY	217.350**	217.350*	80.228	67.466	67.466	1.171***
	(88.954)	*(115.649)*	*(69.572)*	*(66.556)*	*(79.651)*	*(0.325)*
DENSITY×MATURE	0.054	0.054	-0.363	-0.208	-0.208	-
	(0.482)	*(0.442)*	*(0.377)*	*(0.362)*	*(0.359)*	
IND_DB17	-0.010	-0.010	-0.018	-0.013	-0.013	-
	(0.028)	*(0.021)*	*(0.022)*	*(0.021)*	*(0.019)*	
IND_DB18	0.103***	0.103***	0.082***	0.070***	0.070***	0.074***
	(0.031)	*(0.024)*	*(0.025)*	*(0.024)*	*(0.022)*	*(0.017)*
IND_DI26	0.094***	0.094***	0.078***	0.069***	0.069***	0.068***
	(0.017)	*(0.017)*	*(0.013)*	*(0.013)*	*(0.013)*	*(0.014)*
IND_DJ27	0.311***	0.311***	0.147***	0.140***	0.140***	0.136***
	(0.024)	*(0.028)*	*(0.019)*	*(0.018)*	*(0.023)*	*(0.023)*
NORTH-EAST	18.960**	18.960*	6.971	5.850	5.850	0.077***
	(7.753)	*(10.079)*	*(6.064)*	*(5.801)*	*(6.941)*	*(0.018)*
CENTRAL	15.368**	15.368*	5.655	4.742	4.742	0.067***
	(6.280)	*(8.165)*	*(4.912)*	*(4.699)*	*(5.623)*	*(0.017)*
SOUTH	14.438**	14.438*	5.279	4.405	4.405	-
	(5.921)	*(7.698)*	*(4.631)*	*(4.430)*	*(5.301)*	
INSULAR	27.022**	27.022*	9.951	8.379	8.379	0.169***
	(11.030)	*(14.340)*	*(8.626)*	*(8.253)*	*(9.876)*	*(0.030)*
MATURE	-0.915*	-0.915	-3.837***	-3.840***	-3.840***	-4.170***
	(0.513)	*(0.875)*	*(0.401)*	*(0.386)*	*(0.774)*	*(0.753)*
Constant	-47.154**	-47.154	-12.134	-8.859	-8.859	8.194***
	(22.873)	*(29.734)*	*(17.889)*	*(17.114)*	*(20.467)*	*(0.492)*
Adj R^2 (%)	35.66	35.66	31.86	-	-	-
Pseudo R^2	-	-	-	0.079	0.079	0.079
F-value	478.44***	120.68***	403.68***	446.66***	68.94***	80.41***
Neutrality of maturity	52.40***	26.67***	69.32***	75.07***	35.35***	70.20***
Normality ($\chi^2(2)$)	15.82***					
Homoskedasticity	5.53**					
Bad leverage points (No. Obs.)	1070					

This table reports estimates for the model reported in Equation (4.4). Estimates are computed by OLS (column 1), OLS with White-consistent standard errors, Iteratively Reweighted Least Squares (column 3), Median Regression (column 4), Median Regression with bootstrapped standard errors (column 5) and Median Regression with backward selection and bootstrapped standard errors. Variables are defined in Section 4.4.1. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. *Neutrality of maturity*: Wald-test of the significance of the variables related to industry maturity; H0: all coefficients of variables related to maturity (dummy $MATURE$ and moderated effects) are not significantly different from zero. *Normality*: joint skewness and kurtosis test for normality. *Homoskedasticity*: Breusch-Pagan / Cook-Weisberg test for heteroskedasticity. *Bad leverage points*: the reported number of observation is based on Cooks'D>4/n (n=19810).

by a bootstrapped Stepwise Median Regression with backward selection. Backward involves starting with all the candidates variables and test them one by one for statistical significance, deleting any that are not significant (see also Davidsson et al., 2002); as in the previous case bootstrapped standard errors and confidence intervals are considered. As column (6) reports both the most robust and the best specified model, it is assumed as the base of the discussion of results.

As previous findings about business growth factors, *AGE* ($p<0.01$) and *SIZE* ($p<0.01$) are found to be negatively related to firm growth, confirming that smaller and younger firms usually experience higher growth rates. These findings are consistent with the so-called 'stylized finding' that firm growth tends to decline as the firm evolves over its life cycle; moreover, smaller and younger firms are also those more consistent with the Schumpeterian idea of entrepreneurship. Also the interaction variable between age and size *AGE*×*SIZE* is found to be significant ($p<0.01$) but positively related to growth, indicating that the combined effect of a younger age and a smaller size are increasingly related to growth respect to the single presence of one of the two characteristics. Overall these findings are quite consistent with previous research about the relation between firm growth, size and age (e.g. Yasuda, 2005).

