RATIO

Ratio Working Paper No. 206

THE RELATIONSHIP BETWEEN INNOVATION AND NEW FIRM GROWTH

Alexander McKelvie*

Anna Brattström**

Karl Wennberg***

* mckelvie@syr.edu Department of Entrepreneurship & Emerging Enterprises Whitman School of Management, Syracuse University, 721 University Ave. Syracuse, NY 13244 USA

** anna.brattstrom@hhsse Stockholm School of Economics, P.O. Box 6501, SE-11383 Stockholm Sweden

*** karl.wennberg@ratio.se The Ratio Institute, P.O. Box 3203, SE-103 64 Stockholm, Sweden and Department of Economics, Stockholm School of Economics.

THE RELATIONSHIP BETWEEN INNOVATION AND NEW FIRM GROWTH

Alexander McKelvie *
Department of Entrepreneurship & Emerging Enterprises
Whitman School of Management
Syracuse University
721 University Ave.
Syracuse NY 13244
Phone: +1 (315) 443-7252
mckelvie@syr.edu

Anna Brattström
Stockholm School of Economics
P.O. Box 6501
SE-11383 Stockholm
Sweden
Tel: +46-733 86 79 9
e-mail: anna.brattstrom@hhs.se

Karl Wennberg
Stockholm School of Economics
P.O. Box 6501
SE-11383 Stockholm
Sweden
Tel: +46-705-10 53 66
e-mail: karl.wennberg@hhs.se
&
The Ratio Institute
P.O. Box 3203
SE-103 64 Stockholm
Sweden

* Corresponding author

JEL CODES: L26; L22; M13

Acknowledgments: We are grateful for comments from Alex Coad, and funding from The Swedish Research Council and the Torsten and Ragnar Söderberg foundations. All errors remain our own.

THE RELATIONSHIP BETWEEN INNOVATION AND NEW FIRM GROWTH

ABSTRACT

This paper seeks to untangle the relationship between new firm's innovative activities and subsequent growth. We theorize about the inter-related roles of managerial growth willingness, inputs and outputs of innovative activities, and their subsequent link to sales growth. Investigating a longitudinal sample of 282 new Swedish firms reveals a complex set of mediating relationships that, when combined, help explain how innovation affects growth. First, we find growth willingness has an important relationship with innovative inputs such as R&D and market knowledge competence. Second, these inputs affect important innovative outputs such as new product development and the percentage of sales from new products. Third, these outputs directly affect growth – whereas the innovative inputs such as R&D do not have a direct impact. Taken together, our paper highlights the joint importance of managerial attitudes and strategic choices that help to shed new light on the effect of innovation on new firm growth. Implications for research and public policy are discussed.

Keywords: New firm growth; Innovation; Informal; R&D; Growth willingness

INTRODUCTION

Firm entry and growth have long been considered important for the development of an economy (Audretsch, 1995; 2008). However, recent work has provided a more nuanced view of the role of new firms by demonstrating that it is not the establishment of new firms *per se* that drives the economy (e.g., Acs & Szerb, 2007; Shane, 2009, Van Praag & Versloot, 2007). A relatively small portion of all firms, notably rapidly growing firms, actually contributes the positive impact on societal development (Coad & Rao, 2008; Henrekson & Johansson, 2010; Neumark, Wall, & Zhang, 2011). This has inspired scholars to study the mechanisms contributing to new firm growth.

In this research stream, two different perspectives have yielded insight into why some new firms grow more than others. The first perspective focuses on the role of innovation as an explanation for new firm growth (e.g. Lee & Chen, 2009). Surprisingly, accumulated empirical evidence of the link between innovation and growth in these studies can best be described as 'mixed' or 'inconclusive' (Bottazzi et al., 2001; Li & Atuahene-Gima, 2001; Roper, 1997; Rosenbusch, Brinkmann & Bausch, 2011; Stam & Wennberg, 2009). The second perspective focuses on the role of managerial motivation and strategic choices as explanations for new firm growth (e.g., Davidsson, 1991; Delmar & Wiklund, 2008; Gundry & Welsch, 2001; Kolvereid, 1992; Tominc & Rebernik, 2007; Wiklund, Patzelt & Shepherd, 2009). While this perspective has established that managers' active willingness to seek growth is all but a precondition for realized growth, the understanding of which actions and strategic choices managers actually pursue in order to realize growth ambitions remains incomplete.

Although research to date has mainly relied on one perspective or the other, in this paper we seek to develop a more integrative understanding of why some new firms grow in relation to innovation. To accomplish this research objective, we draw upon a unique data set of 282 new

firms in the telecom, IT and media sectors in Sweden. Our study provides two important contributions to the literature on new firm growth. First, we offer a more complete and fine-grained understanding of the nuanced mechanisms behind new firms' ability to realize growth from their innovative activities. In specific, we investigate the effect on growth (in actual sales) of a) managers' willingness to grow, and b) innovative activity in firms. We find that innovative activities serve as a significant mediator of the growth willingness-growth relationship, enabling managers with a willingness to grow to realize this ambition. Thereby, we contribute a more refined understanding of the proximate mechanisms related to both the innovation perspective and to the managerial motivation perspective of new firm growth.

Second, our study contributes to a better understanding of the micro-processes of innovation in new firms. In specific, we investigate two different innovative input processes: a) formal R&D activity and b) the informal processes dedicated to developing knowledge about market needs and demands (hereafter referred to as "market knowledge competence"). We find that formal R&D activity has a positive effect on innovative output, but is not directly related to sales growth. In contrast, market knowledge competence has a direct and positive effect on both innovative output and sales growth. A key implication of this finding is that formal R&D as a sole measure of innovation activity in new firms underestimates the broader set of innovation work conducted. Instead, it is through the combination of informal and formal innovative activities that new firms are able to sustain their growth, both in the short- and longer-term. This separation and inclusion of both approaches to innovation help to sort out some of the contrasting findings of previous studies (Rosenbusch, Brinkmann & Bausch, 2011). Taken together, this study begins to unpack the relationship between managerial motivation, innovation

and growth. Thereby, we offer a more specific examination of what drives new firm growth, an imperative issue for policy makers, managers and researchers.

HYPOTHESIS DEVELOPMENT

The association between innovation and new firm growth

Innovation is universally perceived as exploring something new that has not existed before (Cho & Pucik, 2005). An innovation can be a new product or service, a new production process technology, a new structure or administrative system, or a new plan or program pertaining to organizational members (Damanpour, 1991; Schumpeter, 1934). Innovative firms thereby have something to offer that other firms do not, whether that is a unique product or service or a unique price. Following Schumpeterian logic, such uniqueness enables innovative firms to gain a competitive advantage in the market and thereby grow more rapidly than competitors (Cho & Pucik, 2005; Wiklund & Shepherd, 2003).

Yet, empirical evidence on the link between innovation and growth has yielded mixed and ambiguous results. There are a number of reasons as to why the research findings about this link have been tenuous. A recent meta-analysis indicates that the relationship between innovation and firm growth may be sensitive to the type of innovative activities under study (Rosenbusch, Brinckmann & Bausch, 2011). In particular, researchers have overly relied on formal R&D activity as a proxy for innovation, thereby underestimating the effects of more informal innovation processes in new firms (Stam & Wennberg, 2009). For example, whereas a large body of work (e.g., Falk, 2012) finds evidence of a positive relationship between R&D spending and subsequent growth in new firms, Winters and Stam (2007) were not able to establish such a relationship and Freel and Robson (2004) even found a negative relationship between product

innovation and growth in new firms. A recent cross-country study by Hölzl (2009) shows how R&D is more important to small firms that exhibit high growth - but only in countries close to the global technological frontier. This suggests that the innovative performance of small firms that are ably to realize rapid growth is contingent on the level of technological competition in their immediate context (Delmar, Wennberg & Hellerstedt, 2011), a context that may offer specific benefits to various types of innovative behavior, including, but not exclusive to, formal R&D activity.

As evident from a recent stream of work (e.g., Coad & Rao, 2008; Hervas-Oliver, Garrigos & Gil-Pechuan, 2011; Mason & Brown, 2013, Raymond & St-Pierre, 2010), formal R&D activity may not accurately capture the entire degree to which a start-up actually pursues innovation activities. Studies have shown that measures that rely solely on R&D investments as a measure of innovation are prone to underestimate the R&D efforts of new and small firms , in part due to small firms' emphasis on developmental rather than fundamental research, and because this activity is often informally organized (Roper, 1999; Ortega-Argiles, Vivarelli & Voigt, 2009). Instead, innovation activity in new and small firms may more realistically be viewed as more informal and based on a continuous and iterative interaction with the market. We present some of these mixed results in Table 1 below.

