

**Employee Entrepreneurship: When Do Inventors Found a Spin Off?  
Why Have Most Spin-Off Founders Worked Previously for Small Companies?**

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Diplom-Ingenieur  
Simon Lindenmann  
aus Berlin**

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Promotionsausschuss:  
Vorsitzender: Prof. Dr. Jan Kratzer  
Berichter: Prof. Dr. Dodo zu Knyphausen-Aufseß  
Berichter: Prof. Dr. Christian Landau

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## **Abstract (English)**

This thesis analyzes the decision of employees to found a spin-off (leaving an employed position in order to create an own new venture within the same industry). On the one hand, newly created ventures have a positive influence on the job market, the economy in general and are crucial to economic development and, on the other hand, spin-offs represent a highly successful and significant share of newly created ventures. The thesis consists of three independent papers and supplementary discussions. While the first paper details, based on the existing literature, when spin-off specifics need to be taken into account, the second and third papers empirically analyze the stylized fact that founders of new ventures have disproportionately often previously worked in companies with fewer employees.

The first paper is based on the observation that studies currently often classify new ventures (de-novo) as one group without consideration of subgroup specifics. This is identified as problematic, as spin-offs make up a significant share (approx. 30% in Germany) of de-novo companies and show consistently different behavior along important dimensions. To back this finding, the first paper summarizes and categorizes the factors affecting founding and identifies variations between spin-off and other de-novo firm creation based on theory and empirical results. Thus, the key finding is that there is a risk of misleading results if studies have not controlled for spin-offs in the past, and that future studies on venture creation should differentiate for spin-offs to avoid this hazard.

The rest of the thesis empirically details the above mentioned stylized fact, as the literature so far only speculates on the reason while acknowledging that understanding is important in order to further develop the current theories on spin-off founding. Based on a mail survey administered to patent applicants in Germany, eight factors derived from promising spin-off theories, the Employee Learning Theory (ELT) and the Voluntary Turnover Theory (VTT), are tested for their capability of explaining the stylized fact. Despite significant explanatory power for the probability of founding a spin-off by ELT measures such as experience working in a young company, network size, and quality of experience and VTT measures such as job security and job satisfaction, neither was able to explain the stylized fact. Thus, the key finding is that explanations for the stylized fact most often speculated in the literature are incorrect so far, signifying that ELT and VTT require further development. Based on theoretic reasoning and empirical results, knowledge of entrepreneurial business opportunity is recognized as one explanation for the stylized fact, presenting a direction for further expansion of the common spin-off theories.

### **Abstract – Übersetzung des englischen Abstracts**

Diese Dissertation untersucht die Entscheidung von Mitarbeitern zur Gründung eines Spin-offs (Aufgabe des Angestelltenverhältnisses, um ein eigenes Unternehmen in der gleichen Industrie zu gründen). Das Thema ist wichtig, weil auf der einen Seite neue Unternehmen einen positiven Einfluss auf den Arbeitsmarkt, die Wirtschaft im Allgemeinen sowie deren Entwicklung haben und auf der anderen Seite Spin-offs eine bedeutende, sehr erfolgreiche Untergruppe der Neugründungen repräsentieren. Die vorliegende Arbeit umfasst drei unabhängige Artikel sowie ergänzende Beiträge. Während der erste Artikel basierend auf der vorhandenen Literatur prüft, wann Spin-off Besonderheiten bei Gründungsanalysen berücksichtigt werden müssen, untersuchen die anderen beiden Artikel empirisch, warum überproportional viele Gründer vorher für kleine Unternehmen gearbeitet haben – ein „Stylized Fact“, der bei empirischen Studien immer wieder gefunden wird.

Ausgangspunkt des ersten Artikels ist die Beobachtung, dass viele empirische Studien alle neuen Unternehmen als eine Gruppe (de novo) untersuchen, ohne die Besonderheiten von Untergruppen zu beachten. Dies ist problematisch, da Spin-offs einen signifikanten Anteil der de novo-Firmen ausmachen (~30% in Deutschland) und gleichzeitig ein durchgehend anderes Verhalten entlang wichtiger Dimensionen zeigen. Ermittelt wird dies durch Zusammenfassen und Gruppieren der wichtigsten Einflussfaktoren bezüglich Gründung und Analyse, inwieweit es Unterschiede zwischen Spin-offs und anderen de novo-Firmen gibt. Kernresultat ist, dass ein Risiko für Fehlschlüsse bei allen Analysen besteht, die nicht für Spin-off-Unterschiede kontrollieren. Dies ist sowohl bei bestehenden als auch zukünftigen Arbeiten zu bedenken.

Die restliche Arbeit prüft empirisch den oben erwähnten „Stylized Fact“, bezüglich dessen bis jetzt in der Literatur nur spekuliert wird, obwohl die Bedeutung zur Weiterentwicklung der Spin-off Theorien bekannt ist. Aufbauend auf der Employee Learning Theory (ELT) und der Voluntary Turnover Theory (VTT) werden acht Erklärungen für den „Stylized Fact“ empirisch getestet. Grundlage dafür ist eine postalische Umfrage bei Patentanmeldern in Deutschland. Trotz signifikanter Erklärungskraft der ELT- und VTT-Faktoren bezüglich der Wahrscheinlichkeit, ein Spin-off zu gründen, kann der „Stylized Fact“ damit nicht empirisch erklärt werden. Demzufolge ist das Schlüsselergebnis, dass die üblich-erweise in der Literatur geäußerten Begründungen nicht zutreffen und daher ELT und VTT weiterentwickelt werden müssen. Basierend auf theoretischen Überlegungen und empirischen Ergebnissen wird das Kennen von „Entrepreneurial Business Opportunities“ dafür als erfolgsversprechende Richtung identifiziert.

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## **1 Chapter – Introduction**

### **1.1 Initial situation**

Newly created companies—known as “de novo companies”—have been highlighted and discussed by countless papers and authors throughout the management literature, as they are a prerequisite for economic development (van Stel, Carree, and Thurik, 2005). Their small size and flexibility, in combination with the often existing high quality of their knowledge, allows de novo companies to be a driving force in catalyzing and shaping technology flows (Autio, 1994). Especially technology-based ones are known for their influence on creating, refining and diffusing new technologies (Rothwell, 1991). Small new firms are thus often innovators (Baumol, 1990; Pavitt, Robson, and Townsend, 1987), which might induce “creative destruction” (Schumpeter, 1942). Additionally, de novo companies are a major driver of economic growth (Audretsch, Bönte, and Keilbach, 2008) and employment (Thurik, Carree, van Stel, and Audretsch, 2008). Regions with a higher density of de novo companies show a higher economic growth rate, with technically oriented companies offering even higher growth potential (Brixy, Hessels, Hundt, Sternberg, and Stüber, 2009). Consequently, the creation of new ventures with or without technology orientation is an important research area for management scholars.

There are several different types of de novo companies—one of these is the spin-off, in which a new venture is created by an employee who has worked previously in the same industry. In other words, an individual leaves his/her employer (parent company) to found a new venture, which eventually competes with the former. The employer suffers both from

losing the employee and from having an additional competitor, resulting in a lower survival rate in the years following the transfer (Phillips, 2002), whereby the damage caused to the parent company increases with the importance of the employee.

The described problem is highly relevant because spin-offs represent a significant group among de novo companies, making up approx. 30% of all de novo companies in Germany (Koch, 2006), with even higher numbers reported for the US. For example, approx. 71% of the founders of 100 surveyed Inc. 500 companies (the fastest growing companies in the US) started based on an idea developed at their former employer, thus falling under the definition of spin-off (Bhide, 2000). The share of spin-offs is dependent on the industry. Those in which the competitive advantage is based on the person and less on the invested capital have seen more spin-offs (Garvin, 1983). In high-tech industries, where the know-how is embodied in human capital, spin-offs are the largest group among de novo companies (Audia & Rider, 2005; Franco & Filson, 2006). Good examples are the semiconductor and rigid disk drive industries, where the majority of de novo companies are spin-offs (Christensen, 1993; Agarwal, Echambadi, Franco, and Sarkar, 2004).

Spin-offs not only make up a significant part of de novo companies and reduce the survival chances of the parent company, they also have a better survival rate than other de novo companies (Colombo, Massimo G., and Grilli, 2005; Dietrich & Gibson, 1990; Hunsdiek, 1987; Klepper, 2002; Lindholm, 1994; Sleeper, 1998; Szyperski & Klandt, 1980; Walsh, Kirchhoff, and Boylan, 1984; Agarwal et al., 2004; Audretsch, Houweling, and Thurik, 2004; Bayus & Agarwal, 2007; Beckman, 2006; Chatterji, 2009; Ganco & Agarwal, 2009; Phillips, 2002). A study from Denmark illustrates this best by identifying a 50%

survival advantage for spin-offs when compared to all other market entrants (Eriksson & Kuhn, 2006). The spin-off profits from intangible assets transferred from the former company to the spin-off by the founder (Koster & van Wissen, 2004). This allows it to survive in smaller niches (Audretsch, Prince, and Thurik, 1999) or with less success, as some of the development costs have been paid by the parent company (Klepper & Sleeper, 2005). Despite several theories and some empirical analysis, the nature of the intangible assets transferred by the founding employee has as yet not been established beyond doubt. However, it has to be some kind of “insider” knowledge, which can be more easily learned when working within a company (Sapienza, Parhankangas, and Autio, 2004; Weterings & Koster, 2007). It is often speculated that technical or technology-related knowledge could be part of the insider knowledge (Chatterji, 2009; Klepper & Sleeper, 2005).

Employees working in young, technology-driven industries who possess relevant insider knowledge currently face the decision whether to remain with their employer or capitalize on their insider knowledge by founding a spin-off of their own (Kräkel, 2005). Understanding why some of them choose to start a spin-off while others do not is a major research field of management scholars (Acs & Audretsch, 2003; Venkataraman, 1997) and the overall focus of this study.

## **1.2 Objective**

The objective of this study is to analyze why employees with relevant insider knowledge decide for or against starting a new venture, particularly a spin-off. Therefore, in a first step it is analyzed which factors—according to the literature—influence the decision to found a new venture. This analysis yields a categorized list of factors affecting this decision. Based on this

list, it is verified whether the factors have the same effect for spin-off and start-up founding. Spin-off theory and empirical results are detailed to compare the influence of each identified factor, allowing an assessment of the difference. This provides answers to the first research question:

*Do spin-off specifics need to be taken into account when analyzing new venture creation as a whole?*

Besides answering the question above, the analysis will also identify research areas lacking empirical validation (research gaps). One of those selected for additional investigation was a stylized fact with a missing explanation. Founders of new ventures have disproportionately often previously worked in companies with fewer employees (small enterprises). Several empirical and anecdotal studies come to this conclusion (e.g., Boden, JR, 1996; Eriksson & Kuhn, 2006; Georgellis & Wall, 2005; Gompers, Lerner, and Scharfstein, 2005), which is now considered a stylized fact (Wagner, 2004). However, there is no theory directly linking former company size with founding. Instead, several explanations are currently proposed to detail the stylized fact which connects company size to founding via other measures (e.g., Hyytinen & Maliranta, 2008). None of these has been empirically proven. Understanding why the stylized fact occurs will on the one hand end the speculations and on the other hand further detail the theories on spin-off founding. Identifying the influence path of corporate size on founding will offer a direction for the development of the spin-off theories in general and the employee learning theory in particular. The second research question is therefore:

*How can the stylized fact that more founders come from small companies best be explained?*

### **1.3 Structure of the study**

A typical structure for empirical studies is to first have a theoretic part, followed by the development of the hypotheses, which are subsequently tested and the results discussed in detail. This study, however, has an uncommon structure and does not follow the typical approach for studies. Instead, the main part consists of three papers which each have their own research motivation, question, approach, results, and conclusion. Thus, instead of one study, this documentation consists of three separate studies having a joint topic—the creation of spin-offs. However, due to the independence of each of the three studies and the common topic, the papers overlap in part. This is rather exceptional and might present additional difficulties when reading the document in total.

The structure was selected because the study was set up as a “cumulative dissertation.” Following this design, three papers were prepared which can each be submitted as a stand-alone document. The overall document is a superstructure which supplements the three papers with additional information, explains why the papers were written, details how the results fit together, and identifies next steps to further develop the theories. The complete document comprises seven chapters, each dedicated to a specific topic as shown in figure 1.

Chapter 1 – the chapter you are reading right now – is the introduction, in which the initial situation and the objectives of the dissertation are presented. This is followed by a short section describing the structure of the study and the exact definition of the term “spin-off” as applied throughout the study.

Chapter 2 consists of the complete paper I, a literature review analyzing how influences differ for spin-off and start-up creation. In a first step, the paper identifies the important factors influencing new venture creation. In a second step, it analyzes—based on spin-off theory and empirical results—whether the identified factors vary in their importance for start-up and spin-off creation. Based on this is the conclusion as to whether spin-off specifics need to be taken into account when analyzing de novo companies. Furthermore, the literature review identifies research areas requiring additional investigation.

Chapter 3 is made up of paper II, which empirically examines one research area identified for additional investigation by paper I. The stylized fact that founders have disproportionately often previously worked for small companies has been identified across the literature and lacks a proven explanation, as the literature has as yet only speculated on the explanation for this result. A theory directly linking corporate size to founding does not exist to the best knowledge of the author. Instead, speculations point towards attributes of small companies (e.g., establishing a better network) which could clarify this empirical finding. The paper details seven explanations and empirically analyzes which of those best explains the stylized fact.