Also the ownership structure seems to matter: the affiliation to a group (as both parent or daughter) is found to have a positive impact on growth rates as the complementary variable *INDEPENDENT* has a significant ($p<0.01$) negative sign. Strong results are also found with respect to internationalization as both *FRGNOWN* and *FRGNSUB* are found to be positively related to firm growth ($p<0.01$ and $p<0.01$ respectively). These findings are quite consistent. Being part of a group may facilitate commercial relations among the partners and facilitate the stream of both resources (from parents to daughters) and knowledge (in both the direction between parents and daughter). Besides, the presence of a foreign industrial company in the firm ownership structure (*FRGNOWN*) could be considered a proxy of its international network that in turn could translate, for example, in an easier penetration of foreign markets as well as in a source of foreign experience, knowledge and expectations that could anticipate firm's country trends. In the same way the presence in the ownership of a foreign company *FRGNSUB*, allows the firm to better address foreign markets, due to the direct presence on the territory that translate in a strong operating garrison and closeness to the knowledge of that region. Moreover, both of the previous may facilitate the opportunity recognition ability of the firms.

Also the population density *DENSITY* of the area where the firm resides is found to be positively related to growth ($p<0.01$), confirming past findings about the goodness of agglomeration. Besides agglomeration effects, industry- and location-specific dummies are found to discriminate growth among firms. The sign on these dummies should be read against their correspondent omitted variables, that are the industry dummy *IND_DC19* for mature industries (*IND_DB17*, *IND_DB18*), *IND_DJ28* for the non-mature ones (*IND_DI26*, *IND_DJ27*) and *NORTH-WEST* for the geographic areas. Industry dummies are mainly control variables that account for differences inside the same cluster and so are not further discussed. The same also for location-dummies: as we have already controlled for the role of population density and because we are not considering the full population of industries in an economy, these dummies probably reflects specificities in the distribution of the considered industries over the country.

We can now focus on the effects that industry maturity plays over growth and over growth

factors. As expected, struggling in mature industries (*MATURE* dummy) is statistically ($p<0.01$) and negatively related to growth; this is consistent with the fact that over this phase business demand is saturated, opportunities shrink and competition strengthen. Effects of firm size and age are lessened in mature context as the corresponding interaction terms with the mature dummy (*SIZE*×*MATURE*, *AGE*×*MATURE*) are found to be positively ($p<0.01$) related to growth, opposite to what found for the corresponding non moderated variables. This doesn't mean that in mature industries growth rates are positively related to firm size and age, because the full effect for firms competing in mature industries (defined by the single variable plus the corresponding moderating effect) is still negative in sign; however it says that industry maturity lessen the effect of those variable on firm growth. These results are consistent with the nature of mature industries, where the processes at the base of the competition are better addressed by older and bigger firms (e.g. they are increasingly based on economies of scale or on the presence of overcapacity to raise entry barriers). Again, knowledge of the market is fundamental in mature industries: as products are near commodities, differentiation becomes very difficult and price competition becomes stronger. As firm age could be a proxy of the accumulated knowledge it clearly explains the positive sign of its moderated effect. Following the previous considerations, we should expect that also the affiliation to a group should increase its impact on firm growth in mature industries; on the contrary we found the moderated effect *INDEPENDENT*×*MATURE* positively related to growth ($p<0.01$). An explanation could be that independent companies, as not swamped in settled routines and complex ownership relations, can better identify the signals of decline and grasp the emerging opportunities in mature context. The moderated effects of the other variables we included in our regression analysis do not appear as significant in our equation.

We finally argue that industry maturity does not matter if the null hypothesis of the joint insignificance of the variables related to maturity (dummy *MATURE* and moderated effects) holds (i.e. variable not significantly different from zero). This assumption is checked by a Wald-test for each of the previous model. Despite the bias due to bad leverage points, the few differences among the different specification led us to suggest that asymptotical normality of results hold in all models and as such F-test can be computed. F-value and significance are reported in the Table and clearly reject the neutrality of the maturity phase. As a last remark, although it is statistically significant, the explained variance is always quite low in our model; however, as suggested by Davidsson et al. (2002), since we are dealing with a large share of all the business units in an entire economy, a large share of the variance in growth is likely to be attributable to other macroeconomic, sociological, and individual behavioral characteristics that are not explicit in this regression.