INSERT TABLE 1 ABOUT HERE

A second reason for the inconsistency in the literature linking innovation to growth is due to researchers neglecting the fact that most new firms are not formed for the purpose of innovation and growth. Rather, most new firms are formed as a mean of self-support for the entrepreneur (e.g. Davidsson, 1991; Kolvereid, 1992; Storey, 1994; Tominc & Rebernik, 2007) and only a subset of all entrepreneurs actively seek growth (Autio, Pathak & Wennberg, 2013; Gundry & Welsch, 2001; Wiklund et al., 2003). In fact, the literature on entrepreneurial growth has shown that the growth willingness of entrepreneurs is among the strongest predictors of subsequent growth (Davidsson, Achtenhagen & Naldi, 2010; Delmar & Wiklund, 2008). Since innovation is risky, many entrepreneurs may shy away from pursuing it. In our view, the investment in innovative activities is one method in which entrepreneurs transform their growth willingness into actual growth. As such, not effectively capturing the role of the entrepreneurs' growth willingness may overlook one important underlying mechanism in the relationship between innovation and growth.

In the following sections, we theorize about the relationships between growth willingness, innovation and new firm growth as to develop a more integrative understanding of the process preceding new firm growth. The conceptual framework is outlined in Figure 1 and further discussed below.

INSERT FIGURE 1 ABOUT HERE

The association between growth willingness, innovation input and new firm growth

The motivation and aspirations of the managers of the firm are important factors when considering their behavior and innovative actions. A recurring theme in the Entrepreneurship

literature, and in particular the literature on new firm growth, is the desires of the individuals running the firm. Many individuals start and manage their companies for reasons other than profit maximization or to achieve substantial growth (e.g., Davidsson, 1989; Storey, 1994). Further, many entrepreneurs shy away from pursuing growth due to the potential risks and outcomes of such investments, such as the well-being of employees and the ability to retain control over the organization (Achtenhagen et al., 2011; Wiklund et al., 2003). The changes that stem from having achieved growth may not correlate well with the intentions that the firm was set out to achieve (Wiklund et al., 2009). As a consequence, the intentions and attitudes towards growth provide the guidance to subsequently prompt new firms to achieve growth.

> ***Hypothesis 1:*** *There is a positive relationship between growth willingness and sales growth in new firms.*

Because managers' motivation positively affects growth in new firms, the actions and strategies taken by managers in new firms differ depending on their growth willingness. In other words, motivation to achieve growth is a substantial predictor of the direction, persistence and intensity of action (Wiklund, Davidsson & Delmar, 2003). Motivation as a driving force behind behavior is not necessarily a novel argument within the literature. Penrose (1959) discusses the attempts to grow and commitment of resources towards this endeavor. Stevenson and Jarillo (1990) also make the connection between desire to pursue opportunity, entrepreneurial management and subsequent pursuit. The underlying logic of these arguments is that the individuals' motivation to achieve a certain end state will shape the time and energy devoted to achieving this.

Engaging in innovation is a time-consuming and risky endeavor. Managers seeking growth need to be persistent and highly motivated in their endeavors (Frese, 2011). We therefore

suggest that manages' growth willingness will also influence the innovative activities of the firm. In particular, we suggest that that the higher the motivation to grow the firm, the greater the firm will invest in formal R&D activities. Moreover, we also suggest that the higher the motivation to grow, the more managers will engage seek to develop market knowledge competence, defined as "processes that generate and integrate market knowledge" (Li & Calantone, 1998, p. 13). Such market knowledge competence implies "organized and structured knowledge about the market" (Li & Calantone, 1998). Organized refers to the knowledge being a result of systematic processing whereas structured refers to it being endowed with useful meaning. Following Schumpeterian (1934) logic, such processes should be particularly important for firms seeking to realize innovations such as those related to the opening of a new market or delivering new ways to organize the transactions in that market. Therefore, we hypothesize:

> ***Hypothesis 2:*** *There is a positive relationship between growth willingness and a) formal R&D activities and b) market knowledge competence in new firms.*

The association between formal R&D and innovation output

R&D activity is one important input to the innovation process. By engaging in R&D activity, firms explicitly dedicate resources (time and money) to the process of innovation. R&D does not represent an *ad hoc* activity in firms, but rather a relatively systematic process. Although often iterative, the R&D process involves specific stages and decision points (Cooper, 1992) through which an initial idea is systematically developed, sharpened and consequently transformed from being to a concept, to an early product or service design, that is then tested and validated before finally moving into production ramp-up and launch (Krishnan & Ulrich, 2001). A recent longitudinal study showed that the efficiency of this process has increased over

the past thirty years as firms have increasingly applied a systematic and dedicated approach to R&D (Barczak et al., 2009).

It is generally assumed that dedication of resources to R&D yields two different types of results. On the one hand, R&D represents the process by which firms identify and transform new ideas into tangible products and services. On the other hand, R&D also yields a more intangible output: the creation of new, often tacit, knowledge (Rosenberg, 1990). By engaging in R&D, firms thus realize both new products and services which can be capitalized from in the short term, and a tacit knowledge base that is continuously built up and from which organizational members tap into as they face new problems in the longer term. The value of R&D in organizations is thus highly cumulative and linked to innovation both in the shorter and the longer term. For new firms, typically characterized by a weak resource base (Garnsey, 1998), investment in R&D may therefore come forward as one mean by which the resource based is systematically expanded in the purpose of long-term growth (Coad & Rao, 2008). We thus hypothesize:

> ***Hypothesis 3:*** *There is a positive relationship between formal R&D and a) new products; and b) the percentage of sales from new products in new firms.*

The association between market knowledge competence and innovation output

Besides formal R&D activity, another important input to the innovation process is market knowledge competence. Market knowledge competence is defined as "processes that generate and integrate market knowledge" (Li & Calantone, 1998; p. 13). For new firms, having a willingness to grow and investing in R&D matters little unless there is an actual market demand for such products (Wennberg, Wiklund & Wright, 2011). Established firms can rely on an

existing base of products and established customer relationships to realize short-term profits, while investments in R&D may sustain competitiveness in the long run. This is not, however, a viable strategy for new firms. New firms need to be more fine-tuned in relation to what the market demands – to develop and nurture their market knowledge – in order to quickly realize their innovative products into sales and profits (Schoonhoven et al., 1990). This provides them with necessary cash flow to allow them to continue operations and market feedback about the future prospects for the firms (Delmar, McKelvie & Wennberg, 2013).

An important activity in driving innovation in new firms is the systematic yet informal, process through which such firms acquire knowledge about the market (Li & Calantone, 1998). Understanding what customers want and how a company can deliver products or services to them is critical in establishing a sales revenue base for companies, thereby sustaining survival in the short-run (Doyle, 2008). For new firms, this process represents expanding the knowledge from the entrepreneur/founding team to a more general, firm-based understanding of markets and customers (Peters & Brush, 1996; Wennberg, 2009). Such market knowledge competence may enable firms to identify emerging market demands (Li & Calantone 1998), enhance innovation creativity (Brattström et al., 2012) and improve innovative effectiveness (Davila, 2000). We therefore hypothesize:

> ***Hypothesis 4:*** *There is a positive relationship between market knowledge competence and a) new products; and b) the percentage of sales from new products in new firms.*

The mediating effects of innovation input and innovation output on new firm growth

An important component of our theoretical arguments is that *growth willingness*, *innovative input activities* (R&D and market knowledge competence) and *innovation output* (new products and percentage of sales from new products) are not separate and mutually

exclusive factors. Growth willingness on its own does not necessarily lead to achieved growth. Rather, growth willingness prompts new firms to make investments towards innovation and growth. Pursuing innovation necessitates committing resources and engaging in time-consuming actions. Those firms who do not want to pursue growth will certainly elect not to invest in the potentially risky investment of innovation (Samuelsson & Davidsson, 2009). In other words, we view growth willingness as a goal and the pursuit of innovative activities as the goal-directed behaviors. Arrow (2000) observes that managers' motivations and goals are reflected in the resource allocation and strategic decisions made. Penrose (1959) also discusses the attempts to grow and the commitment of resources towards that endeavor. We argue that these allocations will include time and resources into innovative inputs and outputs towards the pursuit of expansion. These allocations will be visible in such activities as R&D and market knowledge competence. In turn, these behaviors may eventually lead to growth. Studies of Entrepreneurial Orientation in small firms have found that one of the key predictors of risk-taking, innovativeness, and proactiveness is the growth willingness of the manager (Wiklund, 1999).

McKelvie (2007) argues that growth-seeking firms are willing to accept the risks of innovation or tolerance of ambiguity in exchange for the potential gains of growth. He found that new firms who were actively pursuing growth were more innovative. New firms engaging in innovative activities may allow them to grow more rapidly than competitors (Cho & Pucik, 2005). This leads us to suggest that growth willingness in itself will not be positively associated with realized growth when innovative inputs or innovative outputs are controlled for. Therefore, we also expect a mediating effect of market knowledge competence on the relationship between growth willingness and sales growth.