Chapter 4 consists of paper III. This paper analyzes the same research questions as paper II, again trying to explain the same stylized fact based on the employee learning theory and the voluntary turnover theory. The major difference between the two papers is that the latter does not suffer from the same limitations as the former. Two identified influences— aspiration to become self-employed, and selection based on better entrepreneurial skills—can additionally be tested within the research model. Due to data limitations, this testing was not

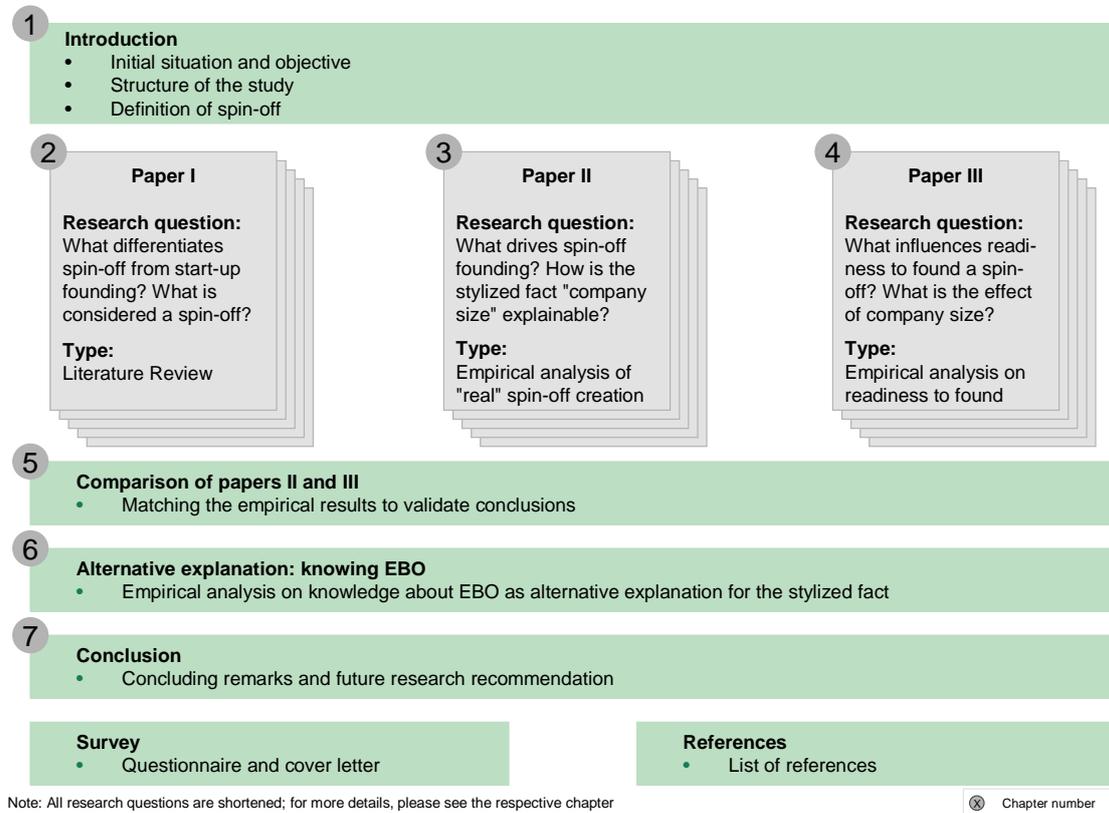
possible in paper II. In addition, the results in paper II could be limited by a recall bias, as founders of spin-offs were asked to remember the time before they founded and answer in regard to that moment. Paper III offers validation of the results, as it does not suffer from the recall bias, which is achieved by analyzing the readiness to found—a preliminary step to founding, instead of the “real” founding.

Chapter 5 compares the empirical results of papers II and III. As both papers analyze the same research question, contrasting the results allows the overall results to be distilled.

Chapter 6 offers an alternative explanation for the stylized fact based on entrepreneurial business opportunities, which is a second explanation path identified in paper III. The explanation is detailed theoretically and empirically, indicating a direction for further development of the most common theory.

Chapter 7 comes to an overall conclusion regarding the research question, taking into account all analysis, followed by recommendations for future research. Thereafter the survey and the cover letter are reprinted and the references listed.

Figure 1: Structural overview of the study



## 1.4 Definition of spin-off

Before starting the detailed analysis, the term “spin-off” must first be clarified. There is no agreed-upon definition for spin-offs in the literature (Blum & Witt, 2006), and several terms such as corporate spin-off, spin-out, and new technology-based venture are often used to express more or less the same concept. Most definitions applied in the literature rely on three dimensions: the entrant type, the founder type, and the relationship between XX and YY (see, for example, Klepper & Sleeper, 2005). Each of these three dimensions will be discussed in the following, starting with the last.

The literature agrees in assuming that spin-offs tend to be connected to the former company of the founder by operating in the same industry (e.g., Agarwal, Echambadi, Franco, and Sarkar, 2002; Koster & van Wissen, 2004; Møen, 2007; Tübke, 2004). However, there is a definition problem for the term “industry,” as the boundaries between industries are often not very accurately described (Garvin, 1983). The same industry can either indicate direct competition in the same market segment, or indirect competition in the same general industry but a different market segment. It might even include working at a different step of the value chain—for example, by providing supply products to the former company. As a result, there exists some uncertainty about industry similarity. In this study, those who indicate that their new venture operates in the same or a similar branch, sector, or service industry as their former company qualify as spin-offs. Hence, this study applies a broad definition of industry, and the relatedness is defined by the founders themselves.

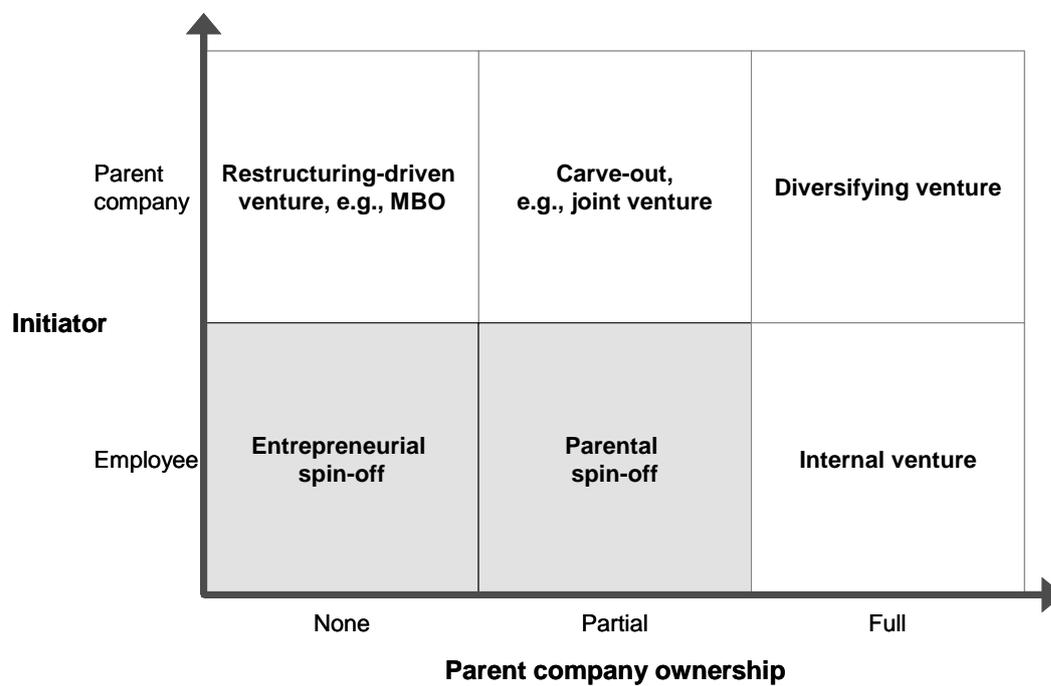
Another dimension relevant to the definition of spin-offs is the founder type, which describes what the founder did previously. Those who found a new venture by leaving a company must be distinguished from those who did not work in a company before. For example, founders who were unemployed or academics are often driven by a specific motivation unrelated to that of company employees. The former might, for example, start up a company to leave unemployment (Brixey et al., 2009), while the latter may lack the ability to introduce an idea into the market (Agarwal et al., 2004; Jong, 2006). The focus of this study is on employee entrepreneurship; individuals not employed in a company are therefore excluded. As a consequence, academic spin-offs (spin-offs founded by someone who previously worked in academia) are also not eligible for this study.

So far, spin-offs are defined as new ventures founded in the same industry by previously company-employed individuals. A wide range of entrants fulfill these requirements at least in part, without being spin-offs in the sense of this study. The remaining new ventures can be categorized along two dimensions: initiator and parent company ownership. The former differentiates new ventures initiated by the parent company from those initiated by an employee. New ventures founded on behalf of the incumbent are usually not entrepreneurially driven by an individual (e.g., Ito, 1995; Knight, 1989; Lehman, 2002). Instead, the existing company often changes its organizational setup (Baron, 2008). The other dimension differentiates the level of parental ownership. New ventures can be owned fully, partially, or not at all by a parent company. The ownership structure determines the level of resources and capabilities of the new venture. An increased ownership share of the parent company strengthens the accessibility to parental resources and capabilities (Koster, 2004).

Categorizing the newly created ventures within one industry along those two dimensions leads to six different entrant types adapted from Helfat & Lieberman (2002) and Koster (2004) as shown in figure 2. New ventures initiated by the parent company are either restructuring-driven ventures (e.g., MBOs), carve-outs (e.g., joint ventures), or diversifying ventures, depending on the level of parent company ownership. New ventures initiated by an employee are either entrepreneurial spin-offs, parental spin-offs, or internal ventures, again depending on the level of parental company ownership. This study focuses on new ventures initiated by the employee and not fully owned by the parent company. Only in entrepreneurial and parental spin-offs do the employees leave the company on their behalf to found a new venture in the same industry, while holding a personal ownership share. Those

thus become employee entrepreneurs, realizing the idea in a new venture within the same industry.

Figure 2: Categorization of new ventures founded in the same industry  
Only entrepreneurial and parental spin-offs are analyzed in the course of this study. Adapted from Helfat & Lieberman (2002) and Koster (2004).



## 2 Chapter – Paper I

### **Do spin-off specifics need to be taken into account when analyzing new venture creation as a whole?**

#### **Abstract**

*This article analyzes whether spin-off and start-up creation differ to an extent that requires the differences to be taken into account when analyzing the founding of new ventures. Currently, studies often classify new ventures (de novo) as a single group, without considering subgroup specifics. This approach has been identified as problematic because spin-offs make up a significant share (approx. 30%) of de novo companies in Germany and show consistently different behavior along important dimensions. To back up this critique, the article summarizes and categorizes the factors affecting founding and identifies differences between spin-off and start-up creation. Theoretical predictions and empirical evidence suggest differences in personal characteristics, motivation, character, socioculture, and external factors. Consequently, there is a risk of misleading results if studies have not controlled for spin-offs in the past—future studies on venture creation should examine spin-offs separately to avoid this pitfall. As a side product, several influences are identified for which predicted theoretical differences await empirical validation.*

## 2.1 Introduction

Entrepreneurship is one of the key research fields of management scholars (Klepper, 2001), being a major driver of economic growth (Audretsch et al., 2008) and a prerequisite for economic development (Schumpeter, 1942; van Stel et al., 2005). Analyzing why new ventures (de novo companies) are founded is the focus of countless studies (e.g., Burmeister & Schade, 2007; Lazear, 2005; Rauch & Frese, 2007). These studies often classify new ventures (de novo) as a single group without taking subgroup specifics into account.

However, results based on empirical analysis of all de novo companies as a group could be misleading if there exists a significant subgroup distorting the results. Without controlling for heterogeneity, the empirical analysis could be biased (Hofstede, Steenkamp, and Wedel, 1999) and may even lead to wrong conclusions (see, e.g., Wagner, 2004). To have the described effect, the subgroup must constitute a significant share and display a consistently different behavior along important dimensions (Sarstedt & Ringle, 2008).

One subgroup which could fulfill these demands is spin-offs—i.e., new market entrants founded by employees of firms in the same industry (Agarwal et al., 2002; Klepper & Sleeper, 2005). They make up a significant share of de novo companies—roughly 30% of the newly created ventures in Germany (Koch, 2006) and upward of 20% in the US (Klepper & Thompson, 2010)—and approx. 71% of the founders of 100 surveyed Inc. 500 companies, the fastest growing companies in the US (Bhide, 2000). To severely distort the results, spin-offs would also have to be significantly different from other de novo companies. The goal of this article is therefore to detail the founding differences between “standard” start-ups (new ventures founded independently of a former company and in a different industry) and spin-

offs along important dimensions. The definition of the latter is dependent on the research question and applied theory. For example, a smaller shoe size of a spin-off founder would probably not qualify as important. This article consequently identifies, in a first step, the most important dimensions influencing founding based on categories developed by Almus & Nerlinger (1999) and Stuart & Abetti (1987). In a second step, each influencing factor will be detailed theoretically for differences in influence or magnitude between spin-off and start-up creation. In a third step, empirical evidence for spin-off founding is presented to contrast theoretic predictions, thus allowing detection of research gaps and evaluation as to whether spin-off founding is significantly different from start-up creation. This represents the major contribution of the article and sets it apart from other literature reviews on spin-offs.

Klepper (2001), for example, reviewed the four most common spin-off theories and compared them to empirical results to identify the best-fitting spin-off theory. Thus, instead of comparing spin-offs with start-ups, empirical spin-off results are compared with the spin-off theories. Similarly, Agarwal et al. (2004) describe the different theoretical and empirical results of research directions influencing spin-offs. The resulting overview draws a holistic picture of spin-offs but does not compare them in detail to start-ups. Santarelli & Vivarelli (2007), on the other hand, details the firms' entry, survival, and growth, but does not consider spin-offs specifically and does not compare the two with each other. This article therefore not only contributes to an important research concern and identifies an area for future research, it is also unlike any literature reviews existing so far.

The remaining paper is organized as follows: First, the important dimensions influencing founding are identified based on the entrepreneurship literature. Next, the spin-

off theories are detailed to provide background information and then applied to predict differences between spin-off and start-up founding, followed by a comparison with the existing empirical evidence. The result section then summarizes the contrasts and highlights research gaps. Finally, recommendations are given for research areas in which spin-off specifics should be taken into account.