4.6 Conclusions

Last years have seen the persistence of a structural crisis affecting many traditional industries of the economies of the developed countries. In such industries, the adverse evolution of both market conditions and internal dynamics has contributed significantly to a general loss of attractiveness that in turn impinged negatively on the performance of the incumbent firms and on that of the whole economic system. From an industry life cycle (ILC) perspective this trend

can be easily read as a continuous shift of the manufacturing industry toward its maturity phase. When firms face declining trends, and both profitability and performances decrease, and even when management does take action, it might be too late, or too difficult for them to radically change their strategy. However also in these industries, it is possible to find emerging firms able to sustain paths of growth and development. Such firms pushed by a growing competition move countertendency respect to their environment and they usually live a new entrepreneurial phase where consolidated managerial practices are put in discussion (Cassia et al., 2006). Indeed, it seems that in the context of the initial signals of decline, the conservative forces of the industry as a whole tend to break up, leaving space for strategic business innovation (and at times creating the very foundation of industry renewal).

Many efforts among practitioners and academics have given increasing importance to understanding what factors in business firms underlie the differences in their growth rates; however, despite previous research has already focused on manufacturing firms, finding consistent relationship from nation to nation (Davidsson et al., 2002), nobody has investigated empirically the moderating role that the ILC could play on growth factors and on growth itself. In the light of these considerations, the aim of this work has been to investigate empirically the impact that the level of industry maturity has over growth as well as how it influences the contribution of the main growth factors. We are not aware of other studies with such a focus before this one.

Specifically, we have focused on the Italian manufacturing industry that experienced, between 1995-2005, a strong structural crisis. As in every other developed country, this industry is made by a wide range of different activities and even if they have progressively matured and restructured, they have not experienced the same level of crisis. Indeed, as the aim of the article is to investigate the value of business growth factors in increasing conditions of maturity, the first contribution of this work has been to clarify and rank the activities that have experienced a more adverse evolution and have become most mature. In the attempt to follow a purely quantitative approach this exercise has been made through a modified application of the Fuzzy Industry Maturity Grid (FIMG - Tay et al., 1992). The results obtained suggest some relevant considerations about industry maturity. First of all maturity appears as a complex and multidimensional concept, whose comprehension requires a close observation of the many different factors that take part in defining the positioning of an industry along the life cycle. Moreover, the definition of maturity cannot be set aside from a clear definition of the economic context and of the time-space horizon considered. Instead of an absolute condition, industry maturity appears to be a relative condition, strictly intertwined with and dependent from the economic context where each industry is placed.

Instead of being a dichotomous condition, industry maturity seems to be a continuous connotation with increasing level of intensity: we cannot observe only industries with a high or low connotation of maturity as it is increasingly distributed among the various activities. So instead of mature or non mature clusters of industries, the best definition is that of clusters more or less mature than others. Manufacture of textiles, leather and related products (DB and DC industries according to the 1-digit Ateco codification) upstands among the most mature industries while the manufacture of basic metals, fabricated metals and other non-metallic mineral products (DI and DJ industries) could be found amongst the most mature.

Results of the econometric analysis have revealed some very interesting insights. As in

previous findings about firm growth determinants, age and size are found to be negatively related to firm growth while the affiliation to a group (as both parent or daughter) is found to have a positive impact on it. Population density of the area where the firm resides is found to be positively related to growth, confirming past findings about the goodness of agglomeration. Also industry- and location-specific dummies are found to discriminate growth among firms. Positive effects on growth rates are also found with respect to some proxies of the internationalization of the firm. Moreover, we also found evidence that industry maturity affects both firm growth and business growth factors. As expected from the nature of the competition, struggling in mature industries is statistically and negatively related to growth. Effects of firm size and age are increased in mature context as the corresponding interaction terms with the maturity dummy are found to be positively related to growth. This is consistent with the nature of mature industries, where bigger and older firms are more able to sustain and implement the processes at the base of competition. Despite the affiliation to a group could be expected to play an important role in mature industries, its corresponding moderated effect is found negatively related to growth. An explanation could be that independent firms, as not swamped in settled routines, can better identify the signals of decline and grasp the emerging opportunities.

Results from our sample must be applied to the universe of Italian firms with some caveats. In fact, on the one hand we cannot control for survivorship bias (as our sample is made only by surviving firms) and on the other one we are subjected to a selection bias. As we have already evidenced, our sample is made only by limited liability firms which are only a share of the total universe of firms of the considered industries. Furthermore firms of mature industries are also slightly under-represented in our sample. Nonetheless some of these problems are common to all empirical analyses on sample data and therefore the possibility of extending the analysis of the determinants of firm growth to unexplored factors such as the moderating role of the industry life cycle remains the relevant feature of this paper.