Hypothesis 5: *The relationship between growth willingness and sales growth in new firms will be mediated by a) formal R&D; b) market knowledge competence; c) new products; and d**)** the percentage of sales from new products**.***

METHODS

Sample

In order to obtain an appropriate sample to study the link between innovation and new firm growth, we began to develop a dataset of independent new firms based on information from Statistics Sweden, the official statistical registry of Sweden. We took a number of steps to develop an appropriate sample of growth-oriented new firms. First, in line with previous studies of new firms (e.g., Yli-Renko et al., 2001), we limited the sample to new firms that were under ten years of age at the time of data collection. Second, we only examined incorporated firms ("*aktiebolag*"), as in Sweden incorporation requires a minimum capital outlay of approximately $15,000 and publicly available annual audited financial statements. Incorporated firms in Sweden have shown higher growth rates compared to other legal forms (Dahlqvist, Davidsson, & Wiklund, 2000) as the capital outlay helps remove many hobby or traditional small businesses that might not be interested in growth or innovation. Third, firms that had yet to achieve any sales were excluded in order to ensure that we were able to focus on the continued entrepreneurial efforts of the new firms, as opposed to their initial product/service launch. The average sales level for the firms in the year prior to our study was 15.73 million SEK[1]. Fourth, we restricted the search to new firms with three or more employees as smaller firms than this are unlikely to have any formal R&D or informal market innovation processes in place. Fifth, we limited the industries to knowledge-intensive sectors including Telecom, Information Technology and Media. These sectors represent an appropriate context to study innovative processes and growth

[1] This sales level is approximately US$2.14 million based on average exchange rate for that year.

as these industries are known for being innovative and the home to many growth-oriented firms (Delmar et al., 2011; Zahra & Bogner, 2000). In sum, the sampling frame represents a theoretically relevant population for studying the relationship of interest.

The CEO was the key informant for this study, as is common in studies of new firms (McDougall et al., 1994). In the sample of new firms, the CEO has the best overall knowledge of the on-going activities of the firms and is likely the key decision-maker regarding many of the decisions concerning innovative initiatives and growth (Zahra, Neubaum & El-Hagrassey, 2002).

The sampling procedure resulted in an initial population of 1803 firms. We sent a personally addressed letter to the CEO of each firm containing a mail questionnaire. After two reminders, we received responses from 403 firms, equivalent to a response rate of 22.4% for the initial. Some of the responding firms did not fit the sampling frame (e.g., inappropriate size in employees, age, sales, or industry), others had incomplete data due to internal non-response or based on the publicly available performance data, and a further seventeen firms underwent some significant change during the period of study (M&A, closure). This reduced the effective sample to 282 firms with complete responses. The mean age of the firms was slightly less than six years and the mean size was 12.33 full-time equivalent employees. 74% of the firms in the sample had fewer than ten full-time employees. The mean is slightly skewed by the six firms with 50 or more employees.

We examined the potential for non-response bias by comparing responding and non-responding firms on the basis of their age, industry, size, and financial performance (sales and profit levels). We found no statistically significant differences ($p > 0.10$) based on t-tests. Furthermore, we employed the method of examining non-response bias by comparing firms responding after the second reminder with firms who had responded earlier. The underlying logic

of this method is that late responders are more closely matched with non-respondents (see Armstrong & Overton, 1977, or Covin, 1991). Again, there were no differences based on either the demographic characteristics. In addition, we also compared these two groups on the basis of the key dependent and independent variables. There were no statistically significant differences ($p > 0.10$). As a final safeguard against potential non-response bias we called a random sample of 200 non-responding firms in order to ascertain why they did not respond. The most common reason for not responding was a lack of time (23.5% of the non-respondents). This appears like a believable reason for not responding, but would also appear to be randomly distributed across levels of the independent and dependent variables. Therefore, we are confident that non-response biases are not a major threat to the validity of the findings.

Variables

The data in this study come from a few different sources. To avoid common method bias we used a different source for the main dependent variable, sales growth. This variable was drawn from the publicly available, audited financial statements acquired from Statistics Sweden. The independent variables (innovative input, innovative output and growth willingness) are based on self-report from the survey. The data used to capture the control variables come primarily from the survey data. However two of these (age, size) were further validated by the publicly available data to ascertain construct validity. We relied upon prior research to construct our measures of innovative input and output, as well as the control variables. All questions used in developing the multi-items constructs can be found in the Appendix, including the appropriate Cronbach's alphas for the constructs.

Dependent variable. The main dependent variable in this paper is *Sales growth*. Sales growth is the most commonly espoused growth measure for new firms as it is widely applicable across a number of industries and is internationally comparable (Brush, Bromiley & Hendrickx, 2000; Delmar, McKelvie & Wennberg, 2012; McGee, Dowling & Megginson, 1995; Short et al., 2009). We capture the rate of sales growth by examining the difference in sales levels from the year that data was initially captured and two years later, divided by the initial year's sales. These data came from the audited financial statements. This growth rate was logarithmically transformed in order to ensure a normal distribution.

Independent/mediator variables. Our examination of the innovation-performance link is based on capturing the role of growth willingness and innovative inputs and outputs. *Growth willingness* was captured using six items that previously validated by Wiklund, Davidsson and Delmar (2003), among others. These items examine the manager's interest in having growth as a strategic orientation including if it means bringing in new sources of financing. In terms of innovative inputs, we examine both the formal R&D processes and the more market-oriented creative processes. Research using *Formal R&D* has tended to focus on the overall spending activities (e.g., Cohen & Klepper, 1996; Katila, Chen & Piezunka, 2012). However, this tends to lead to a negative bias again new and small firms where spending power is likely limited (Rosenbusch et al., 2009). Further, R&D investments have been argued to be endogenous to other firm goals and as such researchers needs to find some way to distinguish between formal and informal R&D efforts (Yang & Huang, 2005). Consequently, there has been some criticism of capturing the reliability of R&D spending in new and small firms as a sole proxy of innovative input (e.g., Roper, 1999; Santarelli & Piergiovanni, 1996). We therefore use a composition index of four different items (with a Cronbach's alpha of 0.942) to include a more

general orientation of the firm towards R&D in relation to their closest competitors and size. We are therefore able to circumvent the problems identified in earlier literature of gauging the R&D input in new firms. This variable does correlate with our direct measure of R&D spending ($r=.462$, $p<.000$), thus offering validity for the composition index as a more general measure of R&D inputs in new firms. *Market knowledge competence* has its basis in the literature on market orientation, and in particular the aspects that involve assimilating market knowledge (Kohli, Jaworski & Kumar, 1993). The items in this construct focus more informal aspects of development, such as brainstorming, idea sharing, and meetings. Further, the focus of each of these activities is on customer or market issues as opposed to technology. This construct incorporated six items and had a Cronbach's alpha of 0.740.

We use two different variables in order to capture innovative outputs. This allows us to see a slightly wider set of metrics for innovative outputs. First, we capture *New Products* by using four separate items that capture the number of innovations relative to competitors and the speed of development of new products. This follows the logic set out in Zahra and Bogner (2000) and elsewhere of approaching new products in a multi-faceted way. To note is that this approach to capture new products it helps break away from other types of new product scales that only rely on 'count' measures by a relative comparison to competitors including numbers, speed, and impact of new products. These four items were on a five-point Likert scale with 'Strongly disagree' and 'Strong agree' as the anchors. We created an index of these four items, with a Cronbach's alpha of 0.877. Second, we capture *the percentage of sales from new products/services that the firm did not offer 12 months previous.* This is a valuable aspect of capturing the importance of innovative outputs as they provide insights in the importance of the new products/services that the firm has launched, rather than simply the number (Cooper and

Kleinschmidt, 1995). The approach for this latter innovative output variable has been used in a number of different contexts and studies on the effectiveness and impact of innovation (e.g., Atuahene-Gima & Ko, 2001; Collins & Smith, 2006; Cooper & Kleinschmidt, 1995; He & Wong, 2004).

We exerted substantial effort to validate these innovative output variables as much as possible given that there is limited consensus in the literature about how to best capture innovative input and output. First, the same questions for the new products and percentage of sales dependent variables were used in a pilot test in a different sample, using multiple respondents from the firm. One of the respondents in that pilot test was the highest executive of the firm, as was the case for the main study. There was high agreement in how these two individuals responded to these questions ($p < 0.10$). Second, we examined the relationship between the new products scale with a separate group of items focusing on the number of new products launched over the last 12 months. There was a high level of correlation ($r=0.518$, $p < .001$), suggesting some validity to this measure. Third, we sent out a second questionnaire to the same sample one year following the original study (response rate 74%). We asked many of the same questions regarding the new products and sales levels coming from new products. There was high correlation among these repeated measures ($p<0.10$), suggesting that there is high convergent validity among the core dependent variables. Taken together, these tests provide some confidence that we have captured valid measures of innovative output that are relevant to the context of new ventures.