## **2.2 Identification of factors influencing founding**

According to the literature, there are in industrial organizations a number of individuals at every moment that are interested in becoming entrepreneurs; these individuals will become entrepreneurs as soon as the environment takes a more favorable direction (Khemani & Shapiro, 1986; Mansfield, 1962). This change is triggered by the expected level of profitability. Thus, for example, an input factor decrease such as reduced costs for raw materials would strengthen profitability, which in turn would allow some individuals to become entrepreneurs.

More advanced theories assume that the decision to become an entrepreneur is not triggered by the absolute, but rather by the relative profitability (Audretsch, 1995; Geroski, 1995; Vivarelli, 1991, 2004). Accordingly, each individual compares his/her personal income with the potential earnings from becoming an entrepreneur. The decision for founding is thus made at the individual level (Winter, 1991) and depends on the person's individual needs and attitudes. In addition, there are factors that influence founding from a company perspective. For example, small companies might be conducive to better business ideas (Geroski, 1995), which are a prerequisite for starting a new venture. Thus, there are in total three distinct sources of factors influencing the decision to found a new venture: the person, the

environment, and the firm—adapted from Almus & Nerlinger (1999) and Stuart & Abetti (1987). Each of these sources will be discussed in detail in the following paragraphs (see also table 1).

Table 1: Overview of identified factors influencing founding

Over-categories	Relevant categories	Literature examples
Person	Personal characteristics Personal, easily assessable factors such as age, race, gender, marital status, education, employment status, management experience, income, assets, entrepreneurs in the family, and job satisfaction	Blanchflower, 2004; Freytag & Thurik, 2007; Grilo & Thurik, 2005a 2005b; Parker, 2004
	Character <ul style="list-style-type: none"> <li>• Psychological characteristic, e.g., need for achievement</li> <li>• Pattern of behavior, e.g., bias in probability perception</li> </ul>	Begley & Boyd, 1987; Busenitz & Barney, 1997; Dyer, 1994; Kolvereid, 1996; McClelland, 1961, 1975; Miner et al., 1989; Rauch & Frese, 2007; Tversky & Kahneman, 1971
	Motivation Factors driving the motivation of individuals such as independence, importance of financial success, self-fulfillment	Berthold & Neumann, 2008; Cartera et al., 2003; Shane et al., 2003
Environment	Sociocultural <ul style="list-style-type: none"> <li>• Population</li> <li>• Legitimization</li> <li>• Social system</li> <li>• Regional specifics</li> <li>• Legal system and administrative complexity</li> </ul>	Etzioni, 1987; Giannetti & Simonov, 2004; Herbig & Miller, 1992; Hessels et al., 2008; Audretsch & Keilbach, 2008; Fairchild & Gregory., 2008; Verheul et al., 2002; Krugman, 1991; Santarelli & Vivarelli, 2007; Moncada et al., 1999
	External <ul style="list-style-type: none"> <li>• Industry and life cycle</li> <li>• Economic cycle and unemployment</li> </ul>	Audretsch, 1995; Audretsch & Keilbach, 2008; Echambadi et al., 2008; van Gelderen et al., 2006; Parker, 2004
Firm	"Prior" organization Factors describing the current employer such as company size, company age, technical know-how, level of focus, CEO change	Franco & Filson, 2006; Garvin, 1983; Klepper, 2001; Klepper & Sleeper, 2005

### 2.2.1 Source: Person

Factors based on the source “person” are those that influence the founding on an individual level. The research field is very wide, but three research areas, which will be discussed in the following, have been identified throughout the literature: *the personal characteristics, the character specifics, and the motivation.*

The *personal characteristics* consist of factors describing the situation an individual is in at that time. Most of these are measurable from the outside, (e.g., gender), and numerous studies have detailed their influence on founding. An agreed-upon list of all relevant factors does not exist. However, often analyzed factors include age, race, gender, marital status, education, employment status, management experience, income, assets, entrepreneurs in the family, and job satisfaction (Blanchflower, 2004; Freytag & Thurik, 2007; Grilo & Thurik, 2005a, 2005b; Parker, 2004).

*Character-specific factors* are internal factors describing psychological characteristics and specific patterns of behavior, which are often unobservable without experiments. Studies on psychological characteristics identify that entrepreneurs disproportionately often have a stronger need for achievement (McClelland, 1961, 1975), a stronger need for control, and a higher tolerance for ambiguity (Begley & Boyd, 1987; Dyer, JR., 1994; Kolvereid, 1996; Miner, Smith, and Bracker, 1989). However, the results are only partially conclusive due to strong variations between studies (Busenitz & Barney, 1997; Rauch & Frese, 2007). Entrepreneurs also show behavioral differences. Typical examples are “reference dependents” (Busenitz & Barney, 1997)—decision-making based on a generalization of non-random, small sample results (Tversky & Kahneman, 1971) and bias in probability recognition (prospect theory)—overweighting of small probabilities for risk (Baron, 2004), and having a tendency for a biased self-assessment, leading, for example, to a self-confidence not corresponding to the actual skill level (Cooper, Dunkelberg, and Woo, 1988), or a very positive expectation of the future (Koellinger, Minniti, and Schade, 2007).

The *motivation* includes factors that an individual is stimulated by, such as independence. These are strongly affected by character-specific factors and, in part, by personal characteristics. For example, founding due to a desire for financial success might be more relevant for individuals who are not already billionaires or who have a stronger need for achievement. Differences in motivation between founders and non-founders have been speculated about for some time (Douglas & Shepherd, 2002; Feldman & Bolino, 2000; Shane, Locke, and Collins, 2003); however, there is neither a fixed set of motivational categories nor a validation. A recent study compared nascent entrepreneurs with average employees based on the motivational categories innovation, independence, recognition, role, financial success, and self-fulfillment (Carter, Gartner, Shaver, and Gatewood, 2003). These categories explained approx. 68% of the decisions but did not show a significant difference between entrepreneurs and employees; similar results are reported for the German engineering industry (Berthold & Neumann, 2008).

### **2.2.2 Source: Environment**

As mentioned above, another source of factors influencing the decision to found a new venture is the environment with the two research areas of sociocultural and external factors.

Sociocultural factors influence the founding from a cultural or regional point of view. Examples are the legitimization of entrepreneurs, the social system, the population, regional specifics, and the legal system with the resulting administrative complexity. A higher social status of entrepreneurs will lead to a stronger focus on entrepreneurial skills in the education system e.g., specific classes on entrepreneurship, improved social capital, and a more favorable tax regulation, increasing the share of entrepreneurs (Etzioni, 1987). A lower

acceptance of entrepreneurial skills and attitudes (e.g., risk-taking) in a society, on the other hand, should reduce the entrepreneurship rate (Giannetti & Simonov, 2004; Herbig & Miller, 1992). A strong social system reduces the risk of failure by providing a safety net for individuals, which reduces the compulsion to found a company for financial resources (Brixy et al., 2009) and the growth and innovativeness of new companies (Hessels, von Gelderen, and Thurik, 2008). Founding should be easier when an exchange of ideas from diverse and or well informed views is fostered, which is dependent on the population. Consequently, a higher population density (Audretsch & Keilbach, 2008), social diversity (Fairchild & Gregory B., 2008; Verheul, Wennekers, Audretsch, and Thurik, 2002), population growth, urbanization rate, and age structure should influence entrepreneurship rates. Similarly to the population, regional specifics also foster entrepreneurship by offering favorable regional terms and conditions. Factors such as regional tax, regional industry diversity, and regional knowledge density influence company creation, according to German regional data (Audretsch & Keilbach, 2008). Regional industry density and regional industry focus are assumed to have a similar effect (Krugman, 1991; Santarelli & Vivarelli, 2007). The influence of the legal system and administrative complexity on founding has been discussed primarily from a theoretic perspective, postulating a positive relationship (Moncada, Tübke, Howells, and Carbone, 1999). Once founding becomes more difficult—for example, due to bureaucratic hurdles, labor laws, or bankruptcy laws—fewer individuals will found a company (Freytag & Thurik, 2007; Peng, Yamakawa, and Lee, 2010).

The second environmental research area covers external factors such as industry, life cycle, economic cycle, and unemployment. As comparing all industries with each other

would be tedious work, other indicators, such as the level of innovation and the position in the life cycle, are derived to describe industry differences and generalize the results (Audretsch, 1995; Echambadi, Bayus, and Agarwal, 2008; Audretsch & Keilbach, 2008; van Gelderen, Thurik, and Bosma Niels, 2006). The basic question at hand regarding the economic cycle and the level of unemployment is which economic circumstances support the founding of new ventures—are more companies founded in economically “bad” times when the high unemployment pushes individuals into founding activities (Brixy et al., 2009; Brockhaus & Nord, 1979), or are economically good times more conducive to founding? According to a study on German regions, it is rather the latter that is relevant in high-tech industries (Audretsch & Keilbach, 2008). The same study found only a minor effect of unemployment rates. However, there exists strong disagreement in the literature regarding the effect of unemployment—for detailed discussions, please see Parker (2004). Similar to the overall economic growth, it is expected that industry growth has an effect. The direction again is inconclusive.

### **2.2.3 Source: Firm**

The third source of factors influencing company creation is the firm, whose effect should be strongest if the prior company and the new venture share an industry, which is typical for a spin-off founding. Thus, instead of detailing the factors directly, the spin-off theories will be detailed in the following, focusing strongly on identifying spin-off-specific influences derived from the prior firm.

### **2.3 Overview of spin-off theories**

There are four major theories detailing spin-off founding. Each will be discussed briefly—for more details and empirical evidence, please see Klepper (2001).

The Agency Theory (AT) assumes that a contractual problem between employee and employer will arise once the employee makes an innovative discovery. The two parties will have difficulty agreeing on the distribution of the profits of the discovery, especially for groundbreaking innovations and innovations that open up new lines of business (Anton & Yao, 1995; Bankman & Gilson, 1998; Gromb & Scharfstein, 2003; Hellmann, 2007; Wiggins, 1995). An employee might leave his/her current company to found his/her own company in order to increase his/her share of the profits of the innovative discovery.

The Organizational Capability Theory (OCT) on the other hand assumes that an existing company has difficulties assessing, implementing, or developing certain types of innovation due to its organizational nature (Bhide, 2000; Cassiman & Ueda, 2006; Cooper, 1985; Garvin, 1983; Pakes & Nitzan, 1983; Tushman & Anderson, 1986). A typical example is a feature innovation, which is most relevant to new users. The established company might rely too heavily on feedback from their current customers to develop the innovation (Christensen, 1993). An employee might found an own company as a reaction to the development hesitation of his/her current established employer.

The Heritage of the Spin-off Theory (HT) suggests that spin-offs are comparable to children and have a parent organization, i.e., the company the founder worked for before. This relationship might offer support, and the creation of the spin-off might have even been planned (Cooper, Gimeno-Gascon, and Woo, 1991; Dyck, 1997). Following this has each

region a birth potential formed by superior firms clustered around successful early entrants (Buenstorf & Klepper, 2009).

The Employee Learning Theory (ELT) assumes that employees improve their human capital while working for a company, allowing an easier founding of a spin-off given the necessary inclination and organizational skills (Bankman & Gilson, 1998). A recent literature review came to the conclusion that the Employee Learning Theory resonates best with the empirical findings (Klepper, 2001); it will therefore be detailed in the following paragraph.

The Employee Learning Theory literature provides two main models of spin-off founding that feature employee learning in an industry evolution context. Both assume that the employee can learn from the company he or she works for. In Franco & Filson (2006)'s model, the employee can only capitalize on his/her knowledge by founding a spin-off, and the success of the spin-off is dependent on the level of knowledge the founder acquired from his/her former employer. This implies that more knowledgeable firms spawn more spin-offs, which furthermore apply a technology comparable to that of their parents. In Klepper & Sleeper (2005)'s model, each company offers an optimal set of product variants, which leaves no room for profitable entrance by non-spin-offs. However, due to learning, an employee can found a spin-off with lower cost based on a product variant of his/her former employer's—the spin-off can be sustained in the existing smaller niches (Audretsch et al., 1999).<sup>1</sup> This implies that spin-offs initially produce a similar but sufficiently different product compared to that of the founder's former company, and that a richer product variant know-how of that company reduces the required organizational skills. Garvin (1983) points out that employee

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<sup>1</sup> The employer did not develop additional variants to close those smaller niches because the costs therefore would exceed the benefits. Basically, he is better off gambling on the non-appearance of a spin-off as long as the probability of having employees with the required organizational skills and inclination is low.

learning is most efficient when the knowledge is embodied in human versus physical capital, which is often the case in immature industries (Klepper, 1996).

The four described spin-off theories acknowledge the influence of the employer on founding. Two prototypes of “prior” employer exist according to the literature—one is called “Xerox company,” the other “Fairchild company” (Gompers et al., 2005).

The Xerox type describes companies that are big, with large research budgets but often also with a high level of bureaucracy. These companies frequently show a higher reluctance to introduce new ideas into the market (Chesbrough, 2003). A famous and name-giving example of this type is Xerox, which had developed several important PC technologies but did not commercialize any of them. To finalize the development and commercialize their idea, employees often have to leave this type of company (Gompers et al., 2005). The Xerox type fits very well to the OCT, as both assume that an employee leaves because his/her idea is neglected by the current company.

The Fairchild type, on the other hand, includes companies that are young, entrepreneurial, and frequently develop new ideas. Here, an employee can learn the entrepreneurial process, work in diverse functions, be provided with an entrepreneurial role model, and build an entrepreneurial network (e.g., contact to a VC) (Gompers et al., 2005). The famous name-giving example is Fairchild Semiconductors, which, due to its many spin-offs, is considered the founder of Silicon Valley (Saxenian, 1994). Employees might decide to leave this kind of company to found their own venture, as they often lack the career advancement options and the financial resources for diversification, or because the employees

are selected based on their above-average entrepreneurial skills (Hyytinen & Maliranta, 2008). Hence, this type fits very well with the ELT, especially with Klepper's version.

Both prototype companies have spawned spin-offs in the past and consequently exist in the real world. However, empirical analysis indicates that more spin-offs originate from Fairchild companies (Gompers et al., 2005).