As a concluding remark, an important consideration emerging from the study regards the role of entrepreneurship in mature industries. While entrepreneurial activity is highly concentrated in the initial phase of the firm's life cycle, and thus even more in the initial phases of an industry, the role of the entrepreneur has always been seen as paramount subsequently. In our view entrepreneurship should regain a central role in mature industries because these are the contexts where opportunities are less likely to emerge, to the extent that only an entrepreneur - or an entrepreneurial organization - could be able to recognize and exploit them. If there are common elements at the base of the success in mature industries, then there should a research interest in identifying them, both by entrepreneurs, who can draw inspiration from emerging companies for implementing strategies of development, and by policy makers in order to develop policies that could support a phase of renewal in such contexts.

4.7 References

Abernathy, W. J., & Utterback, J. M. (1978). Patterns of industrial innovation. *Technology Review*, *80*(7), 40–47.

Acs, Z., & Armington, C. (2004). The impact of geographic differences in human capital on service firm formation rates. *Journal of Urban Economics*, *56*(2), 244–278.

Almus, M., & Nerlinger, E. A. (1999). Growth of new technology-based firms: which factors matter? *Small Business Economics*, *13*(2), 141–154.

Amin, A., & Smith, I. (1990). Decline and restructuring in the uk motor vehicle components industry. *Scottish Journal of Political Economy*, *37*(3), 209–240.

Anand, J., & Singh, H. (1997). Asset redeployment acquisitions and corporate strategy in declining industries. *Strategic Management Journal*, *18*(1), 99–118.

Ardishvili, A., Cardozo, S., Harmon, S., & Vadakath, S. (1998). Towards a theory of new venture growth. In *Frontiers of entrepreneurship research*. Babson College-Kauffman Entrepreneurship Research Conference, Ghent, Belgium.

Audretsch, D., & Dohse, D. (2007). Location: a neglected determinant of firm growth. *Review of World Economics*, *143*(1), 79–107.

Auster, E. R. (1992). The relationship of industry evolution to patterns of technological linkages, joint ventures, and direct investment between u.s. and japan. *Management Science*, *38*(6), 778–792.

Baden-Fuller, C. W. F. (1989). Exit from declining industries and the case of steel castings. *The Economic Journal*, *99*(397), 949–961.

Barba Navaretti, G. (2000). Is the suspect guilty? labour market effects of trade liberalisation in textile. In G. Galli, & J. Pelkmans (Eds.), *Regulatory reform and competitiveness in europe*. Edward Elgar.

Barba Navaretti, G., Bugamelli, M., Faini, R., Schivardi, F., & Tucci, A. (2007). Le imprese e la specializzazione produttiva, dal macrodeclino alla microcrescita? In *I vantaggi dell'italia*. Fondazione Debenedetti.

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, *17*(1), 99–119.

Bazen, S., & Thirlwall, A. P. (1989). *Deindustrialization*. London: Heinemann Educational Publishers.

Becchetti, L., & Trovato, G. (2002). The determinants of growth for small and medium sized firms. the role of the availability of external finance. *Small Business Economics*, *19*(4), 291–306.

Cabral, L. (2005). Sunk costs, firm size and firm growth. *Journal of Industrial Economics*, *43*(2), 161–172.

Cassia, L., Fattore, M., & Paleari, S. (2006). *Entrepreneurial strategy: emerging businesses in declining industries*. Cheltenham: Edward Elgar.

Clarke, R. (1985). *Industrial economics*. WileyBlackwell.

Corcoran, W. (1990). The machine tool industry under fire. In D. L. Losman, & S. Liang (Eds.), *The promise of american industry: an alternative assessment of problems and prospects* (pp. 227–247). New-York: Quorum.

Davidsson, P. (1989). Continued entrepreneurship and small firm growth (PhD thesis, Stockholm School of Economics, 1989).

Davidsson, P., Achtenhagen, L., & Naldi, L. (2007). What do we know about small firm growth? In S. Parker (Ed.), *The life cycle of entrepreneurial ventures* (Vol. 3). International Handbook Series on Entrepreneurship. Springer.

Davidsson, P., Kirchhoff, B., Hatemi, J., & Gustavsson, H. (2002). Empirical analysis of business growth factors using swedish data. *Journal of Small Business Management*, *40*(4), 332–349.