Control variables. We employ four different control measures in this study. We control for the *age* of the firm based on computing the founding year. The *size* of the firm was based on the number of full-time employees at the time of the survey data collection. Both of these

measures were captured via self-report data and then confirmed through the publicly available data. We also control for *Venture capital ownership* by calculating a binary dummy variable for if a VC or equivalent owned 50% or more of the firm. The reasoning behind this is that access to large amounts of capital has been lined to innovativeness and growth (e.g., Schoonhoven, Eisenhardt & Lyman, 1990). VC ownership information was based on self-report data. Finally, we capture *Technological dynamism* using six items from Chandler and Hanks (1994) and Narver, Slater, and MacLaclan (2004). This construct had a Cronbach's alpha of 0.825. The items used can be found in the Appendix.

Our reliance on a sole informant for the majority of variables increases the risk for some source biases. We took some steps to minimize the likelihood of common source bias from providing a major threat to our data. First and most important, we measured our dependent variable, sales growth, using an exogenous measure. We also validated the control variables of firm age and size by using publicly available data. Second, we used different formats and scales for our key independent and mediator variables. This included using 1-5 Likert scales, categories, and self-report specific numbers. This helps reduce the risk of source bias as respondents are less likely to artificially inflate answers via answering on the same scale throughout (Bagozzi, Yi, & Phillips, 1991; Podsakoff et al., 2003). Finally, we made sure to conduct the survey anonymously, with the directive that there are no wrong answers and that participants should simply answer as truthfully as possible (Podsakoff et al., 2003). Taken together, these actions help mitigate the risk against the potential bias of using single informants.

ANALYSIS AND RESULTS

We first examined the descriptive statistics and correlation matrix for the variables in the study. The correlations among the control variables and independent/mediator variables are relatively low, with the exception of Growth willingness and Formal R&D ($r = .394$; $p < .01$). The correlations are not critically high (Tabachnick & Fidell, 2000), but were large enough to prompt us to examine the variance inflation factors (VIF's). These fall well below the critical values set out in Hair et al., (1998), suggesting the multicollinearity is not a major issue in this study. We also investigated condition indices for all model specification, finding that all condition indices remain substantially below the critical level of 30. In fact, the highest condition indices are when the mediating variables are entered in to the regressions. Even then, the highest condition index is 19.54. The bivariate correlations and descriptive statistics are available in Table 2 below.

Further, there are relatively high correlations among some of the core variables in this study, such as *New products* and *Percentage sales from new products*. (r= .303). This is not entirely surprising given that there is likely to be some overlap among these as they all relate to innovative outputs. We therefore treat these as separate moderator variables and do not include them into the same regressions, thus circumventing potential problems with higher correlations among some core mediating variables.

INSERT TABLE 2 ABOUT HERE

We first examine the impact of the cross-sectional relationships between Growth willingness and our two innovative input variables. These represent Hypotheses 2a and 2b. We test these hypotheses using hierarchical linear regression. The results are available in Table 3. We first entered the base model variables of *Firm age*, *Firm size*, *VC ownership*, and *Technological dynamism* for each of the two innovative input variables. These variables had varying explanatory powers reflecting approximately 5% of the variance explained for Market knowledge competence and Formal R&D, respectively. We then entered the independent variable of *Growth willingness* into a separate block. Both of the models were statistically significant, as visible from the F-statistics (at least $p < .01$) and had increases in explanatory power of 3.2% (for Market Knowledge Competence; $p < 0.001$) to 11% (for R&D; $p < .000$). Thus, both H2a and H2b, where we hypothesize about a positive relationship between Growth willingness and innovative inputs, were supported. To note is that the change in explanatory power variable (ΔR^2) reflects explanatory power over and above the 'base models'.

We then examine the impact of the innovative input variables (Market knowledge competence; Formal R&D) on innovative output (New products; percentage of sales from new products). These relationships reflect H3a-b (Formal R&D) and H4a-b (Market knowledge competence). We followed the same hierarchical linear regression procedure as described above, with the base model being entered first before the focal independent variables are entered. In regards to the role of Formal R&D, we find that it has a statistically significant positive effect on both New products ($p < 0.000$) and percentage of sales from new products ($p < 0.000$). This provides support for H3a and H3b. Further, we find that Market knowledge competence has a positive relationship with new products ($p < 0.001$) but not percentage of sales from new products. This implies support for H4a but not H4b.

Although the relationships managerial growth willingness and the product mix offered by new firms are not part of our theoretical model, we also find a strong positive relationship between Growth willingness and the percentage of sales from new products ($p < 0.000$). In terms of the control variables, we find that technological dynamism has a positive relationship with Formal R&D, New products, and the percentage of sales from new products. Firm age had a negative and statistically significant relationship with Market knowledge competence ($p< 0.000$) and the percentage of sales from new products ($p < 0.000$).

We now turn our attention to the longitudinal relationships, where we examine the effects of our key variables on sales growth. These reflect Hypotheses 1 and 5a-d. The results are available in Table 4 below. We first examine the effect of Growth willingness on subsequent sales growth (H1). This is presented in Model 1 of Table 4. We find a strong positive relationship ($p < 0.001$), providing support for H1.

The set of hypotheses relating to H5 imply a mediating effect of innovative input and outputs on the relationship between growth willingness and sales growth. In order to test these relationships, we follow the procedure established by Baron and Kenny (1986) and the procedure established by Sobel (1982; 1986). Following Baron and Kenny's (1986) procedure, innovative input and output function as a mediator if four conditions are met: 1) Growth willingness positively affects innovative input and innovative output; 2) Innovative input and innovative output affect sales growth; 3) Growth willingness positively affects sales growth; 4) In the presence of innovation input or innovation output, the effect of growth willingness on sales growth is reduced.

Condition 1 above is partly met as growth willingness significantly affects Formal R&D; Market knowledge competence, and Percentage of sales from new products. The effect on New

products, however seems to occur indirectly, mediated by the innovation input variables. Condition 2, showing that innovative input and outputs directly affect sales grow, is also met, with the exception of Formal R&D that is only marginally satisfied (β= .117, p <0.10). We find that there is a direct impact of Market knowledge competence (β= .159, p <0.01), New products (β= .156, p <0.05) and percentage of sales from new products (β= .216, p <0.001). The entire regression results are available upon request. We also see that Condition 3 is met, which is reflected in our Hypothesis 1 and presented in Model 1 of Table 4. Condition 4 is partly met: in the presence of Market knowledge competence, the significance of growth willingness is reduced (Model 3 of Table 4). There is a similar effect for New products (Model 4) and the percentage of sales from new products (Model 5). Formal R&D activity (Model 2), however, does not reduce the significance of growth willingness. These results are further confirmed by the Sobel test for mediation (Sobel, 1982; Sobel, 1986). We find that the relationship between growth willingness and sales growth is mediated by Market knowledge competence (z= 2.24; p < 0.025), and the percentage of sales from new products (z=3.03; p < 0.002). The mediating effect of New products has marginal support (z=1.85; p < 0.064). Taken together, Hypothesis 4b; and 4d are fully supported, Hypothesis 4c is marginally supported, and Hypothesis 4a is not supported.

INSERT TABLES 2 & 3ABOUT HERE

We further performed a number of robustness tests. Many small-N studies using survey data are susceptible to non-response bias and potentially correlated explanatory variables. Related to these correlations is the risk that variables such as innovative output are endogenously related to firm growth. While the calculation of VIF factors (all below 1.303) and condition

indices (all below 20) presented in our results section indicated no apparent problem of multicollinearity among explanatory variables, we nevertheless decided to investigate the sensitivity of our estimates based on potential outliers, frequently a cause of high correlations. We therefore fitted a set of alternative models where the top and bottom 5% outliers in growth were removed from the data by using a Winsoring algorithm. Results (available upon request) remained essentially the same as those reported in Table 4, although the reduction of firms in the sample reduced some of the effect size. Second, we re-estimated all models in Table 4 using a measure of firm growth achieved prior to data collection in order to decrease the potential of endogeneity in a firm's growth rate (Coad, 2010). This decreased the sample size from 282 to 271 as some firms had only achieved sales in the year of our data collection; there was therefore some missing data for firms. However, all of our main effects were identical in direction and level of significance except for growth willingness. This was statistically significant on the 10% level. Notably, the variable related to previous growth rate variable was not significant in our model, suggesting that there is no apparent endogeneity related to firm-specific persistence in growth rates. Finally, we examined an alternate operationalization of a key variable in order to see if the effects held. We replace our Formal R&D measure with a self-reported R&D spending variable. We achieve the same results as with our Formal R&D measure. Taken together, these robustness tests indicate some safeguards against multicollinearity and endogeneity (Hamilton & Nickerson, 2003). We do note that it is never possible to totally eliminate the potential for these effects and therefore suggest that future research using true panel data with both perceptual measures of R&D activities and a longer time series of growth outcomes is needed to provide stronger claims of causality.