Several factors relating to the prior organization are identifiable based on the prototypes and the overall theory. Each category will be mentioned shortly and discussed later together with the empirical findings. According to the ELT, the know-how of a company has an important influence on founding, as companies with superior **know-how** or **young** or **small** ones offer a better learning environment (Garvin, 1983). In addition, founding is influenced by the inclination of employees, which is dependent on **company growth**. Employees might be more willing to leave a company that does not experience very strong growth (Gompers et al., 2005). Being **focused** and knowing an industry very well, and being diversified and having a broader understanding, could both have a positive effect on founding (OCT). Moreover, the OCT assumes that employees will present their idea to the employer, which requires a certain level of trust (AT). Thus, a **special event** which disrupts the employee-employer relationship, such as a CEO change, should increase the spin-off probability.

#### **2.4 Difference between spin-off and start-up influences**

So far, this paper has only identified and categorized the factors influencing the decision to found a new venture. Next, it will detail for each research area whether the influencing factors vary for spin-off and start-up creation—first theoretically, then by contrasting the empirical results.

#### **2.4.1 Difference regarding the source person**

*Personal characteristic.* As mentioned above, this research area is composed of measures describing the current situation of an individual. According to the ELT, founding is based on accumulated human capital acquired while being employed. This accumulation takes time, increasing the duration of employment before founding. In addition, the OCT assumes that an employee knows about an important innovation neglected by the current employer. Determining that an innovative idea is important and neglected due to organizational limitations is dependent on experience and a detailed understanding of innovation and the market, which requires time to build up. Thus, both ELT and OCT suggest that spin-off founders should be older than start-up founders, a hypothesis which is additionally supported by the fact that only spin-off founders are required to have worked in a company before. This should further increase the average **age** of spin-off founders compared to start-up founders.

Learning is also dependent on the level and quality of information an employee receives while working for a company (ELT). Having access to more—and even partially restricted—information should increase the learning success (Venkataraman, 1997). A higher hierarchical level usually provides better and more information. As a consequence, employees in higher hierarchical positions should be in a better position to learn; hence, spin-off founders should more often have **management experience**.

An employee learns something which makes him better able to found a new company than those who have not learned it (ELT). An explanation of how or what the employee learns is missing (Klepper, 2001), but it must be something learned more easily when working inside a company. Typical examples could be new technological developments,

specific process knowledge, specific customer demand knowledge, or specific supply knowledge (Garvin, 1983). Empirical evidence in the medical device industry suggests that the learning often involves technology or technology-related specifics (e.g., FDA approval process) (Chatterji, 2009). Those areas seem to offer valuable knowledge mainly acquirable internally. As a result, spin-off founders should more often have a technical background either by **education or experience**.

Taken together, a spin-off founder is older, has more technical education, and often has management experience, which also has implications for other influencing factors. The technical world, for example, is typically dominated by male employees. If the majority of spin-off founders come from that stock, the number of **female** spin-off founders should be even lower than the number of female start-up founders. In addition, technically oriented employees with a longer work tenure and disproportionately high management experience should also have an above-average salary. This, combined with the longer working period before founding, should lead to a build-up of more assets. Spin-off founders should therefore have a higher **income** and more **assets** at the time of founding than start-up founders. In addition, well educated, experienced, technical employees could have a lower risk of becoming unemployed than the average individual, which would reduce the push motivation of the **personal risk of unemployment**. The higher salary and the likely received promotion should increase the job satisfaction of spin-off founders. However, leaving a job despite being satisfied with it seems rather uncommon. Thus, these employees might place a different importance on job satisfaction drivers such as development of innovations and recognition of ideas than the average individual. This could explain why the employee—regardless of

his/her higher salary and hierarchical position—has lower **job satisfaction** than the average employee. One reason reported less often by spin-off than by start-up founders is the importance of financial success and independence. There are also categories such as race, marital status, and parents' job in which no differences between spin-off and start-up creation are expected. For an overview, see table 2.

Table 2: Personal characteristics: different influences for spin-off and start-up creation

	Relevant categories	Spin-off-specific results	Spin-off-specific difference expected?
Person: Personal characteristics	• Age	Spin-off founders are older than start-up founders ( <i>Eriksson &amp; Kuhn, 2006; Koch, 2006</i> )	✓ Learning in a company requires time—spin-off founders are older
	• Race		✗
	• Sex	Spin-off founders are disproportionately often male ( <i>Eriksson &amp; Kuhn, 2006</i> )	✓ Spin-off founders are often from the technical world—more often male
	• Marital status		✗
	• Education	Well educated, more specialized, e.g., natural science or medical degree or applied for a patent ( <i>Chatterji; 2009; Cooper, 1984 &amp; 1986</i> )	✓ Spin-off founders often from technical world—additional education required
	• Employment status		✓ Technical, well educated employees might have lower unemployment risk
	• Management experience	Spin-off founders have a higher hierarchical level ( <i>Eriksson &amp; Kuhn, 2006</i> )	✓ Improved learning with information from different angles—manager
	• Income		✓ Technically oriented managers should have above-average income
	• Assets		✓ Above-average income and later founding allows build-up of more assets
	• Parents' job		✗
	• Job satisfaction	Spin-off founders have lower job satisfaction ( <i>Mueller, 2007; Garvin, 1983</i> )	✓ Different importance for drivers such as financial success

The empirical evidence supports the theoretical predictions. Spin-off founders are indeed on average **older** than start-up founders, more often **male**, and tend to come from a **technical background** (Eriksson & Kuhn, 2006; Koch, 2006). For example, 66% of spin-off founders in the medical device industry have either a natural science or a medical education or have

applied for at least one patent (Chatterji, 2009), which is above the average for start-up founders. Similarly, based on case studies for technical industries, it was established that spin-off founders are frequently above average in terms of **education and experience, and are often considered seasoned specialists** (Cooper, 1984, 1986). In addition, spin-off founders have more often previously worked in **high hierarchical positions** and in a larger variety of roles (Eriksson & Kuhn, 2006). Founders of spin-offs often also report low prior **job satisfaction** (Garvin, 1983; Mueller, 2007), which is frequently induced by a neglect of their idea or a strongly negative experience, for example, being passed over for an expected promotion (Audretsch & Keilbach, 2008). However, no studies directly compare job satisfaction of spin-off and start-up founders; thus, any assessment of the difference is speculative.

*Character specifics.* As mentioned above, this research area focuses on the differences between founders and non-founders, along their psychological characteristics and behaviors. According to the AT, OCT, and ELT, an employee with a mayor idea is often better off leaving the current company. Only founding his/her own company allows him to either develop and introduce the neglected idea (OCT and ELT) or to profit from it fairly (AT). Thus, an employee with a major idea is in a way “forced by the circumstances” to become an entrepreneur, which is often contrary to start-up founders. Consequently, spin-off founders could have a stronger push motivation and might not need to be the “prototype” founder. Basically, the better the learning, the lower the required quality of the skill set (Klepper & Sleeper, 2005). Thus, theory predicts that spin-off founders differ from start-up founders by

being more similar to employees in regard to **psychological characteristics** and **behavioral patterns**. For an overview, see table 3.

Empirical evidence for the differences between spin-offs and start-up founders regarding their psychological characteristics and their pattern of behavior is as yet lacking.

Table 3: Character: different influences for spin-off and start-up creation

	Relevant categories	Spin-off-specific results	Spin-off-specific difference expected?
Person: Character	<i>Psychological characteristic</i>		
	• Need for achievement		✓
	• Need for control		✓
	• Tolerance for ambiguity		✓
	• Career anchor—long-term preference		✓
	<i>Pattern of behavior</i>		
	• Reference-dependent—generalization based on a small, non-random sample		✓
• Bias in probability perception (prospect theory)		✓	
• Bias in self-assessment, e.g., too high self-esteem		✓	
			Spin-off founder "forced" to found to develop idea or profit from it fairly. Thus, founder is less of a prototype founder—fewer typical characteristics

*Motivation.* This research area details motivational differences between founders and non-founders. To create a new venture, a spin-off founder needs inclination (ELT), which could be influenced by the motivation. Those motivated more strongly by developing **innovations**

and receiving **recognition** are more likely to found spin-offs as a way to develop their own neglected idea. Despite the AT's prediction of not receiving the fair value for the idea by sharing with the employer, empirical and more anecdotal evidence suggests that ideas were usually presented to the current employer before a founding (Klepper, 2001). This might indicate that spin-off founders are motivated less by **financial success** or **independence**, as those strongly motivated by these two would run with their idea and found their own company instead of trying to convince their current employer to develop the idea internally. Based on the theory, spin-off founders are motivated more strongly by innovation and recognition and less by financial success and independence compared to start-up founders. Role and self-fulfillment should be similar across both founder types, as the theory is silent on both. For an overview, see table 4.

Table 4: Motivation: influence differences for spin-off and start-up creation

	Relevant categories	Spin-off-specific results	Spin-off-specific difference expected?
Person: Motivation	• Innovation		✓ Neglect of idea by current employer starting point for founding—disproportionately high interest in innovation
	• Independence		✓ Leaving as a last resort to develop the own idea—on average, less driven by independence
	• Recognition		✓ Limited recognition if idea is not introduced in the market—disproportionately high interest in recognition
	• Role		✗
	• Financial success		✓ Suggesting the idea to employer despite knowledge of "unfair" earning share—on average, less driven by financial success
	• Self-fulfillment		✗

Empirical evidence analyzing the motivational differences between spin-off founders and start-up founders is scarce at best. However, there are some studies on high-tech founders, which typically include a significant share of spin-off founders (Cooper, 1985). As more detailed results are lacking, those will be detailed next. A study based on 85 interviews in Australia showed that innovation and independence were the two most important factors for high-tech founders (Amit, MacCrimmon, Zietsma, and Oesch, 2000). Moreover, innovation, recognition, and achievement were the key motivations of academic spin-off founders (Corman, Perles, and Vancini, 1988). Innovation and recognition for the innovation seem to be the major driving forces for high-tech founders. As mentioned above, high-tech founders usually include a significant share of spin-off founders (Cooper, 1985). Thus, it is highly likely that spin-off founders are strongly motivated by innovation and recognition. Studies analyzing founders across industries, including non-technical industries, report a much lower motivation by innovation and recognition and a higher importance of financial success (Cassar, 2007). Thus, when comparing the more technical spin-off founders with the average start-up founder, motivational differences are highly likely. However, the existing evidence does not show whether that also holds true within one industry.

#### **2.4.2 Differences regarding the source environment**

Founding is also influenced by the environment and hence by sociocultural and external factors. Detailing will start with the former, including primarily local influences. Above, it was explained that spin-off founders have a higher push motivation, as founding is their

chance to develop and profit fairly from their idea. As a consequence, the pull motivation is less relevant for spin-off than for start-up founding. The **social status** of being an entrepreneur (one of the driving factors of the pull motivation) should therefore have a lower influence on spin-off creation. As also discussed above, the average spin-off founder has a lower personal risk of unemployment due to his/her above-average education and experience, reducing the effect of size and coverage of the **social system**. Differences across the unemployment regulations of the social system should have a lower influence on spin-off than on start-up creation.

An advantage of spin-offs is the founder's relationship to the parent company (the company he or she worked for before), since the founder often receives formal and informal access to additional resources such as knowledge, equipment, or potential employees (Chatterji, 2009). The advantage is strongest when the physical distance between parent company and spin-off is small (Buenstorf & Klepper, 2010; Klepper, 2007). Case examples often highlight the positive effect of speaking informally with former colleagues, for example over lunch, or just walking over with some puzzling results to talk to a former expert colleague (Bhide, 2000). **Regions** with a high density of relevant companies (often those with advanced technologies) should therefore see more spin-off foundings (Buenstorf & Klepper, 2010; Klepper & Sleeper, 2005). Start-ups also profit from proximity to potential customers, competitors, or suppliers for similar reasons, but spin-offs likely profit more from the proximity to their parent company and are thus more often founded in their region (Buenstorf & Klepper, 2009).

The ELT assumes that the employees profit from something they learned while being employed, allowing them to offer a product variant of the parent company's product (Klepper & Sleeper, 2005). However, products are often protected by patent against being copied. The ability to offer a product variant as a spin-off is therefore highly dependent on the protective power of the patents (Kim & Marschke, 2005), which is at least partially driven by the **patent laws**. Those should influence spin-offs more than other creations which do not rely on insider knowledge (e.g., start-ups) (Maselli, 1997). Population factors such as population density and social diversity are known to have an influence on founding, but the theory does not predict any difference across venture types. The same holds for employment rights and bureaucracy, which should have a similar effect on each. For an overview, see table 5.

The empirical evidence is once again limited, but there are some studies which evaluate specific regions, comparing spin-off and start-up founding. For example, there is empirical evidence of a higher rate of spin-offs compared to start-ups for the location Silicon Valley in the American laser industry (Klepper & Sleeper, 2005) and for Silicon Valley and Massachusetts for venture capital-financed spin-offs (Gompers et al., 2005). In addition, approx. 80% of spin-offs in Germany are located near their parent company (Koch, 2006), which should differ from the average start-up location distribution—otherwise, there would be a very strong agglomeration. Consequently, regional specifics do have an effect and, at least in Silicon Valley and Massachusetts, the effect is stronger for spin-offs than for start-ups (Buenstorf & Klepper, 2009; Klepper, 2007). Empirical evidence also suggests a lower turnover rate of employed scientists when more patents are applied for by the company (Kim & Marschke, 2005). This indicates that patents influence the spin-off rate and, thus, that the

power of the patent law should also have an effect. However, empirical analysis investigating whether there is a stronger effect on spin-offs than on start-ups is missing and can therefore only be speculated about.