Dobbs, M., & Hamilton, R. T. (2007). Small business growth: recent evidence and new directions. *International Journal of Entrepreneurial Behaviour and Research*, *13*(5), 296–322.

Evans, D. S. (1987). Tests of alternative theories of firm growth. *Journal of Political Economy*, *95*(4), 657–674.

Faini, R., & Sapir, A. (2005). Un modello obsoleto? crescita e specializzazione dell'economia italiana. In *Oltre il declino*. Fondazione R. Debenedetti. Roma.

Filson, D., & Songsamphant, B. (2005). Horizontal mergers and exit in declining industries. *Applied Economics Letters*, *12*(2), 129–132.

Foster, R. (1986). Working the s-curve. assessing technological threats. *Research Management Journal*, *4*, 153–173.

Fukasaku, Y. (1998). Revitalising mature industries. *OECD Observer*, *213*, 19–21.

Gera, S., & Mang, K. (1997). The knowledge-based economy: shifts in industrial output. *Canadian Public Policy*, *24*(2), 149–184.

Gibb, A. A., & Davies, L. (1990). In pursuit of frameworks for the development of growth models of the small business. *International Small Business Journal*, *9*(1), 15–31.

Gilbert, B., McDougall, P., & Audretsch, D. (2006). New venture growth: a review and extension. *Journal of Management*, *32*(6), 926–950.

Giovannetti, G., & Quintieri, B. (2007). Globalizzazione, specializzazione produttiva e mercato del lavoro. In *Globalizzazione, specializzazione produttiva e mercato del lavoro: verso un nuovo welfare*. Fondazione Manlio Masi and CNEL.

Glancey, K. (1998). Determinants of growth and profitability in small entrepreneurial firms. *International Journal of Entrepreneurial Behaviour and Research*, *4*(1), 18–25.

Grant, R. M. (1991). The resource-based theory of competitive advantage: implications for strategy formulation. *California Management Review*, *33*, 114–135.

Grant, R. M. (2002). *Contemporary strategy analysis: concepts, techniques, applications*. Oxford: Blackwell.

Green, G., & McNamara, K. (1987). Traditional and non traditional opportunities and alternatives for local economic development. In L. J. Beaulieu (Ed.), *The rural south crisis: challenges for the future*. Boulder, CO: Westview.

Hall, B. (1987). The relationship between firm size and firm growth in the u.s. manufacturing sector. *Journal of Industrial Economics*, *35*(4), 583–606.

Hannan, M. T., & Freeman, J. H. (1977). The population ecology of organizations. *American Journal of Sociology*, *82*(5), 929–964.

Harhoff, D., Stahl, K., & Woywode, M. (1998). Legal form growth and exit of west-german firms: empirical results for manufacturing, construction, trade and service industries. *Journal of Industrial Economics*, *46*, 453–488.

Heinonen, J., Nummela, N., & Pukkinen, T. (2004). To grow or not to grow? an analysis of internationally growth orientated finnish smes. In *EIBA 2004 annual conference*.

Hoy, F., McDougall, P., & D'Souza, D. (1992). Strategies and environments of high-growth firms. In D. Sexton, & J. Kasarda (Eds.), *The state of the art of entrepreneurship* (pp. 341–357). PWS-Kent, Boston.

Jovanovic, B. (1982). Selection and the evolution of industry. *Econometrica*, *50*(3), 649–670.

Jovanovic, B., & MacDonald, G. (1994). The lifecycle of a competitive industry. *Journal of Political Economy*, *102*, 322–347.

Klepper, S. (1992). *Entry, exit and innovation over the product life cycle: the dynamics of first mover advantages, declining product innovation, and market failure*. Mimeo, Carnegie Mellon University.

Klepper, S. (1996). Entry, exit, growth, and innovation over the product life cycle. *American Economic Review*, *86*(3), 562–583.

Koberg, C., Uhlenbruck, N., & Sarason, Y. (1996). Facilitators of organizational innovation: the role of life-cycle stage. *Journal of Business Venturing*, *11*, 133–149.

Levitt, T. (1965). Exploit the product life cycle. *Harvard Business Review*, *18*, 81–94.

Lieberman, M. (1990). Exit from declining industries: shakeout or stakeout? *Rand Journal of Economics*, *21*, 538–554.

Marshall, A. (1890). *Principles of economics*. London: Macmillan.

McGahan, A. M., Argyres, N., & Baum, J. A. C. (2004). Context technology and strategy: forging new perspectives on the industry life cycle. In J. Baum, & A. M. McGahan (Eds.), *Business strategy over the industry lifecycle*. Advances in Strategic Management. JAI Press.