DISCUSSION

The purpose of this study was to offer a detailed examination the link between innovation and growth in new firms by examining the role of growth willingness and the mediating roles of innovative input and innovative output. Our findings provide support to the notion that growth willingness is an underlying attitude that affects the subsequent behaviors of new firms (innovation) that help them to realize growth. By investigating a sample of 282 new firms in the Swedish IT, telecom and media sectors, we find that there is a complex set of relationships between growth willingness, innovative input, innovative output, and subsequent sales growth.

We provide two important contributions to the literatures on new venture growth and the role of innovation in growth. First, we offer important contributions to research on growth willingness in new firms. Previous work within the field of entrepreneurship has found that growth willingness is an imperative factor for understanding subsequent growth in new firms. However, our study is unique in the sense that it has been able to theoretically argue and empirically find some of the mechanisms through which such growth willingness leads to growth (Davidsson, 1991; Gundry & Welsch, 2001; Kolvereid, 1992; McKelvie & Wiklund, 2011). To this end, we contribute to this literature by showing that innovative market offerings are a central mean by which firms with a pro-growth agenda realize their ambitions. We show that the important strategic decisions and actions to invest in innovative inputs such as market knowledge competence and innovative outputs – all risky and potentially costly investments – do pay off for subsequently achieving growth.

Second, our findings also contribute to the research on small firms' innovation and growth by identifying Market knowledge competence as being as important as Formal R&D activities to bear fruit. The literature that examines the innovation-performance link have generally used Formal R&D activity (in particular R&D spending) as a proxy for innovation

(Cohen & Klepper, 1996; Rosenbusch, Brinkmann & Bausch, 2011). Whereas there are good reasons for doing so (see Hall, 2004), several scholars (such as Coad and Rao, 2008; Hervas-Oliver, Albors Garrigos & Gil-Pechuan, 2011; Mason and Brown, 2013) have also pointed out that formal R&D activity as sole proxy for innovation underestimates the actual amount of innovation work spent in the firms. Our cross-sectional findings suggest that both Formal R&D and Market knowledge competence are important processes through which firms develop new products and render sales from new products. Nevertheless, our longitudinal data suggests that of these two types of innovation processes, it is only the Market knowledge competence that leads to a positive effect on overall sales growth. These findings highlight that it is the ability of new firms to systematically but informally probe the market – rather than the existence of formal R&D processes – that explains over-all growth of firms. The effect of Formal R&D activity on growth, if anything, thus seems to occur only indirectly, through the positive effect of sales from new products on growth. An implication of this finding is that Formal R&D may constitute an important activity through which firms develop a stock of knowledge, thus enhancing the long-term innovative capability of the firm. However, such a long-term innovation strategy is not enough for new, small firms. Instead, new firms – facing short-term needs to survive and generate revenue to fund operations – must also innovate in close interaction with market demands in order to realize growth. Thus, our study provides important evidence on the micro-processes through which firms with a growth ambition seek to develop a more innovative product offering.

This approach also offers important methodological implications. While existing literature has focused extensively on the role of formal R&D activities in stimulating growth (e.g., Bottazzi et al., 2001; Li & Atuahene-Gima, 2001; Roper, 1997; Stam & Wennberg, 2009),

the accumulated results from these studies remains inconclusive (Rosenbusch et al., 2011). For example, Demirel and Mazzucato (2012) suggest that the relationship between R&D and growth is conditional on firm size and Coad and Rao (2008) point to a positive relationship between R&D investments and growth for the fastest growing firms, but a negative relationship for others. Our creation of a composite index to gauging R&D input in new firms offers an alternative as a more general measure of R&D inputs in new firms, identified as a chief problem in the empirical literature on new and small firm's innovative activities (e.g., Rosenbusch et al., 2011; Stam & Wennberg, 2009). Using and developing such complementary measures of R&D activities in new firms may help scholars to unearth the specific nuances by which R&D efforts effect subsequent firm growth. Our study also suggests that smaller firms with a slower growth rate may indirectly benefit from formal R&D activity, but only if they are able to complement this activity with more informal, market knowledge competence.

Taken together, these findings shows that while prior research has tended to focus either on managerial growth willingness or on innovation as separate explanations for growth in new firms, our findings suggest that these are two inter-related facets of growth. They should therefore be studied in tandem. As evident from our study, new firms with a willingness to grow devote time and resources to innovation activities and are more oriented towards new products and customers in their offerings. Moreover, our study shows that for firms with a pro-growth agenda, such investments do pay off in higher growth rates. As intuitive as this link between managers' aspirations, innovation activities and growth may be, to the best of our knowledge, it has hitherto remained untested. A main contribution of our analysis is thus that it lends robustness to the view of innovation and growth as two intertwined processes. For policy-makers seeking to stimulate growth among new firms, our finding implies that such stimulation activities

should include policies that enable innovative activity among new firms. Our results lends support to Shane's (2009) suggestions that policy makers should reallocate resources from programs seeking to stimulate 'all startups' to programs that support high growth companies. For example, policies supporting this might include requiring government agencies to set aside a portion of their budgets to support commercially viable R&D projects at small companies (Shane, 2009) or offer R&D tax credits to new firms (Baghana & Mohnen, 2009; Berg, Dijk and Hulst, 1990). However, policy makers should not by trying to 'pick winners' by targeting specific sectors or types of startups (Cantner & Kösters, 2012; Hölzl, 2009).

Limitations

This study, as with all studies, comes with a number of limitations, each of which offers opportunities for future research. To begin with, this study relies upon a number of self-report measures, such as on the growth willingness and innovative processes of the firms. This was important as these in-depth types of behavioral data are not publicly available. However, they may also be related to potential biases. While we have carried out a number of tests to show that the impacts of these biases are limited, we cannot discount that there are any biases at play. Further triangulating the data with other objective measures would be beneficial. In addition, we have focused attention on internally-oriented innovative inputs, such as having internal discussions, brainstorming, or an in-house R&D focus. Many new firms may engage with external partners as part of their innovative processes (King, Covin & Hegarty, 2003), such as collaborating with universities or with large firms (Lockett & Wright, 2005; Sherwood & Covin, 2008). Capturing the on-going collaborative efforts over time would be beneficial. Indeed, this study focuses on the innovative processes and growth at one point in time. There may be differential impacts of R&D, growth willingness, and market knowledge competences

throughout the lifetime of the firms (Falk, 2012; Stam & Wennberg, 2009). As such, studying these efforts in a longitudinal manner would be a valued contribution to the literature. Finally, the firms in this study come from a number of different industries that are part of broader IT, telecom and media sectors. While this enhances the internal validity of our measures and may be important to the extent that it investigates an important sector in most developed nations (Armington & Acs, 2004), the diversity of the competitive logics within these industries may not be fully captured. For instance, Peneder (2008) shows that the innovative intensity of different industries vary greatly, indicating that the conditions for new firms to innovative may be distinct across sectors. Innovative industries have higher growth and survival rates among the firms that have survived the first few years compared to other industries (Audretsch, 1995) and thus comparative studies across a range of industries may enhance whether the results provided in this paper lends itself to generalization to a broader set of industries.

CONCLUSIONS

While prior research has tended to focus either on managerial growth willingness or on innovation as separate explanations for growth in new firms, this study suggests that these are two inter-related facets of growth, and should be studied in tandem. We contribute to the literature on growth willingness by showing that one of the mechanisms through which such growth willingness leads to growth can be found in studying new firm's innovative efforts and market offerings. As these activities are risky and costly, our examination of the relationships that show how the attitudes of managers towards growth impact their subsequent strategies and actions to achieve growth. We also contribute to the literature on R&D activities in new firms by highlighting Market knowledge competence as important for the on-going innovative output and growth. While formal R&D activity does have a positive effect on new products in firms, the

effect on growth only occurs indirectly when the market adopts such new products. Our study thereby contributes a more fine-grained understanding of the relationship between growth willingness, innovation and actual growth, an imperative issue for researchers, policy makers and managerial practice.

REFERENCES

Acs, Z., & Szerb, L. (2007). Entrepreneurship, Economic Growth and Public Policy. *Small Business Economics*, 28(2-3), 109-122.

Armington, C., & Acs, Z. (2004). Job creation and persistence in services and manufacturing. *Journal of Evolutionary Economics*, 14, 309–325.

Armstrong, J. & Overton, T. (1977). Estimating nonresponse bias in mail surveys. *Journal of Marketing Research*, 14, 396-402.

Arrow, K.J. (2000). Innovation in large and small firms. In R. Swedberg (Ed.), *Entrepreneurship: The social science view* (pp. 229-243). Oxford: Oxford University Press.

Audretsch, D.B. (1995). *Innovation and industry evolution*. London: MIT Press.