Table 5: Socioculture: different influence for spin-off and start-up creation

Relevant categories	Spin-off-specific results	Spin-off-specific difference expected?	
<b>Environment: Socioculture</b>	<b>Population</b> <ul style="list-style-type: none"> <li>Population density</li> <li>Social diversity</li> <li>Others, e.g., population growth, urbanization rate, age structure</li> </ul>	<ul style="list-style-type: none"> <li>X</li> <li>X</li> <li>X</li> </ul>	
	<b>Legitimization</b> <ul style="list-style-type: none"> <li>Social status of entrepreneur</li> <li>Acceptance and support of entrepreneurial skills</li> </ul>	<ul style="list-style-type: none"> <li>✓</li> <li>✓</li> </ul>	<ul style="list-style-type: none"> <li>Leaving as a last resort to develop and profit from the own idea—on average, less effected by pull motivation of legitimization</li> </ul>
	<b>Social system</b> <ul style="list-style-type: none"> <li>Extensiveness and coverage</li> </ul>	<ul style="list-style-type: none"> <li>✓</li> </ul>	<ul style="list-style-type: none"> <li>Spin-off founding because idea is neglected, thus less push motivation from unemployment</li> </ul>
	<b>Regional specifics</b> <ul style="list-style-type: none"> <li>Regional tax</li> <li>Regional industry and economic</li> </ul>	<p>More spin-off creation in Silicon Valley (Klepper &amp; Sleeper, 2005), Massachusetts (Gompers et al., 2005), Detroit (Klepper, 2007), and Akron (Buenstorf &amp; Klepper, 2009)</p>	<ul style="list-style-type: none"> <li>X</li> <li>✓</li> </ul> <ul style="list-style-type: none"> <li>Technologically advanced regions with more spin-offs, as those are better parents</li> </ul>
	<b>Legal system and administrative complexity</b> <ul style="list-style-type: none"> <li>Extensiveness and accessibility of the legal system</li> <li>Level of employment rights</li> <li>Level of bureaucracy</li> </ul>	<p>Lower turnover rate when more patents are applied for (Kim &amp; Marschke, 2005)</p>	<ul style="list-style-type: none"> <li>✓</li> <li>X</li> <li>X</li> </ul> <ul style="list-style-type: none"> <li>Spin-offs rely on internal knowledge—patent law should have disproportionately high influence on spin-off founding</li> </ul>

The environment also influences founding through external factors independent of the location someone is in. As discussed above, and in line with ELT and OCT, a spin-off founder learns some kind of “insider” knowledge by working in the industry prior to founding. **Industries** in which insider knowledge is more relevant due to fast changing product requirements, high innovation speed, segment-specific supplier relationships, and low overall transparency (Garvin, 1983) should also see disproportionately high spin-off

creation, as insiders there have a competitive advantage over “external” founders. The knowledge can be acquired over time by any founder, but the spin-off founder has a head start. In addition, emerging industries should also offer more favorable terms for spin-offs, as the number of large companies aggressively defending their position in the market is limited (Helfat & Lieberman, 2002). In industries where the critical advantage is based not on skills and knowledge of the employee but rather on physical investments, spin-offs should appear less frequently (Garvin, 1983) or have a different character (Feeser & Willard, 1988). Here, the insider knowledge is less efficient.

A spin-off is often founded due to an idea being passed over, or in order to profit fairly from it (ELT/OCT/AT). Passing up on an idea needs time thus the idea was assumed to be profitable at economic conditions in the past and did not become profitable recently due to more favorable conditions. In addition, the spin-off needs fewer sales to be successful, as part of the development costs were borne by the founder’s former employer (Klepper & Sleeper, 2005). As a result, spin-off founding should not depend on a positive economic development; a stable demand should be sufficient (Gompers et al., 2005). The impact of **economic growth** or **industry growth** should therefore be lower for spin-offs than for other venture creation. As mentioned before, the push motivation of unemployment is lower due to the higher qualification of spin-off founders, leading to a reduced relevance of the **unemployment rate** for spin-offs compared to start-up creation. For an overview, see table 6.

External influences are analyzed empirically by some studies. No significant industry effect for spin-off founding was established based on a sample of VC-sponsored companies in NBER categories 2 and 3 (Gompers et al., 2005). The result might have been biased due to

the narrow sample and the limitation to public companies. A broader study based on the Danish population identified significant differences for spin-off rates across industries. For example, the financial, hotel, commerce, and service industries had significant spin-off founding variations (Eriksson & Kuhn, 2006), supporting the theoretic predictions.

Table 6: External factors: different influences for spin-off and start-up creation

	Relevant categories	Spin-off-specific results	Spin-off-specific difference expected?
Environment: External factors	<b>Industry and life cycle</b>		
	• Industry/industry type	Difference between financial, service, and hotel industry (Eriksson & Kuhn, 2006) No industry differences (Gompers et al., 2005)	✓ Industries which offer advantage of insider knowledge should see more spin-offs
	• Level of innovation		✓ Highly innovative industries offer additional chances for insiders
	• Position in life cycle	Later lifecycle, lower spin-off rates (Klepper & Sleeper, 2005); indicators for lifecycle with no effect (Brittain, 1986; Agarwal et al., 2004; Tübke, 2004)	✓ Emerging industries are positive for spin-off founding, later stages negative, as advantage is more capital-based
	<b>Economic cycle and unemployment</b>		
	• Overall economic growth	Stable growth and recession with high spin-off rate, low spin-off rate at very strong growth (Eriksson & Kuhn, 2006)	✓ Founding based on need or unused idea—only demand required
• Industry growth	Neither industry nor market growth with effect on spin-off founding rate (Brittain, 1986; Agarwal et al., 2004) only stable demand required—no positive economic industry growth required (Klepper & Sleeper, 2005), higher entrant rate also increases spin-off rate (Klepper, 2007)	✓ Founding based on need or unused idea—only demand required	
• Unemployment rate		✓ Spin-off founding because idea is neglected, thus less push motivation from unemployment	

Spin-off founding rates decreased in later life cycle stages in the American laser industry (Klepper & Sleeper, 2005). However, indicators used to proxy the life cycle stages, such as firm entrance rate or firm turnover rate, did not have any significant influence in the American semiconductor industry (Brittain & Freeman). Likewise, the industry sales and the number of companies in the industry did not have a significant effect on the founding of spin-

offs, neither in the American disk drive industry (Agarwal et al., 2004) nor across industries in Europe (Tübke, 2004). The results regarding life cycle stages are therefore inconclusive.

Neither the industry growth in the disk drive industry (Agarwal et al., 2004) nor the market growth in the American semiconductor industry (Brittain & Freeman) had a significant effect on spin-off founding. Similar results were established in the American laser industry, where favorable industry settings did not markedly increase spin-off rates (Klepper, 2007), but a stable demand preconditioned spin-off creation (Klepper & Sleeper, 2005). Results for Denmark are similar, indicating that spin-off rates were high in times of stable growth and during recessions (Eriksson & Kuhn, 2006). Only during times of very high growth was the spin-off founding rate reduced, probably because the employees wanted to profit immediately from this disproportionately high growth.

### **2.4.3 Differences regarding the source firm**

Founding is also dependent on the firm, especially the last company the founder worked for before the founding, which is spin-off-specific. Therefore, instead of comparing spin-offs to start-ups, it is only analyzed whether theory and empiricism are in line with each other along the identified factors. For an overview, see table 7.

Table 7: Spin-off-specific firm effects

Relevant categories	Spin-off-specific results	
Firm: Prior organization	Company size	<ul style="list-style-type: none"> <li>• Companies with fewer employees have more spin-offs (<i>Eriksson &amp; Kuhn, 2006; Gompers et al., 2005</i>)</li> <li>• Companies with lower sales volume do not have more spin-offs (<i>Agarwal et al., 2004</i>)</li> <li>• Company size is only relevant when not controlled for technical know-how (<i>Franco &amp; Filson, 2006</i>)</li> </ul>
	Company age	<ul style="list-style-type: none"> <li>• Inverted U-shape of spawning regarding age—first more spawning, then less (<i>Klepper &amp; Sleeper, 2005; Klepper, 2007</i>)</li> <li>• Older companies spawn fewer spin-offs (<i>Gompers et al., 2005</i>)</li> <li>• No significance of company age (<i>Agarwal et al., 2004</i>)</li> <li>• Companies which are young and small are the hotbeds of founding (<i>Wagner, 2004</i>)</li> </ul>
	Corporate growth	<ul style="list-style-type: none"> <li>• Significant growth effect across industries (<i>Eriksson &amp; Kuhn, 2006</i>)</li> <li>• Decreasing growth increases spin-off probability (<i>Gompers et al., 2005</i>)</li> <li>• No significant effect in the disk drive industry (<i>Agarwal et al., 2004; Franco &amp; Filson, 2006</i>)</li> <li>• Companies with better technological know-how spawn more (<i>Agarwal et al., 2004; Franco &amp; Filson, 2006; Klepper &amp; Sleeper, 2005; Gompers et al., 2005; Tübke, 2004</i>)</li> </ul>
	Know-how of parent co.	<ul style="list-style-type: none"> <li>• Companies with high-quality patents have even higher spawning rates (<i>Gompers et al., 2005; Klepper &amp; Sleeper, 2005; Klepper, 2007</i>) or more experienced production leaders (<i>Buenstorf &amp; Klepper 2009; Klepper, 2007; Buenstorf 2009; Burton et al., 2002; Chatterji, 2009</i>)</li> <li>• Early mover know-how or entrance position increases spawning rates (<i>Agarwal et al., 2004; Brittain, 1986; Franco &amp; Filson, 2006</i>)</li> <li>• Having superior knowledge and early mover experience decreases spawning rates (<i>Agarwal et al., 2004</i>)</li> <li>• Founding of parent company with VC increases spawning rates (<i>Gompers et al., 2005</i>)</li> </ul>
	Corporate focus	<ul style="list-style-type: none"> <li>• Focused companies have a higher spin-off rate (<i>Agarwal et al., 2004; Gompers et al., 2005</i>)</li> <li>• Diversified companies have a higher spin-off rate (<i>Brittain, 1986; Klepper &amp; Sleeper, 2005</i>)</li> </ul>
	Specific events	<ul style="list-style-type: none"> <li>• CEO change increases spin-off rates in the next two years (<i>Eriksson &amp; Kuhn, 2006</i>)</li> <li>• Ownership structure change increases spin-off rates (<i>Klepper &amp; Sleeper, 2005; Klepper, 2007</i>)</li> </ul>

**Company size.** The size of the company the founder is leaving has been identified as an important lever through the literature, e.g., (Cooper, 1985; Hyytinen & Maliranta, 2008). A direct theoretic explanation for the relationship has not been proposed to the best knowledge of the authors. Instead, several explanations via other levers have been speculated. For example, employees in small companies have a better possibility to establish a network, to have the founder as a role model, to get to know the entrepreneurial process, and to learn in more different roles, improving the learning and facilitating the spin-off founding. Other negatively directed explanations are that small companies have less career advancement options and fewer financial resources to develop additional ideas, which drives employees

into founding to benefit from their new ideas. In addition, employees in small companies might be preselected<sup>2</sup> based on above-average entrepreneurial skills. Thus, the relationship between corporate size and spin-off founding is frequently explained with the advantages and disadvantages small companies offer their employees (Hyytinen & Maliranta, 2008).

Empirical evidence strongly suggests that companies with fewer employees have more frequent spin-offs than larger ones, e.g., (Eriksson & Kuhn, 2006; Gompers et al., 2005). However, once the company size is measured by a different scale, such as sales volume (Agarwal et al., 2004), or controlled for the relatively higher technological know-how of small companies (Franco & Filson, 2006), the effect is no longer significant. Empirical evidence explaining how corporate size affects founding is missing completely. Basically, it is a stylized fact without an agreed theory (Wagner, 2004).

**Company age.** The age of the company the founder is leaving has also received attention in the literature, since younger companies often interact with unexploited ideas, while lacking the financial resources to commercialize all of them. Employees in young companies can learn about unexploited business opportunities more often, which should foster spin-offs. This often requires some time, explaining why middle-aged companies of approx. 14 years spawn the most spin-offs (Klepper, 2007). In addition, the same arguments hold as for employment in small companies, because most young companies are also small companies (Wagner, 2004).

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<sup>2</sup> Two preselection methods are possible: either self-selection by employees based on the idea that more relevant knowledge for founding an own company can be learned in small companies, or selection by the employer based on the need for employees with more entrepreneurial spirit in small companies or a stronger involvement of the founder in the recruiting process.

The empirical evidence is in line with the theory suggesting that older companies spawn fewer spin-offs (Agarwal et al., 2004; Gompers et al., 2005; Klepper, 2007; Klepper & Sleeper, 2005; Phillips, 2002), that young companies also spawn fewer spin-offs (Klepper, 2007; Klepper & Sleeper, 2005), and that companies which are young and small at the same time are the “hotbeds” for founding (not spin-offs exclusively) (Wagner, 2004). However, there are also examples, such as the disk drive industry, which do not show a significant effect of corporate age (Agarwal et al., 2004).

**Company growth.** The company’s development could influence the decision to found a spin-off, as flourishing companies can offer their employees additional benefits. These do not only include personal ones, such as bonuses and promotions, but also the possibility to more easily provide additional financial resources for the development of the employee’s idea. Once the growth rates decline, however, the employee might leave the “sinking ship,” following the same logic even faster. Empirical evidence is inconclusive—in the disk drive industry, for example, no company growth effect is identified (Agarwal et al., 2004; Franco & Filson, 2006), while studies across industries recognize the expected effect (Eriksson & Kuhn, 2006; Gompers et al., 2005).

Another factor suspected of having an influence on founding is the **know-how of the parent company** both in terms of technical knowledge and in terms of specific experience such as market entrance know-how. According to the ELT, the founder learns “something” while employed. Precisely what the individual learns is not yet established (Klepper, 2001); however, “something” needs to be there to learn from. Technical knowledge or specific experience, e.g., regarding FDA approval processes, is often speculated to be valuable

knowledge acquirable while working for a company (Buenstorf, 2007; Chatterji, 2009). Thus, companies having more thereof should also have higher spin-off rates (Burton, Sørensen, and Beckman, 2002; Garvin, 1983). Two additional arguments also point to a positive effect of cutting-edge knowledge in the prior company.