Mooney, C., & Duval, R. (1993). *Bootstrapping: a nonparametric approach to statistical inference*. Newberry Park, Ca.: Sage Publications.

Mueller, D., & Tilton, J. (1969). Research and development costs as a barrier to entry. *Canadian Journal of Economia*, *2*, 570–579.

Nickell, S. (1996). Competition and corporate performance. *Journal of Political Economy*, *104*(4), 724–746.

Orser, B., Hogarth-Scott, S., & Riding, A. (2000). Performance, firm size, and management problem solving. *Journal of Small Business Management*, *38*(4), 42–58.

Patton, A. (1959). Stretch your product's earning years - top management's stake in the product life cycle. *Management Review*, *38*(6), 67–79.

Porter, M. E. (1980). *Competitive strategy: techniques for analyzing industries*. New York: Free Press.

Porter, M. E. (1981). The contributions of industrial organization to strategic management. *The Academy of Management Review*, *6*(4), 609–620.

Rowthorn, R., & Wells, J. (1987). *De-industrialization and foreign trade*. Cambridge, UK: Cambridge University Press.

Smallbone, D., & North, D. (1995). Targeting established smes: does their age matter? *International Small Business Journal*, *13*(3), 4–22.

Smallbone, D., & Wyer, P. (2000). Growth and development in the small firm. In S. Carter, & D. James-Evans (Eds.), *Enterprise and small business*. Prentice Hall, Harlow.

Smallwood, J. E. (1973). The product life cycle: a key to strategic market planning. *MSU Business Topics*, *21*(1), 29–36.

Storey, D. (1994,). *Understanding the small firm sector*. Routledge, London.

Suarez, F., & Utterback, J. M. (1995). Dominant design and the survival of firms. *Strategic Management Journal*, *16*(6), 415–430.

Sutton, J. (1998). *Technology and market structure*. Cambridge, MA: MIT Press.

Tan, H., & Lewis, E. (1994). Adjustment responses of troubled industries in u.s. manufacturing. In H. Tan, & H. Shimada (Eds.), *Troubled industries in the united states and japan*. London: Macmillan Press.

Tay, D. P. H., Tham, K. W., & Ho David, K. H. (1992). The fuzzy industry maturity grid and its application to the singapore property sector. *Urban Studies*, *29*(8), 1305–1322.

Variyam, J. N., & Kraybill, D. S. (1992). Empirical evidence on determinants of firm growth. *Economic Letters*, *38*, 31–36.

Wagner, J. (1995). Exports, firm size, and firm dynamics. *Small Business Economics*, *7*(1), 29–39.

Weinzimmer, L., Nystron, P., & Freeman, S. (1998). Measuring organizational growth: issues, consequences and guidelines. *Journal of Management*, *24*(2), 235–262.

Wells, L. (1972). International trade: the product life cycle approach. In L. Wells (Ed.), *The product life cycle and international trade* (pp. 5–22). Boston, MA: Harvard University Press.

Wiklund, J. (1998). Small firm growth and performance: entrepreneurship and beyond (PhD thesis, Jonkoping International Business School, 1998).

Yasuda, T. (2005). Firm growth, size, age and behavior in japanese manufacturing. *Small Business Economics*, *24*, 1–15.

4.8 Appendix

4.8.1 Correlation Matrix

TABLE 4.8
Correlation matrix of the variables used in multivariate regressions - all sample

		1	2	3	4	5	6	7	8
1	SIZE	1							
2	AGE	**0.181**	1						
3	AGE×SIZE	**0.598**	**0.888**	1					
4	INDEPENDENT	**-0.397**	**-0.153**	**-0.324**	1				
5	FRGNOWN	**0.180**	**0.035**	**0.120**	**-0.269**	1			
6	FRGNSUB	**0.301**	**0.100**	**0.237**	**-0.430**	**0.128**	1		
7	MATURE	**0.069**	**0.173**	**0.175**	**-0.031**	0.003	**0.045**	1	
8	IND_DB17	**0.061**	**0.153**	**0.155**	**-0.024**	-0.008	**0.024**	**0.638**	1
9	IND_DB18	-0.004	**0.037**	**0.030**	-0.001	0.017	**0.028**	**0.450**	**-0.099**
10	IND_DI26	-0.001	**0.034**	**0.025**	**-0.040**	0.006	-0.008	**-0.255**	**-0.163**
11	IND_DJ27	**0.104**	**0.052**	**0.094**	**-0.099**	**0.048**	**0.026**	**-0.157**	**-0.100**
12	NORTH-EAST	0.021	**0.053**	**0.055**	**-0.039**	0.018	0.003	**-0.110**	0.021
13	CENTRAL	-0.015	0.003	-0.006	0.019	-0.017	-0.009	0.010	-0.019
14	SOUTH	-0.019	0.002	-0.008	0.019	-0.001	-0.021	**0.165**	**0.109**
15	INSULAR	**0.045**	**-0.028**	-0.002	0.002	0.001	**0.051**	0.010	**-0.073**
16	DENSITY	**-0.070**	**-0.043**	**-0.068**	0.023	-0.013	**-0.054**	0.004	0.003