Audretsch, D. (2008). *The Entrepreneurial Society*. Oxford: Oxford University Press.

Autio, E., Pathak, S., & Wennberg, K. (2013). Culture's Consequences for Entrepreneurial Behavior: A multi-level analysis. Working paper, Imperial College Business School

Armstrong, J. S. & Overton, T. S. (1977). Estimating non-response bias in mail surveys'. *Journal of Marketing Research*, 14, 396–402.

Baghana, R., & Mohnen, P. (2009). Effectiveness of R&D tax incentives in small and large enterprises in Québec. *Small Business Economics*, 33(1): 91-107.

Bagozzi, R.P., Yi, Y., & Phillips, L.W. (1991). Assessing construct validity in organizational research. *Administrative Science Quarterly*, 36(3), 421-458.

Baker, T., Miner, A. S., & Eesley, D. T. (2003). Improvising firms: Bricolage, account giving and improvisational competencies in the founding process. *Research Policy*, 32(2), 255-276.

Barczak, G., Griffin, A. & Kahn, K.B. (2009). Trends and drivers of success in NPD practices: Results of the 2003 PDMA Best Practices Study. *Journal of Product Innovation Management*, 26(1), 3-23.

Baron, R.M. & Kenny, D.A. (1986). The Moderator Mediator Variable Distinction in Social-Psychological Research - Conceptual, Strategic, and Statistical Considerations. *Journal of Personality and Social Psychology*, 51, 1173-1182.

Berg, M., Dijk, A., & Hulst, N. (1990). Evaluating a Dutch scheme for encouraging research & development. *Small Business Economics*, 2(3): 199-211.

Birch, D.L., & Medoff, J. (1994). Gazelles. In L. Solmon, & A. Levenson (Eds.), *Labor Markets, Employment Policy and Job Creation*. London: Westview Press.

Bottazzi, G., Dosi, G., Lippi, M., Pammolli, F., & Riccaboni, M., (2001). Innovation and corporate growth in the evolution of the drug industry. *International Journal of Industrial Organization*, 19, 1161–1187.

Brattström, A., Löfsten, H. & Richtnér, A. (2012). Creativity, trust and systematic processes in product development. *Research Policy*, 41(4), 743-755.

Brush, T. H., Bromiley, P., & Hendrickx, M. (2000). The free cash flow hypothesis for sales growth and firm performance. *Strategic Management Journal*, 21(4), 455-472.

Cantner, U., & Kösters, S. (2012). Picking the winner? Empirical evidence on the targeting of R&D subsidies to start-ups. *Small Business Economics*, 39(4): 921-936.

Chandler, G. N. & Hanks, S.H. (1994). Market attractiveness, resource-based capabilities, venture strategies and venture performance. *Journal of Business Venturing*, 9, 331–349.

Christensen, C.M., & Bower, J.L. (1996). Customer power, strategic investment, and the failure of leading firms. *Strategic Management Journal,* 17 (3), 197–218.
Cho H-J, & Pucik, V. (2005). Relationship between innovativeness, quality, growth profitability, and market value. *Strategic Management Journal,* 26, 555–575.
Coad, A. (2007). Testing the principle of 'growth of the fitter': The relationship between profits and firm growth. *Structural Change and Economic Dynamics*, 18, 370-386.
Coad, A. (2008). *Firm growth: A survey* (CES Working Paper No. 2007.24). Paris: Centre d'Economie de la Sorbonne.
Coad, A. (2010). Exploring the processes of firm growth: evidence from a vector auto-regression. *Industrial and Corporate Change*, 19(6), 1677–1703
Coad, A., Frankish, J. Roberts, R.G. & Storey, D.J. (2013). Growth paths and survival chances: An application of Gambler's ruin theory. *Journal of Business Venturing*. Forthcoming.
Coad, A. & Rao, R. (2008). Innovation and firm growth in high tech sectors: A quantile regression approach. *Research Policy,* 37, 633-648.
Cohen, W.M., & Klepper, S. (1996). Firm size and the nature of innovation in industries: The cases of product and process R&D. *The Review of Economics and Statistics*, 78(2), 232-243.
Cooper, R.G. (1992). Stage Gate Systems for New Product Success. *Marketing Management* 1(4), 20-29.
Cooper, R. G., & Kleinschmidt, E. J. (1995). Benchmarking the firm's critical success factors in new product development. *Journal of Product Innovation Management*, 12(5), 374-391.
Covin, J. G. (1991). Entrepreneurial vs. conservative firms: A comparison of strategies and performance. *Journal of Management Studies*, 28, 439–462.
Damanpour, F. (1991). Organizational innovation: A meta-analysis of effects of determinants and moderators. *Academy of Management Journal,* 94(3), 555-590.
Davila, T. (2000). An empirical study on the drivers of management control systems' design in new product development. *Accounting, Organizations and Society* 25(4-5), 383-409.
Davidsson, P. (1991). Continued entrepreneurship: Ability, need, and opportunity as determinants of small firm growth. *Journal of Business Venturing,* 6(6), 405–429.
Davidsson, P., Lindmark, L., & Olofsson, C. (1998). The extent of overestimation of small firm job creation- an empirical examination of the regression bias. *Small Business Economics*, 11, 87-100.
Del Monte, A., & Papagni, E. (2003). R&D and the growth of firms: empirical analysis of a panel of Italian firms. *Research Policy,* 32, 1003–1014.
Delmar, F. & Wiklund, J. (2008). The effect of small business managers' growth motivation on firm growth: A longitudinal study. *Entrepreneurship Theory & Practice* 32(3), 437–457.
Demirel, P. & Mazzucato, M. (2012) Innovation and firm growth: is R&D worth it? *Industry and Innovation,* 12(1), 45-62.
Day, G. S. (1994). The capabilities of market-driven organizations. *Journal of Marketing,* 58(4), 37-52.
Deeds, D.L. (2001). The role of R&D intensity, technical development and absorptive capacity in creating entrepreneurial wealth in high technology start-ups. *Journal of Engineering and Technology Management,* 18 (1), 29–47
Delmar, F., Davidsson, P. & Gartner, W. (2003): Arriving at the high growth firm. *Journal of Business Venturing,* 18(2), 189-216.

Delmar, F., & Wiklund, J. (2008). The effect of small business managers' growth motivation on firm growth: A longitudinal study. *Entrepreneurship Theory & Practice* (May), 437–457.
Delmar, F., McKelvie, A. & Wennberg, K. (2013). Untangling the relationships among growth, profit and survival in new firms. *Technovation*, Forthcoming.
Delmar, F., Wennberg, K., & Hellerstedt, K. (2011). Endogenous growth through knowledge spillovers in entrepreneurship: an empirical test. *Strategic Entrepreneurship Journal*, 6(3), 199–226.
Doyle, P. (2008). *Value-Based Marketing* (2nd ed.) Chichester: Wiley
Falk, M. (2012). Quantile estimates of the impact of R&D intensity on firm performance. *Small Business Economics*, 39(1): 19-37.
Freel, M.S. (2000). Do small innovating firms outperform non- innovators? *Small Business Economics*, 14, 195–210.
Freel, M., & Robson, P. (2004). Small firm innovation, growth and performance. Evidence from Scotland and Northern England. *International Small Business Journal*, 22(6), 561–575.
Frese, M. (2011). Entrepreneurial Actions: An action theory approach. In D. Cremer, R. Van Dick and J. Murnighan (Eds.). Social Psychology and Organizations (pp 87-120). New York: Routledge.
Garnsey, E. (1998). A theory of the early growth of the firm. *Industrial and Corporate Change*, 7, 523–556.
Gundry, L. K., & Welsch, H. P. (2001). The ambitious entrepreneur: High growth strategies of women-owned enterprises. *Journal of Business Venturing*, 16(5), 453-470.
Hair, J. F., Anderson, R. E., Tatham, R. L. & Black, W. C. (1998). *Multivariate Data Analysis* (Fifth ed.). Upper Saddle River, NJ: Prentice Hall.
Hamilton, B. H., & Nickerson, J. A. (2003). Correcting for endogeneity in strategic management research. *Strategic Organization*, 1(1): 51-78.
He, Z.-L., & Wong, P.-K. (2004) Exploration vs. exploitation: An empirical test of the ambidexterity hypothesis. *Organization Science,* 15, 481–494.
Hervas-Oliver, J-L., Garrigos, J.A. & Gil-Pechuan, I. (2011). Making sense of innovation by R&D and non-R&D innovators in low technology contexts: A forgotten lesson for policymakers, *Technovation*, 31(9), 427-446
Henrekson, M., & Johansson, D. (2010). Gazelles as job creators: a survey and interpretation of the evidence. *Small Business Economics*, 35(2), 227-244.
Hill, C.W.L., & Rothaermel, F.T., (2003). The performance of incumbent firms in the face of radical technological innovation. *Academy of Management Review* 28 (2), 257–274.
Katila, R., Chen, E. L., & Piezunka, H. (2012). All the right moves: How entrepreneurial firms compete effectively. *Strategic Entrepreneurship Journal*, 6(2), 116-132.
King, D.R. Covin, J.G., & Hegarty, W.H. (2003). Complementary resources and the exploitation of technological innovations. *Journal of Management*, 29(4), 589-606.Kitila, R., & Shane, S. (2005). When does lack of resources make new firms innovate? *Academy of Management Journal*, 48 (5), 814– 829.
Kleinknecht, A. (1987). Measuring R&D in small firms: How much are we missing? *The Journal of Industrial Economics*, 36(2), 253-256.
Kolvereid, L. (1992). Growth aspirations among Norvegian entrepreneurs. *Journal of Business Venturing*, 7, 209-222.
Kohli, A. K., Jaworski, B. J. & Kumar, A. (1993). MARKOR: A measure of market orientation. *Journal of Marketing Research*, 30, 467–477