Founding is often based on a business opportunity, and identifying one is dependent on prior information and existing capabilities (Shane, 2000). Consequently, companies with cutting-edge knowledge could provide a greater likelihood of identifying a business opportunity. In addition, a new company often needs to rely on personal credibility to receive necessary complimentary resources (Birley, 1985; Johannisson, 1988). When unambiguous quality measures are rare, judgment can be influenced by origination from institutional affiliations (Gompers & Lerner, 2001). Being affiliated to a “marquee firm” strengthens the legitimization of a new venture (Stuart, Hoang, and Hybels, 1999). Marquee firm are often knowledge-rich firms which might have introduced groundbreaking innovations into the market (Aldrich, Renzulli, and Langton, 1998). As a result, having learned at the technological “leader” should increase the personal credibility, which in turn increases the probability of founding.

The empirical evidence suggests that companies with a better technological knowledge (Agarwal et al., 2004; Burton et al., 2002; Chatterji, 2009; Franco & Filson, 2006; Gompers et al., 2005; Klepper & Sleeper, 2005), detailed submarket-specific capabilities (Buenstorf, 2007), long-time top producers (Buenstorf, 2007; Klepper, 2007), and owners of high quality patents (Gompers et al., 2005; Klepper & Sleeper, 2005) spawn more spin-offs. In addition, companies which have early mover experience in an industry also spawn more

spin-offs (Agarwal et al., 2004; Brittain & Freeman; Franco & Filson, 2006). However, there is also evidence that having superior technological knowledge and an early mover advantage at the same time reduces the spin-off rate (Agarwal et al., 2004), indicating that employees leave companies less often to found if new ideas have a chance of being developed and introduced into the market. Interestingly, parent companies which were founded with the help of VC themselves also have a higher spin-off rate. Employees seem to learn from this experience as well (Gompers et al., 2005).

There are two contradicting arguments regarding the effect of **company focus**. One claims that companies focused on only one industry or product line should have more spin-offs. Employees with ideas not covered by the company focus are forced to leave and start their own company to realize the idea. The other claims that diverse companies offer employees a better learning environment (e.g., combination of product features), which would in consequence have a higher spin-off rate. Both theories—a higher spin-off rate of focused companies (Agarwal et al., 2004; Gompers et al., 2005) and a higher spin-off rate of diverse companies (Brittain & Freeman; Buenstorf, 2007; Klepper & Sleeper, 2005)—have some empirical support.

Furthermore, it is suspected that **specific events** which disrupt a company, such as a new CEO, induce additional uncertainty in the employee-employer relationship. A new CEO might, for example, redistribute resources or at least slow important decisions. This might lead to more employees founding a spin-off. Empirical evidence supports the theory, as a new CEO (Eriksson & Kuhn, 2006; Klepper, 2007) and owner changes (Klepper & Sleeper, 2005) seem to have the expected effect.

## **2.5 Result**

This section summarizes the results and highlights the research gaps identified for founding a spin-off. These are influencing factors where the theoretic predictions are either not in line with the empirical results or where empirical results are missing completely.

Personal characteristics vary between spin-off and start-up founders. Factors such as age, education, or gender were theoretically predicted to have a different influence on spin-off than on start-up founding, supported by empirical evidence. However, there exist theoretical predictions which have not been empirically tested—for example, income and assets—which are expected to be higher for spin-off than for start-up founders. The question of how job satisfaction varies between founder types has also not been addressed empirically.

The character of founders and non-founders differs. Empirical evidence has identified behavior differences such as a bias in probability perception and varying psychological characteristics. The spin-off theory implies that spin-off founders are often not the “prototype” founders. Instead, they are forced by the circumstances to become entrepreneurs to develop and profit fairly from their idea. Thus, the theory predicts that spin-off founders might vary in respect to psychological characteristics and patterns of behavior when compared to start-up founders, which has as yet not been tested empirically.

The drivers of motivation for founders and non-founders should vary according to the literature, but the empirical evidence is inconclusive. One reason for this could be that the differences between spin-off and start-up founders regarding motivation were not taken into account properly. According to the theory, spin-off founders should be motivated more strongly by innovation and recognition and less by financial success and independence. They

decide to found in order to develop their neglected idea and not to be more independent or earn more money. These predicted differences, however, have not yet been tested empirically.

Spin-off theory predicts several differences regarding the influence of socioculture on spin-off and start-up creation. Spin-offs are founded out of a need to develop a neglected idea; thus, neither the pull motivation of the social status nor the limitation of the push motivation by an extensive unemployment system should have a similar effect. The importance of the patent laws should also vary, as spin-offs rely more often on protected internal knowledge of their former employer. In addition, the spin-off profits most from the relationship to the parent company if the local proximity is high, leading to a regional allocation. Empirical evidence is scarce at best. Some evidence exists on regional allocation, but other effects have not yet been analyzed.

External factors such as industry, life cycle, economic cycle, and industry growth should also vary between spin-off and start-up creation. Young, intransparent, technologically driven industries should experience more spin-off creation. Similarly supported by evidence, industrial growth and economic cycle have a lower effect on spin-off creation. The business idea relies only on stable demand and does not become more profitable all of a sudden due to a change of economic growth. Theory also predicts a lower effect of the unemployment rate on spin-offs, as the push motivation of unemployment is limited, but this theory has not yet been empirically validated, either.

The firm the founder worked for before also has an important influence on venture creation, especially if the former was active in the same industry. The size of the parent

company has been identified as a stylized fact. The explanations do not suggest a direct relationship; instead, they assume that corporate size influences spin-off founding via a different lever. Several are suspected, e.g., a better possibility for building a relevant network, but none have been empirically proven.

Two diametric arguments have been suggested for the effect of corporate diversity on spin-off creation. One implies that working for a focused company has a positive influence on spin-off creation, the other implies a negative. Interestingly, there is empirical evidence for both theories from different industries. Thus, a further validation across industries is required to identify which is more accurate.

In addition, spin-off theory details that specific company events which disrupt the organization have an influence on spin-off founding. This is supported by empirical evidence for CEO changes and owner structure changes. Nevertheless, the list of disruptive events is by no mean exhaustive. Events such as a redesign of the organizational structure or a restructuring of the organization through waves of layoffs should also induce insecurity and could thus influence the creation of spin-offs. Again, additional empirical research is required.

## **2.6 Conclusion**

Founding a new venture is influenced by three sources: the person, the environment, and the firm. This paper has highlighted that the personal characteristics—the motivation and the character—differ significantly between founders of start-ups and spin-offs. Consequently, when analyzing founding from a personal perspective, it is essential to take spin-offs into account specifically. The same holds true when environmental conditions are detailed, as

external factors and socioculture have a varying influence on spin-off and start-up creation. In addition, the effect of the parent company should also be analyzed specifically, as it is probably stronger for spin-offs. Hence, when analyzing founding incorporating spin-offs, specifics are required, since spin-offs are a large, significantly different subgroup, which might interfere with the results. Furthermore, this review has identified several factors where theoretic differences are expected and an empirical validation is required. These factors are recommended for future research.

### **3 Chapter – Paper II**

#### **Why have most spin-off founders previously worked for small companies? An empirical analysis of seven common explanations**

##### **Abstract**

*This article details the unexplained stylized fact of why most individuals who choose to start a new venture have previously worked for small companies. Seven explanations (company size is positively mediated by experience working in a young company, network size, quality of experience, breadth of experience, job security, job satisfaction, and expecting a promotion by founding a spin-off) were derived from the Employee Learning Theory and the Voluntary Turnover Theory. All were empirically tested simultaneously on the basis of a mail survey administered to patent applicants in Germany, including spin-off founders. With the exception of breadth of experience and expectation of a promotion, all measures had a significant effect on the probability of founding a spin-off, but none were capable of explaining the stylized fact that most of the founders had worked for small companies. As the most common reasons discussed in the literature are not supported, additional explanations are required and proposed.*

### **3.1 Introduction**

The endeavor to understand why some individuals choose to start a new venture and others do not represents a major research field for management scholars (Acs & Audretsch, 2003; Venkataraman, 1997). Newly created ventures have a positive influence on the job market (Thurik et al., 2008) and the economy in general (Agarwal, Audretsch, and Sarkar, 2007; van Stel et al., 2005) and are crucial to economic development (Schumpeter, 1942). Studies analyzing new venture creation, which control for former company size, have determined a stylized fact: the founders of new companies have a disproportionately high likelihood of having previously worked for small companies, i.e., those with fewer employees (e.g., Boden, JR, 1996; Eriksson & Kuhn, 2006; Georgellis & Wall, 2005; Gompers et al., 2005). For a summary of these studies, please see table 5 in the appendix. To the best of the authors' knowledge, there is no agreed-upon explanation for the stylized fact, and as Hyytinen & Maliranta, (2008 p. 18) stated, "distinguishing between these alternative explanations is left for future work." Understanding this stylized fact is important, as it allows on the one hand an increase in the explanatory power and on the other hand an opportunity to test the current entrepreneurship theory. Arguments supportive of the stylized fact should offer directions for future detailing, while those not supportive should be reconsidered. Several authors have highlighted the importance of the stylized fact, often leading to speculations as to why the empirical result occurred (Cooper, 1985; Feeser & Willard, 1989; Gompers et al., 2005; Hyytinen & Maliranta, 2008; Mason, 1991; Mueller, 2006; Wagner, 2004). Although a stylized fact exists regarding the founding of spin-offs, there is no consensus on why this fact

is true, and it is therefore important to uncover the explanation to advance entrepreneurship theory for this stylized fact.

The goal of this study is to analyze whether seven explanations currently discussed in the literature are supported by empirical evidence for spin-off founding in Germany. Spin-off founding, unlike the more general entrepreneurship, is analyzed because by definition the founder previously worked for another company in the same industry (Klepper & Sleeper, 2005). For other de novo companies such as those founded out of university, the stylized fact might not be compelling, since these founders do not have a former company. To derive the seven explanations for the stylized fact, an explanatory model for spin-off founding based on the Employee Learning Theory (ELT) and the Voluntary Turnover Theory (ELT) is developed. This model allows simultaneous testing of these explanations, which represents the main contribution. The approach appears to be unique; no literature currently exists that empirically tests these explanations.

The remainder of the paper is structured as follows: The theory chapter presents the explanatory model developed for spin-off founding and the derived hypotheses. Next, the research design is presented, followed by the empirical evidence. After this, the results are discussed, and finally, the conclusions are drawn.

## **3.2 Theory**

### **3.2.1 Explanatory model**

The ELT is the starting point of the explanatory model, since a recent literature review on spin-off founding theories concluded that it resonates best with the empirical spin-off findings across all analyzed industries in various papers (Klepper, 2001). The literature

provides two models of spin-off founding that feature employee learning in an industry evolution context. Both assume that the employee can learn from the company he or she works for and will profit from this by founding. In Franco & Filson (2006)'s model, the employee can only capitalize on knowledge by founding a spin-off, whereby the success of the spin-off is dependent on the level of knowledge the founder acquired from the former employer. In Klepper & Sleeper (2005)'s model, each company offers an optimal set of product variants, which leaves no room for profitable entrance by non-spin-offs. However, due to the employee's learning, he or she can found a spin-off at a lower cost based on a variant of his/her former employer's product, thus allowing the spin-off to be sustained in the existing smaller niches.<sup>3</sup> Hence, according to the ELT, individuals will found a spin-off once they have learned sufficiently and possess the necessary organizational skills and inclination (Bankman & Gilson, 1998).

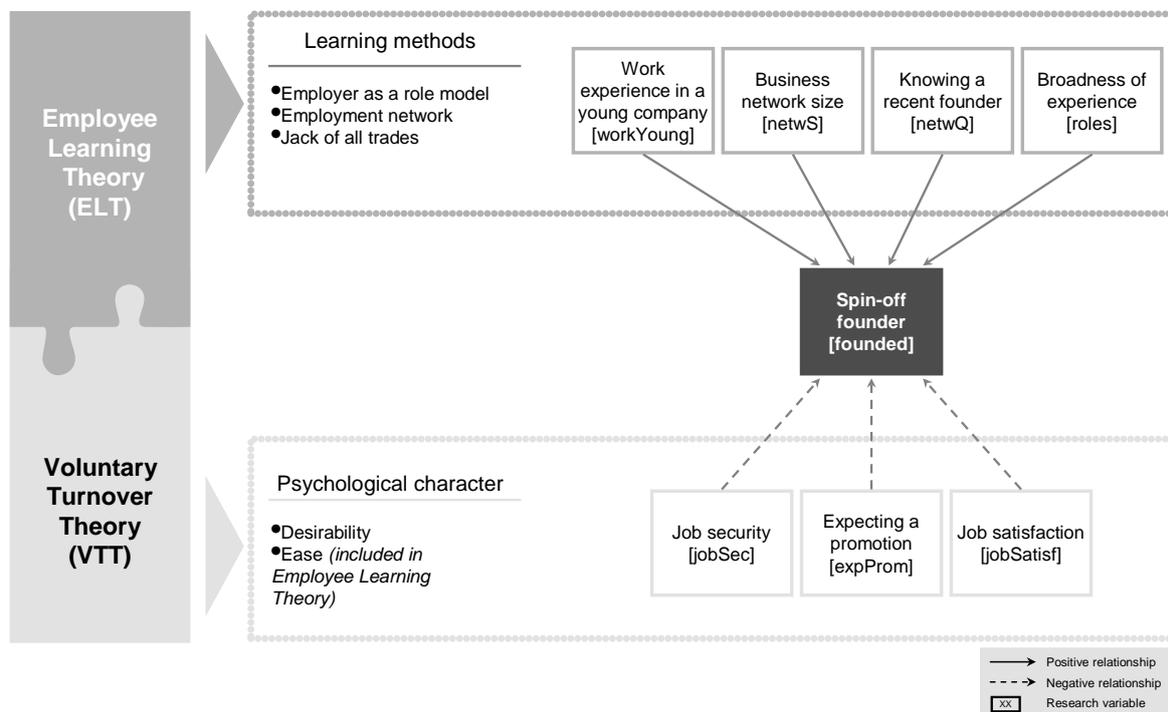
However, the ELT lacks details on what and how the employee learns while employed (Chatterji, 2009; Klepper, 2001). Therefore, three learning methods are applied: having an employer as a role model, having a relevant network, and being a Jack of all trades. Each will be discussed in conjunction with the respective hypothesis. The theory is also short of a precise definition of the term inclination. Therefore, the VTT is applied, which states that the decision to leave one's current job depends on an inducement-contribution utility balance, which, in turn, is based on two pillars: the perceived ease of moving on and the perceived desirability of doing so (March & Simon, 1958). Ease is often conceptualized as the quality of the alternative, while desirability is described on the basis of job satisfaction and

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<sup>3</sup>The employer did not develop additional variants to close those smaller niches, because the costs would exceed the benefits. He is thus better off gambling on the non-appearance of a spin-off as long as the probability of having employees with the required organizational skills and inclination is low.

organizational commitment (Felps, Mitchell, Hekman, Lee, Holtom, and Harman, 2009). In the context of spin-offs, ease is not only the quality of the alternative but also what has been learned and the level of developed organizational skills that make a transfer easier—this therefore resonates very well with the ELT. In contrast, desirability compares the current situation with the opportunity. Although it includes inclination, it delves deeper by also considering external pressures such as job security. For more details on the VTT, see Griffeth, Hom, and Gaertner (2000) and the overview of the applied measures, which will be detailed together with their respective hypothesis (figure 3).