		9	10	11	12	13	14	15	16
9	DB18	1							
10	DI26	**-0.115**	1						
11	DJ27	**-0.071**	**-0.116**	1					
12	NORTH-EAST	**-0.045**	**-0.083**	**0.081**	1				
13	CENTRAL	0.004	-0.016	-0.020	**-0.407**	1			
14	SOUTH	0.022	**0.077**	**-0.059**	**-0.405**	**-0.184**	1		
15	INSULAR	**0.032**	0.007	**-0.030**	**-0.383**	**-0.174**	**-0.173**	1	
16	DENSITY	-0.003	**0.064**	-0.011	**-0.237**	**0.140**	**0.200**	**-0.621**	1

The table reports pairwise correlation coefficients for the independent variables adopted in the model described by Equation (4.4). Variables are defined in Section 4.4.1. Significant correlations (99% confidence level) are indicated in bold type.

Chapter 5

Conclusions

Over recent years the topic of firm growth has gained increasing attention from researchers, since growth creates employment, generates wealth and enhances general economic development. In this sense, it is not surprising that growth is considered the *"the very essence of entrepreneurship"* and *"is a subject of all times"*. The research carried out in this thesis contributes to the literature about firm growth by addressing the topic from a different perspective, that is investigating *"unusual growth"* (where the word *unusual* has, in the different chapters, both a good and bad sense). The dissertation includes an introduction (Chapter 1) and three essays (chapter 2, 3 and 4).

The Introduction gives a brief overview of the topic of *small business growth*, highlighting the advancements that have been made from the theories of growth in the field of economics to the actual search for the determinants of growth typical of the firm growth studies. The central idea of this part is to evidence that studies about small firm growth are no longer short in supply and that large evidence is devoted to the long list of internal and external factors that have been hypothesized to influence firm growth. Despite of these findings, however, is not easy to distil a coherent picture of the topic and this is likely due to differences in theoretical and epistemological perspectives and interpretations, operationalizations, empirical contexts, modeling and analysis approaches, as well as the inherent complexity of the phenomenon itself. This is probably also related to the fact that at first this literature has been decidedly phenomenon-driven rather than-theory driven and studies have included a broad range of aspects as in a sort of "laundry list" approach. This way of selecting growth antecedents has been recently severely criticized and over time we expect to observe a progressive shift toward more theory-driven studies. In order to deal with this complexity, academics should developed useful strategies of research. Suggested ways are, for example, to give up ambitions of approaching full explanation but instead enhance our understanding of the interplay among a smaller set of specific factors or to limit the study to a more homogeneous empirical context and studying the effects of a narrow set of theory-driven and carefully operationalized predictors.

In the light of these considerations, the baseline idea of the dissertation has been to investigate no more firm growth as a general topic but to look at growth in some specific, relevant settings. Specifically, the dissertation focuses on unusual trajectories in the path of growth of firms and on their related determinants (i.e. on what makes such firms to behave in a different manner than expected). Unusual means that despite in a such environment we can expect or observe a dominant 'behaviour' in terms of growth of firms, at the same time we can also perceive the

presence of behaviors that are different from the dominant one (or at least different respect to what an external observer would expect) but that could be even more interesting. In this sense the concept of unusual is close to that of anomalous. The recurrence of this dichotomy characterizes the whole research framework of the dissertation where the central question is the explanation of what drives this unusual growth. This research idea has been declined in the dissertation into three essays. Different methodologies have been adopted in each of them, in order to best address each topic. The results discuss both management and policy implications. Although we consider this set of articles a valid contribution to the literature on the topic of small business growth and performance, we believe that further researches could extend the results.