Krishnan, V. & Ulrich, K.T. (2001). Product development decisions: A review of the literature. *Management Science,* 47(1), 1-21.
Lee, R.P., & Chen, Q., (2009). The immediate impact of new product introductions on stock price: the role of firm resources and size. *Journal of Product Innovation Management,* 26 (1), 97–107
Li, T., & Calantone, R.J. (1998). The impact of market knowledge competence on new product advantage: Conceptualization and empirical examination. *Journal of Marketing*, 62(4), 13-29.
Liao, J., Welsch, H., & Stoica, M. (2003). Organizational absorptive capacity and responsiveness: An empirical investigation of growth-oriented SMEs. *Entrepreneurship: Theory & Practice, 28*(1), 63-85.
Lockett, A. & Wright, M. (2005). Resources, capabilities, risk capital and the creation of university spin-out companies. *Research Policy,* 34(7), 1043-1057.
Macpherson, A., & Holt, R. (2007). Knowledge, learning and small firm growth: A systematic review of evidence. *Research Policy, 36*, 172–192.
Mason, C. & Brown, R. (2013). Creating good public policy to support high-growth firms. *Small Business Economics,* 40(2), 211-225
McDougall, P., Covin, J. G, Robinson, R. B. & Herron, L. (1994). The effects of industry growth and strategic breadth on new venture performance and strategy content. *Strategic Management Journal,* 15, 537–554.
McGee, J. E., Dowling, M. J., & Megginson, W. L. (1995). Cooperative strategy and new venture performance: The role of business strategy and management experience. *Strategic Management Journal*, 16, 565-580.
McKelvie, A. (2007). *Innovation in new firms: Examining the role of knowledge and growth willingness*. Doctoral dissertation. Jönköping International Business School, Sweden.
Mowery, D.C. (1983). Industrial research and firm size, survival, and growth in American manufacturing, 1921–1946: An assessment. *Journal of Economic History,* 43 (4), 953–980.
Narver, J.C., Slater, S.F., & MacLachlan, D.L. (2004). Responsive and proactive market orientation and new-product success. *Journal of Product Innovation Management* 21 (5), 334–347.
Neumark, D., Wall, B., & Zhang, J. (2010). Do small businesses create more jobs? New evidence for the United States from the National Establishment Time Series. *Review of Economics and Statistics*, 93(1), 16-29.
Ortega-Argiles, R., Vivarelli, M. & Voigt, P. (2009). R&D in SMEs: A paradox? *Small Business Economics*, 33(1), 3-11.
Peneder, M.R. (2008). Firm entry and turnover: the nexus with profitability and growth. *Small Business Economics,* 30, 327–344.
Penrose, E. (1959). *The Theory of the Growth of the Firm*. Oxford: Oxford University Press.
Peters, M.P., & Brush, C.G. (1996). Market information scanning activities and growth in new ventures: A comparison of service and manufacturing businesses. *Journal of Business Research*, 36, 81-89.
Podsakoff, P.M., MacKenzie, S.B., Lee, J.-Y. & Podsakoff, N.P. (2003). Common Method Biases in Behavioral Research: A Critical Review of the Literature and Recommended Remedies. *Journal of Applied Psychology,* 88, 879-903.
Raymond, L., & St-Pierre, J., (2010). R&D as a determinant of innovation in manufacturing SMEs: an attempt at empirical clarification. *Technovation,* 30, 48–56.

Roper, S. (1997). Product innovation and small business growth: a comparison of the strategies of German, UK and Irish companies. *Small Business Economics*, 9, 523–537.
Roper, S. (1999). Under-Reporting of R&D in Small Firms: The Impact on International R&D Comparisons. *Small Business Economics*, 12(2): 131-135.
Rosenberg, N. (1990). Why do firms do basic research (with their own money)? *Research Policy*, 19(2), 165–174.
Rosenbusch, N., Brinckmann, J., & Bausch, A. (2011). Is innovation always beneficial? A meta-analysis of the relationship between innovation and performance in SMEs. *Journal of Business Venturing*, 26(4), 441-457.
Samuelsson, M., & Davidsson, P. (2009). Does venture opportunity variation matter? Investigating systematic process differences between innovative and imitative new ventures. *Small Business Economics*, 33(2), 229-255.
Santarelli, E., & Piergiovanni, R. (1996). Analyzing literature-based innovation output indicators: the Italian experience. *Research Policy*, 25(5), 689-711.
Santarelli, E. & Sterlacchini, A. (1990). Innovation, formal vs. informal R&D, and firm size: Some evidence from Italian manufacturing firms. *Small Business Economics*, 2(3), 223-228.
Schumpeter, A. (1934). *The Theory of Economic Development*. Cambridge, MA: Harvard University Press.
Shane, S. (2000). Prior knowledge and the discovery of entrepreneurial opportunities. *Organization Science*, 11 (4), 448–469.
Schoonhoven, C.B., Eisenhardt, K.M., & Lyman, K. (1990). Speeding products to market: Waiting time to first product introductions in new firms. *Administrative Science Quarterly*, 35(1), 177-207.
Sherwood, A.L. & Covin, J.G. (2008). Knowledge acquisition in university-industry alliances: An empirical investigation from a learning theory perspective. *Journal of Product Innovation Management*, 25(2), 162-179.
Sobel, M.E. (1982). Intervals for Indirect Effects in Structural Equation Models". *Sociological Methodology* 13, 290–312
Sobel, M. E. (1986). Some New Results on Indirect Effects and Their Standard Errors in Covariance Structure. *Sociological Methodology* 16, 159–186.
Stam, E. & Wennberg, K. (2008). The roles of R&D in new firm growth. *Small Business Economics*, 33, 77-89.
Storey, D. J. (1994). *Understanding the Small Business Sector*. London: Routledge.
Tabachnik, B. G. & Fidell, L. S. (2000). *Using Multivariate Statistics*. Boston, MA: Allyn & Bacon.
Tominc, P., & Rebernik, M. (2007). Growth Aspirations and Cultural Support for Entrepreneurship: A Comparison of Post-Socialist Countries. *Small Business Economics*, 28(2-3), 239-255.
Van Praag, C.M. & Versloot, P. (2007). What is the value of entrepreneurship? A review of recent research. *Small Business Economics*, 29(4), 351-382.
Wiklund, J. (1999). The sustainability of the entrepreneurial orientation-performancerelationship. *Entrepreneurship: Theory & Practice*, *24*(1), 37-48.
Wiklund, J., Davidsson, P., & Delmar, F. (2003). What do they think and feel about growth? An expectancy-value approach to small business managers' attitudes toward growth. *Entrepreneurship Theory and Practice*, 27(3), 247-270.

Wiklund, J., Patzelt, H., & Shepherd, D.A. (2009). Building an integrative model of small business growth. *Small Business Economics* 32(4), 351-374.

Wiklund, J. & Shepherd, D.A. (2003). Knowledge-based resources, entrepreneurial orientation, and the performance of small and medium-sized firms. *Strategic Management Journal*, 24(3), 1307-1314.

Yang, C.-H., & Huang, C.-H. (2005). R&D, Size and Firm Growth in Taiwan‘s Electronics Industry. *Small Business Economics*, 25(5): 477-487.

Yli-Renko, H., Autio, E., & Sapienza, H. (2001). Social capital, knowledge acquisition, and knowledge exploitation in young technology-based firms. *Strategic Management Journal*, 22, 587–613.

Wennberg, K.. (2009). Knowledge Combinations and the Survival of Financial Service Ventures. *Journal of Evolutionary Economics*, 19(2), 259-276.

Wennberg, K., Wiklund, J., & Wright, M. (2011). The effectiveness of university knowledge spillovers: Performance differences between university spinoffs and corporate spinoffs. *Research Policy*, 40(8), 1128-1143.