Figure 3: Overview of applied theories

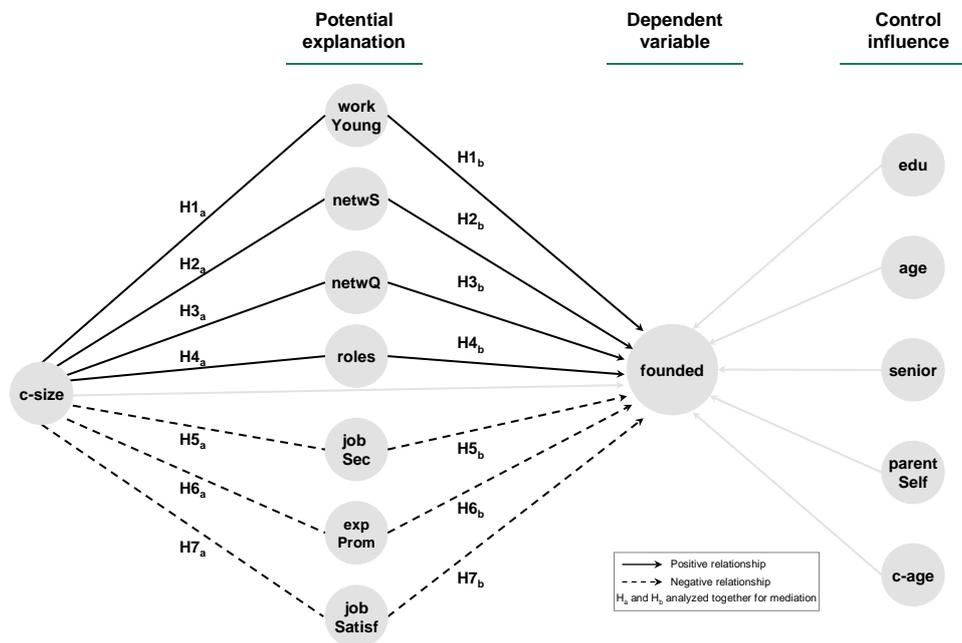


### 3.2.2 Hypothesis development

As mentioned in the introduction, the empirical evidence across the literature points, without a unified explanation, toward the stylized fact that founders of new companies are much more likely to have previously worked in small companies. To the best of the authors' knowledge, there is as yet no theory linking former company size to spin-off founding directly, i.e., without intermediates. Instead, the explanations typically assume that former company size acts on founding via intermediates (figure 4).

Figure 4: The research model

HX<sub>a</sub> and HX<sub>b</sub> together validate whether each measure mediates company size on founding a spin-off: Seven hypotheses, H1–H7, are tested. Company size (c-size) and five additional control variables are included in the model.



### 3.2.2.1 Explanations derived by the ELT

The current employer can be a role model for the employee by serving as a social model to be emulated (Johnson, 1986; Mason, 1991). However, learning from a role model depends on the proximity of the interaction, which should be optimal in young companies (Wagner, 2004). In addition, while working in that company, the employee has the opportunity to gather information about the transition from employment to entrepreneurship and the challenges faced during the processes of founding and establishment and their respective solutions (Sorensen & Audia, 2000). Thus, the work experience one gains while working for a young company should facilitate the establishment of a spin-off and should therefore increase the probability of founding a new company.

Employees of small companies are more likely to have experience working in a young company because young companies tend to also be small companies (Wagner, 1997). In addition, these employees change their job more frequently, which increases the chances of an individual having worked in a young company at one time (Mobley, 1982). As a consequence, having experience in a young company could be an explanation for the stylized fact.

*H1: Company size (c-size) is positively mediated by experience working in a young company toward founding a spin-off.*

When comparing the development of the corporate landscape in Silicon Valley and along US Route 128 in the 1980s, Saxenian (1994) concluded that the larger number of small

companies in Silicon Valley was one of the key factors explaining the disproportionately high growth there. They offered a decentralized and flat organizational structure, which provided a network for exchange of opportunities and growth (Dubini & Aldrich, 1991). Similarly, working in a company will expose the employee to a network of suppliers of labor, goods, and capital, as well as to a network of customers and competitors (Hite, 2005). The network acts not only as a source of information on new opportunities (enhanced knowledge) (Baron & Ensley, 2006), it also allows a potential entrepreneur to rely on personal credibility to receive necessary complimentary resources (Birley, 1985; Johannisson, 1988) in absence of a track record. In addition, the network established while working as an employee becomes part of the social capital inherited by the spin-off (Higgins & Gulati, 2003). Both reduce the liabilities of a new enterprise (Stinchcombe, 1965) and thus help the founding. The effectiveness depends on the size of the network. Having a small network, e.g., only one close contact, will limit the opportunity to learn valuable information or receive helpful resources, as each close contact can only provide a certain amount (Singh, Hills, Lumpkin, and Hybels, 1999).

Employees in small companies have a wider scope of tasks, as they are less specialized (Hyytinen & Maliranta, 2008). This could enable them to have a larger relevant network. Furthermore, company size could influence the size of the network, which, in turn, could be the reason behind the stylized fact.

*H2: Company size is positively mediated by the employee's network size toward founding a spin-off.*

The effectiveness of the network is also conditioned by the network quality, which is dependent on the task. Having a network of high-quality suppliers, while likely not being very helpful in securing capital, would indeed be helpful when it comes to designing the supply chain. Being in contact with a recent founder may give an entrepreneur the opportunity to learn from that person's experience, which would be helpful when considering founding a spin-off (Davidsson & Honig, 2003). Alternatively, observing a founder may increase the interest in becoming one, as the founder acts as a role model (Baron, 2000). The empirical evidence confirms that the probability of becoming self-employed increases with each additional entrepreneur known to an employee (Arenius & Maria Minniti, 2005; Minniti, 2004). Thus, knowing a recent founder should increase the readiness to found a spin-off.

Employees in small companies come in contact with entrepreneurs more often due to the regional clustering of new ventures (Fosfuria & Rønne, 2004; Santarelli & Vivarelli, 2007) or due to selection—more entrepreneurs leave small companies; hence, employees in small companies are more likely to know an entrepreneur. Both explain that company size correlates strongly with knowing a recent founder (network quality), which, in turn, could be an explanation for the stylized fact.

*H3: Company size is positively mediated by an employee's network quality toward founding a spin-off.*

Entrepreneurs must incorporate, manage, and delegate several different resources, which is easier when the entrepreneur has at least a basic knowledge of a large number of business areas, thus being a Jack of all trades. Even hiring others to perform the task requires some knowledge in order to judge the quality of the applicants. The most common way of learning relevant knowledge is by gaining work experience in a variety of roles (Lazear, 2005). Individuals with the goal of becoming an entrepreneur could consciously try to work in different roles to acquire the varied background that is conducive to founding. This explanation seems to dominate the literature and resonates well with the ELT. Alternatively, endowment differences in the general skill set across people could allow those with more skills to work in more roles, thus making them better qualified for entrepreneurship. Empirical studies of Stanford MBA students and the German population yield similar results, as the number of roles positively influences the likelihood of becoming an entrepreneur (Lazear, 2005; Wagner, 2004).

Employees in small companies tend to have a broader scope of tasks, as they are less specialized (Hyytinen & Maliranta, 2008) and are exposed to more detailed knowledge (Garvin, 1983). This could allow employees in small companies to learn a broader set of skills, which, in turn, could explain the stylized fact.

*H4: Company size is positively mediated by the number of roles inherited toward founding a spin-off.*

### 3.2.2.2 Explanations derived from the VTT

No explanations were derived from the ease pillar of the VTT, as it resonates very well with the ELT. Three promising explanations—job security, expecting a promotion, and job satisfaction—were selected on the basis of desirability. Each will be explained in conjunction with the respective hypothesis.

Job security—that is, the subjective perceived likelihood of involuntary job loss (de Witte, 1999)—reflects the difference between the job security that is experienced and the one that is preferred (Hartley, Jacobsen, Klandermanns, and van Vuuren T., 1991). A low level of job security is a source of stress that creates fear and anxiety (Greenhalgh & Rosenblatt, 1984). The intention of leaving one's current job increases to avoid this stress completely (Arnold & Feldman, 1982) or because—for those who are worried about job continuity—it is rational to look out for more secure opportunities (Greenhalgh & Rosenblatt, 1984). A low level of job security could also be a weak form of forced self-employment, where those expecting unemployment become entrepreneurs to avoid being unemployed (Brixy et al., 2009; Brockhaus & Nord, 1979). The empirical evidence collected by meta-analysis indicates that people with a lower level of job security have a higher turnover intention and turnover rate (Sverke, Hellgren, and Näswall, 2002); thus, they are more open to other options.

Small companies have a more variable growth rate and a higher mortality than large companies (Brock & Evans, 1986; Evans, 1987), resulting in a lower overall level of job security (Wagner, 1997). This effect is partially countered since individuals with a lower interest in job duration or stability should also be more attracted by those jobs (Evans & Leighton, 1989), which increases the subjective level of job security.

*H5: Company size is positively mediated by the level of job security toward founding a spin-off.*

A promotion is a reward in itself and a source of status and additional income, leading to more interesting work, more responsibility, and a greater use of one's knowledge and abilities (Childs, 1985). Therefore, employees expecting a promotion should have a lower desire to leave their current company (Wagner, 2004).

Small companies usually have fewer levels of hierarchy, as well as fewer positions at each level, resulting in an overall lower likelihood of promotion once an employee has reached managerial level (Mueller, 2006). Hence, in small companies, employees have less reason to believe that a promotion is imminent.

*H6: Company size is positively mediated by the expectation of a promotion toward founding a spin-off.*

Low job satisfaction, or the difference between an individual's level of aspiration and the conditions of the current employment situation (Benkhoff, 1997), is a motivation to search for opportunities beyond one's current job (Herron & Sapienza, 1992). The lower the level, the more extensive the search for new opportunities will be because of emotionally driven avoidance, attraction to alternatives, or other motives arising from dissatisfaction (Moblely, 1977). Empirical evidence is supportive, as a reduced level of job satisfaction increases

voluntary turnover intention, turnover, and interest in becoming self-employed (Hyytinen & Ilmakunnas, 2007b; Tett & Meyer, 1993).

There is also support for the relationship between company size and the level of job satisfaction. Employees founding a spin-off often feel frustrated due to a neglect of their proposed idea (Garvin, 1983), which could have been induced by the limited resources of small companies. In contrast, (Schiller, 1986) reports higher job satisfaction among young employees in small companies. Thus, company size should have an influence on the level of job satisfaction, but the direction is open for discussion. For similarity with the other hypotheses, a test is conducted assuming an overall positive relationship.

*H7: Company size is positively mediated by the level of job satisfaction toward founding a spin-off.*

In addition, five control variables were included in the model and discussed briefly as follows. For more details, see the cited literature. Age, the first control variable, decreases the probability of turnover (Arnold & Feldman, 1982) and founding (Eriksson & Kuhn, 2006; Grilo & Irigoyen, 2006). The second, education, and the third, seniority, also both have a positive effect on founding (Blanchflower, 2004; Cooper et al., 1991; Hyytinen & Ilmakunnas, 2007a), which is explained by better preparation for the wide range of problems confronting the founders of new ventures (Stuart & Abetti, 1987). The fourth, a self-employed parent, increases the probability of founding a spin-off as a result of first-hand experience (Duchesneau & Gartner, 1988; Dunn & Holtz-Eakin, 2000; Fairlie & Robb, 2007), and the fifth, company age, increases the probability of founding because young companies can be

hotbeds of founding (Wagner, 2004). In addition, despite the lack of a direct theoretical explanation, company size is included because it is part of the stylized fact. It allows controlling whether the stylized fact holds for this sample and evaluating how the relationship changes once the additional measures are applied.

### **3.3 Research design**

This paper analyses the direct effect as well as the indirect influence of company size on founding a spin-off using a two-step approach. The first step establishes the direct effect of company size and measures on founding a spin-off, while the second investigates whether company size is mediated.

#### **3.3.1 Sample and data collection**

This study focuses on German technology-based spin-off founding, as this constitutes a significant and economically important sub-group (Brixy et al., 2009). The individuals of interest were required to be male and to have submitted at least one German patent application together with a company in 2006/07 in international patent classification H04, G10L, C02, B09, H61B, H61C, H61F, H61G, H61H, H61J, or H61M, all of which govern the clean-tech, medical technology, and communication industries. Moreover, patent applicants were excluded if they did not file together with a company (to avoid free inventions) and if the address of either the company or the individual was outside Germany. To limit company effects, only 15 individuals per company were randomly selected if more than 15 different researchers from the same company had filed a patent application in 2006/07 in the above patent classifications. In total, the sample consisted of 1,650 individuals

who were sent a mail survey. This group of individuals was selected because they currently work at the technological edge in their respective fields, very likely have a good grasp of the market, and work in industries that have recently seen many new ventures. Consequently, they have good starting conditions to be classical spin-off founders (Almeida & Kogut, 1999).