The first article (Chapter 2) regards the growth expectations implied in the offer prices of IPO firms. In efficient capital markets we should expect prices to reflect fair assumption about the future growth expectations of firms (also because investors repeatedly buy IPOs); however the article finds that this is never the case. Specifically, it compares the real ex-post realizations of IPO firms with their growth inferred from their offer prices in order to investigate the determinants of such estimation errors. ex-post realisations do not meet such ambitious ex-ante targets: the median post-IPO growth rates are only slightly positive (1.8%) over the five years following an IPO. IPO prices are also compared with "fair value" estimates obtained by using actual ex-post cash flows in our reverse-DCF model, and find that the median IPO firm is overvalued at the offering by 74%. Several robustness tests are provided to confirm that such optimism is implicit in the offer prices. It is found that smaller and younger firms are particularly exposed to upward bias, perhaps because future cash flows are easier to predict for more mature companies (with more available information). High levels of income and high levels of debt also induce estimation errors due to unmatched growth expectations. In addition to these fundamentals, market demand for shares is a determinant of estimation errors. Firms with a high positive difference between the market and book values of their equity at the IPO are priced on growth rates that are at least partially overestimated. Last, a high initial underpricing is correlated with high estimation errors. When a specific issue appears to be overvalued, the underwriter discount the offer price more. This is in line with Loughran and Ritter (2002) conjecture that underwriters may "lean against the wind" of investor over-optimism. Estimation errors are also associated with long-term stock returns. The market does indeed react negatively to the disclosure of lower than expected cash flows. An intuitive explanation for this behavior is that investors are constantly evaluating the accuracy of pre-IPO estimates and revising their price expectations accordingly.

The second article (Chapter 3) regards hyper-growth firms. Literature seems to suggest that all firms experience growth and that high-growth is the norm, at least for a few, over a firm's life; however, this is not always the case and both high-growth and hyper-growth are the result of sustainable entrepreneurial efforts. This work tries indeed to investigates if hyper-growth firms are inherently different from other firms or if they are simply the results of contingencies and circumstances. The article should also seen as a first attempt to address the topic of hyper-growth which has been neglected by previous academic research: *"a very surprisingly conclusion is that despite its economic upside potential, growth research has focused predominantly on 'normal' to 'high' growth rates ... while overlooking formidably high growth*

or hyper-growth firms" (Markman and Gartner 2002). When compared to their slow-growth counterparts, hyper-growth firms are found to be younger and more involved in M&A and listing activities; moreover, they are found to raise higher levels of debt, with a lower solvency and to rely more (in relative terms) upon investments in fixed assets. The affiliation to a parent company as long as a larger availability of (idle) slack resources are also found to play a distinctive role in distinguishing hyper growth firms. The interpretations of such results are well described inside the essay.

Finally the last article (Chapter 4) is devoted to the investigation of emerging firms in mature industries; it tries to shed light on the factors that enable firms facing unattractive and declining contexts to separate their path of growth with respect to the one prevailing in their own business arena. this work is to investigate empirically the impact that the level of industry maturity has over firm growth as well as how the contribution of the main firm growth factors change in increasing conditions of maturity. We are not aware of other studies with such a focus before this one. To address this issue this article focuses on the Italian manufacturing industry that has progressively matured and restructured between 1995-2005, experiencing a strong structural crisis. It replicates previous researches about business growth factors in manufacturing industries while adjusting for the moderating role of industry maturity. Results of the analysis show that instead of being a dichotomous condition, industry maturity seems to be a continuous connotation with increasing level of intensity: we cannot observe only industries with a high or low connotation of maturity as it is increasingly distributed among the various activities. So instead of mature or non mature clusters of industries, the best definition is that of clusters more or less mature than others. Results confirm previous findings about business growth factors. Age and size are found to be negatively related to firm growth while the affiliation to a group (as both parent or daughter) is found to have a positive impact on it. Population density of the area where the firm resides is found to be positively related to growth, confirming past findings about the goodness of agglomeration. Also industry- and location-specific dummies are found to discriminate growth among firms. Positive effects on growth rates are also found with respect to some proxies of the internationalization of the firm. Moreover, we also found evidence that industry maturity affects both firm growth and business growth factors. As expected from the nature of the competition, struggling in mature industries is statistically and negatively related to growth. Effects of firm size and age are increased in mature context as the corresponding interaction terms with the maturity dummy are found to be positively related to growth. This is consistent with the nature of mature industries, where bigger and older firms are more able to sustain and implement the processes at the base of competition. Despite the affiliation to a group could be expected to play an important role in mature industries, its corresponding moderated effect is found negatively related to growth. An explanation could be that independent firms, as not swamped in settled routines, can better identify the signals of decline and grasp the emerging opportunities.