Zahra, S. A., Neubaum, D. O. & El-Hagrassey, G. M. (2002). Competitive analysis and new venture performance: Understanding the impact of strategic uncertainty and venture origin. *Entrepreneurship Theory and Practice*, 27, 1–28.

FIGURE 1. Conceptual framework

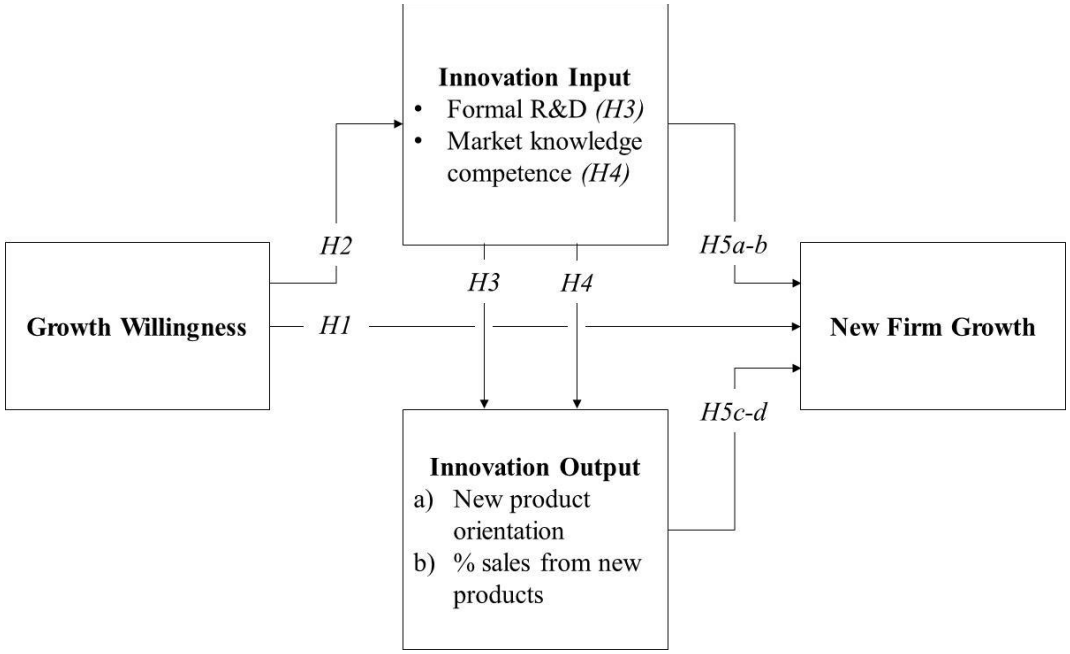

Table 1. Examples of studies of the relationship between innovation and growth

Study	Sample	Independent variable	Findings
Nolan et al. (1980)	Pharmaceutical industry, UK	R&D	**Positive:** R&D activity is positively related to growth in sales and growth in employment
Mowery (1983)	US manufacturing firms 1921-1946	R&D	**Ambiguous:** R&D employment only significantly impact growth for the period 1933-1946
Roper (1997)	2 721 small business in the UK, Ireland and Germany	New product orientation	**Positive:** Positive effect on firm growth
Freel (2000)	228 small, UK manufacturing firms	New product orientation	**Ambiguous:** Innovators does not necessarily grow, but when they do, they grow more rapidly than non-innovators
Bottazzi et al. (2001)	Pharmaceutical industry, global sample	Discovery of new chemical substances and patents	**Unrelated:** No relationship between innovative position and firm growth
Deeds (2001)	80 newly public pharmaceutical biotechnology companies	R&D intensity, technical capabilities and absorptive capacity	**Positive:** Positive relationship between R&D intensity and growth
Del Monte & Papagni (2003)	Italian manufacturing firms	R&D	**Positive:** Positive relationship between R&D activity and sales growth
Freel & Robson (2004)	1 347 manufacturing and service firms in Scotland and Northern England	New product orientation	**Ambiguous:** Negative relationship (for manufacturing firms) between product innovation and growth in sales but positive relationship between product innovation and employment growth

TABLE 2. Descriptive statistics and bivariate correlations

	Mean	S.d.	Min	Max	1	2	3	4	5	6	7	8	9
1. Firm age	5.64	2.23	2.00	10									
2. Firm size	12.33	43.22	3.00	636	-.039								
3. VC ownership	.05	.22	0.00	1	-.022	.028							
4. Technological dynamism	22.19	4.32	9.00	30	-.012	-.039	.030						
5. Growth willingness	17.94	5.39	6.00	30	-.140*	-.023	.273**	.080					
6. Formal R&D	11.68	4.82	4.00	20	-.135*	-.030	.089	.150*	.384**				
7. Customer knowledge	18.66	4.45	6.00	29	-.183	.044	.141*	.097	.228**	.291**			
8. New products	12.44	3.77	4.00	20	.095	.036	.065	.244**	.271**	.558**	.346**		
9. % sales from new products	23.75	24.34	0.00	100	-.263**	-.059	.081	.218**	.391**	.392**	.226**	.303**	
10. Sales growth	.20	.95	-8.19	6.09	-.127	-.007	.013	-.067	.144*	.086	.154*	.129*	.241**

Notes: ** p<0.01, * p<0.05 (two-tailed tests); n= 282

TABLE 3. Effects of growth willingness on innovative inputs and innovative outputs

	DV: Market knowledge competence	DV: Formal R&D	DV: New products	DV: % sales new products
Firm age	-.160**	-.080	.007	-.203***
Firm size	.043	-.037	.045	-.041
VC ownership	.074	-.032	-.004	.003
Tech. dynamism	.075	.120*	.154**	.139*
Growth willingness	.187**	.363***	.060	.273***
Formal R&D			.454***	.238***
Market knowledge competence			.186**	.044
F-statistic	5.328***	10.535***	21.10***	15.768***
R^2	.091	.164	.368	.308
Adj. R^2	.074	.148	.350	.288
ΔR^2	.032**	.119***	.295***	.174***

Notes: Standardized coefficients (two-tailed p-values); *** p<0.001, ** p<0.01, * p<0.05; n= 282; ΔR^2 reflects an increase over and above the base model of firm age, size, VC ownership, and technological innovation.

TABLE 4. Effects of growth willingness, and the mediating roles of innovative inputs and innovative outputs on sales growth

	Model 1	Model 2	Model 3	Model 4	Model 5
Firm age	-.127*	-.122*	-.132*	-.117	-.098
Firm size	-.014	-.012	-.020	-.018	-.004
VC ownership	.064	.067	.073	.069	.075
Tech. dynamism	-.083	-.091	-.085	-.115	-.095
Growth willingness	.152*	.121	.121	.115	.064
Formal R&D		.075			
Market knowledge competence			.137*		
New products				.128*	
% sales from new products					.193**
F-statistic	3.356**	2.958**	2.965**	3.413**	3.959**
R^2	.058	.062	.083	.072	.083
Adj. R^2	.041	.041	.062	.051	.062
ΔR^2	.021*	.005	.017*	.014*	.029**

Notes: Standardized coefficients (two-tailed p-values); *** p<0.001, ** p<0.01, * p<0.05; n= 282; ΔR^2 reflects an increase over and above the base model of firm age, size, VC ownership, technological innovation and growth willingness (with the exception of Model 1).

APPENDIX. Item included as part of multi-item measures

Technological dynamism (α=0.825)
The technology in our markets is changing rapidly.
It is very difficult to forecast where the technology in this market will be in the next few years.
Technological developments in this market are rather minor. (reverse coded)
A large number of new products/services in this market have been made possible through technological breakthroughs.
Products/services in our industry become obsolete quickly.
Technological changes provide big opportunities in this market.
Growth willingness (α=0.809)
We strongly prefer stability over growth (reverse coded).
We are willing to bring in new owners in order to grow the firm.
The firm is willing to take on new loans in order to grow the firm.
The firm is committed to achieving growth, even if it means lower profits.
We strongly prefer to keep the firm at its present size, even if there is the possibility to grow (reverse coded).
The general attitude of the firm is to grow as big as possible, as quickly as possible.
Market knowledge competence (α=0.740)
We regularly have meetings with people from different functional areas to discuss market trends and developments.
A lot of informal hallway talk is about customers' needs and expectations.
We devote quite a bit of time to understanding changing market trends.
Brainstorming meetings are frequently held about customer demands.
We regularly have meeting with people from different functional areas to discuss technological trends and developments.
Marketing personnel in our firm spend time discussing customers' future needs with people in other functional areas.
Formal R&D (α=0.942)
We spend more on R&D than our main competitors given our size.
We spend more on R&D than the industry average given our size.
We have one of the most productive R&D groups in the industry given our size.
R&D is a major priority for our business.
New products (α=0.877)
We introduce more new products/services than our most important competitors.
We introduce products/services faster than our most important competitors.
We introduce many new products/services to the market.
Relative to our main competitors, our firm is well-known for introducing breakthrough-type products and services.