Of the 324 questionnaires that were returned (19.6%), 61 were excluded for various reasons: 3 because the respondent was female, and women are less likely to found (Blanchflower & Oswald, 1998), 30 because they entered into self-employment without founding a spin-off, and 28 because their questionnaires had extensive missing values or clear signs of misunderstandings. Identifying these unfitting cases before was impossible due to a lack of information, leaving 263 observations. In total, these had 120 missing values (1.98% of the total values), all missing completely at random, since Little's MCAR test (Little & Rubin, 1987) for the non-random distribution of missing values showed no significance ( $p > 0.05$ ). Based on this finding, any imputation method (replacement) could be applied (Hair, Anderson, Tatham, and Black, 1998). The study used Multivariate Imputation by Chained Equations (MICE) to generate an average over a set of 20 imputed data samples in order to replace the missing values (van Buuren & Oudshoorn, 1999). This method allows the simultaneous generation of imputed data with different data levels, from nominal scales to interval scales without relying on a specific distribution assumption.

### **3.3.2 Variables**

The questionnaire employed in this study had never been used in the context of patent applicants and spin-off founding and included instruments created or adapted for this

purpose. Nomology and content were therefore validated by means of a proven two-stage preliminary test (e.g., Enns, Huff, and Higgins, 2003). First, seven academics (faculty members and PhD students) reviewed the survey and research model, after which ten individuals randomly selected from the sample were asked to respond to the questionnaire in detail. Follow-up telephone interviews confirmed that each question was relevant and understood correctly, and that no important dimensions were omitted. The variables will be mentioned briefly in the following; for more details, see table 4 in the appendix.

The following factors were coded as dummy variables: employment experience in a company 10 years or younger (*workYoung*) (Wagner, 2004), proximity to a recent founder (*netwQ*) (SOEP), company size of 200 or less (Leptien, 1996; Wagner, 2004), and founding of a spin-off (*founded*). The latter took the value of 1 if respondents had become self-employed in the same industry without participating in a family business, a management buyout, or a university/research institute spin-off.

The metric codes were the number of close business contacts someone had (*netwS*) (Birley, Cromie, and Myers, 1991; Burt, 1984; Marsden, 1990) and the breadth of the experience measured by the number of different roles held (*roles*) (Lazear, 2005; Wagner, 2004).

The following were assessed as the sum of several 1–7 Likert scale questions: expecting a promotion (*expProm*) (SOEP), level of job security (*jobSec*) (McKnight, Phillips, and Hardgrave, 2009), and level of job satisfaction (*jobSatisf*) (Leptien, 1996). The questions regarding satisfaction with a promotion and job security were included in *expProm* and *jobSec* to limit multicollinearity<sup>4</sup>. Internal consistency was present for all variables, as the

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<sup>4</sup> Leaving certain aspects of job satisfaction aside has been done before, for example, when considering actual job quitting, only the future components of job satisfaction were analyzed Clark (2001).

Cronbach alphas were above the threshold of 0.7 (Cohen, 2009), and the principal axis factor analysis had one explaining factor with an eigenvalue above 1, except for one question on expProm, which was excluded.

To rule out alternative explanations, five control variables were additionally incorporated: level of seniority (senior), employee's age (age), employee's education (edu), parent self-employment (parentSelf), and company age (c-age). While age was assessed as years since birth, the other factors were coded as dummy variables.

The sample consisted of founders and employees. While the latter answered the questionnaire from their current point of view, the former were asked to apply their responses to the last position they held before founding their spin-off. They had to recall past events to answer the questions, which could lead to a recall bias, as the use of cognitive information collected in retrospective is methodically critical (Ericsson & Simon, 1984). This will be further discussed in (chapter 3.6).

### **3.3.3 Method**

Due to the binary scale of the dependent variable (founded), a maximum-likelihood logistic regression was applied (Long & Freese, 2006). The likelihood ratio test and chi-square test were calculated to validate the rejection of the null hypothesis and the difference in explanatory power across models. Afterwards, the mediation of company size (c-size) was tested through bootstrapping<sup>5</sup> (Preacher & Hayes, 2008), allowing the simultaneous testing of multiple mediators while considering controls. The mediation effect was calculated as the

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<sup>5</sup> An SPSS macro, which accompanies Preacher & Hayes (2008) and is available for download on <http://www.comm.ohio-state.edu/ahayes/>, was used to analyze the mediator effect. The approach limits distributional problems; its use is therefore strongly recommended.

product of the regression coefficient from company size to a proposed mediator (path a) and the regression coefficient of this proposed mediator toward the dependent variable (path b).

Applying the bootstrap procedure creates a specified number of additional cases (5,000 across this study) by randomly sampling with replacement from the original responses. Their mean value, standard deviation, and confidence intervals are estimated and combined for an overall assessment. Statistical significance requires that no zero is included in the bias corrected and accelerated 95% confidence intervals. Since the applied macro does not operate with nominal mediators, a separate regression for path a was calculated in those cases. To facilitate interpretation, all variables except the dependent variable were standardized before and held to their mean when not discussed (Cohen, 2009). The calculation was supported by SPSS version 17 in combination with the abovementioned macro.

### **3.3.4 Descriptive statistics**

Table 8 and 9 presents the descriptive statistics for the whole sample, a split by the variable founded (highlighting differences between founders and non-founders), and a split by the variable c-size to identify differences across company sizes. As expected, spin-off founders were more likely to have previously worked in smaller (c-size:  $\Delta$ mean 0.302\*\*\* t = 4.559) and younger (c-age:  $\Delta$ mean 0.120\*\* t = 2.204) companies. Although they were younger (age:  $\Delta$ mean -6.723\*\*\* t = 6.005), they more often held senior positions (senior:  $\Delta$ mean 0.285\*\*\* t = 4.291). In addition, more knew a founder (netwQ:  $\Delta$ mean 0.250\*\*\* t = 3.642), had a smaller network (netwS:  $\Delta$ mean -0.663\*\* t = 2.843), a lower level of job security (jobSec:  $\Delta$ mean -2.079\*\* t = 3.031), and a lower level of job satisfaction (jobSatisf:  $\Delta$ mean -2.555\*\*

t = 3.193). Most of those working in small companies had employment experience in a young company (workYoung:  $\Delta$ mean 0.378\*\*\* t = 6.654), a higher level of seniority (senior:  $\Delta$ mean 0.198\*\* t = 3.256), and a lower age (age:  $\Delta$ mean -4.204\*\*\* t = 3.852). In addition, small companies were also more often young companies (c-age:  $\Delta$ mean 0.378\*\*\* t = 6.654). Multicollinearity is not a serious concern, as the VIF average was 1.31 (maximum 1.61), and only four Pearson correlations had a value above 0.4 (none was above 0.5).

Table 8: Descriptive statistics of the sample:  
total sample, difference between founders and employees,  
and difference between employees in small and large companies

Variables	Total sample		Grouped by founded						Grouped by company size							
	Mean	SD	Spin-off founded		Employed		$\Delta$ Mean	T-value	P-value	$\leq 200$ employees		$> 200$ employees		$\Delta$ Mean	T-value	P-value
			Mean	SD	Mean	SD				Mean	SD	Mean	SD			
founded	0.251	0.434								0.406	0.494	0.162	0.369	0.245***	4.559	<0.001
age	42.430	9.035	37.394	7.499	44.117	8.892	-6.723***	6.005	<0.001	39.760	8.096	43.964	9.210	-4.204***	3.852	<0.001
senior	0.635	0.482	0.848	0.361	0.563	0.497	0.285***	4.291	<0.001	0.760	0.429	0.563	0.498	0.198**	3.256	0.001
edu	0.567	0.496	0.545	0.502	0.574	0.496	-0.028	0.396	0.693	0.500	0.503	0.605	0.490	-0.105	1.653	0.099
parentSelf	0.224	0.418	0.288	0.456	0.203	0.403	0.085	1.430	0.154	0.208	0.408	0.234	0.424	-0.025	0.475	0.635
c-age	0.183	0.387	0.273	0.449	0.152	0.360	0.120**	2.204	0.028	0.427	0.497	0.042	0.201	0.385***	8.841	<0.001
c-size	0.365	0.482	0.591	0.495	0.289	0.455	0.302***	4.559	<0.001							
workYoung	0.354	0.479	0.288	0.456	0.376	0.486	-0.088	1.290	0.198	0.594	0.494	0.216	0.412	0.378***	6.654	<0.001
netwS	3.971	1.604	3.474	1.670	4.137	1.551	-0.663**	2.843	0.005	4.198	1.553	3.840	1.623	0.358	1.770	0.078
netwQ	0.586	0.494	0.773	0.422	0.523	0.501	0.250***	3.642	<0.001	0.646	0.481	0.551	0.499	0.095	1.505	0.133
roles	3.156	1.368	3.273	1.431	3.117	1.348	0.156	0.777	0.439	3.313	1.482	3.066	1.295	0.247	1.359	0.176
jobSec	21.073	4.897	19.516	5.797	21.595	4.452	-2.079**	3.031	0.003	20.705	5.163	21.285	4.740	-0.58	0.904	0.367
expProm	12.155	4.388	12.495	4.936	12.041	4.196	0.454	0.727	0.468	12.628	4.716	11.883	4.178	0.745	1.284	0.201
jobSatisf	31.123	5.723	29.209	6.488	31.764	5.308	-2.555**	3.193	0.002	30.896	6.106	31.254	5.506	-0.358	0.474	0.636
N	263		66		197					96		167				

\*p < 0.10 \*\*p < 0.05 \*\*\*p < 0.001 two-tailed test

Table 9: Pearson correlations of the sample

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
founded	1													
age	-0.323**	1												
senior	0.257**	0.029	1											
edu	-0.025	0.164**	0.07	1										
parentSelf	0.088	-0.024	0.01	-0.081	1									
c-age	0.135*	-0.231**	0.154*	-0.004	0.053	1								
c-size	0.272**	-0.224**	0.198**	-0.102	-0.029	0.480**	1							
workYoung	-0.080	-0.081	0.082	0.021	0.041	0.412**	0.381**	1						
netwS	-0.180**	0.098	0.03	-0.013	-0.064	0.027	0.108	0.043	1					
netwQ	0.220**	-0.206**	0.052	-0.019	0.064	0.138*	0.093	0.057	-0.011	1				
roles	0.050	0.241**	0.300**	0.134*	-0.068	-0.003	0.087	0.003	0.1	0.051	1			
jobSec	-0.184**	0.133*	0.028	-0.057	0.077	-0.065	-0.057	0.064	-0.01	-0.066	0.06	1		
expProm	0.045	-0.159**	0.198**	0.125*	-0.027	0.169**	0.082	0.171**	0.051	0.065	0.111	0.340**	1	
jobSatisf	-0.194**	0.082	0.07	0.092	-0.045	-0.012	-0.03	0.058	0.141*	-0.077	0.001	0.474**	0.475**	1

\* = p < 0.05 \*\* = p < 0.01 two-tailed test

founded: 1 = spin-off founded; 0 = employed

age: Years since birth

senior 1 = head of department or above; 0 = below head of department

edu: 1 = attended university; 0 = No university attended

parentSelf: 1 = parent self-employed; 0 = No parent self-employed

c-age: 1 =  $\leq 10$  years; 0 =  $> 10$  years

c-size: 1 =  $< 200$  employees, 0 =  $\geq 200$  employees

workYoung: 1 = worked in C < 10y, 0 = not worked in C < 10y

netwS: number of close contacts to discuss business topics

netwQ: 1 = know a recent founder; 0 = do not know a recent founder

roles: number of different roles inherited

jobSec: level of job security

expProm: expecting a promotion

jobSatisf: level of job satisfaction

### 3.4 Results

Four logistic regression models detail the direct effects on founding a spin-off (table 10). Model 1 takes into account only control variables and company size to identify the stylized fact, Model 2 includes additional measures derived by the ELT, Model 3 also includes the ones from the VTT, and Model 4 validates the results by incorporating young and small companies.

Model 3 significantly improved the explanatory power upon the baseline of Models 1 and 2 according to the likelihood-ratio test. Furthermore, since neither the calculated logistic coefficients nor their significances were altered considerably between models, the explanations focus on Model 3.

In line with the prediction, working in a small company (c-size:  $b = 1.817^{***}$ ,  $p < 0.001$ ,  $e(b) = 6.151$ ) and having a higher network quality (netwQ:  $b = 1.224^{**}$ ,  $p = 0.004$ ,  $e(b) = 3.400$ ) increased the probability of founding a spin-off, while a higher level of job security (jobSec:  $b = -0.385^*$ ,  $p = 0.059$ ,  $e(b) = 0.681$ ) and job satisfaction (jobSatisf:  $b = -0.398^*$ ,  $p = 0.063$ ,  $e(b) = 0.671$ ) decreased the probability of founding a spin-off. Contrary to the expectations, employment experience in a young company (workYoung:  $b = -1.756^{***}$ ,  $p < 0.001$ ,  $e(b) = 0.173$ ) and having a larger business network (netwS:  $b = -0.666^{**}$ ,  $p = 0.001$ ,  $e(b) = 0.514$ ) significantly reduced the likelihood of founding a spin-off. Neither a broader range of experience (roles:  $b = 0.139$ ,  $p = 0.482$ ,  $e(b) = 1.150$ ) nor expecting a promotion (expProm:  $b = 0.275$ ,  $p = 0.114$ ,  $e(b) = 1.317$ ) had a significant effect.

As there is evidence supporting the theory that young and small companies are the “hotbeds of founding” (Wagner, 2004), the variable c-young/small (taking the value of 1 if

the employee was currently working in a small and young company, otherwise 0) was included in Model 4. Neither the explanatory power (log likelihood ratio test = 0.5) nor the coefficients of any measures changed significantly when compared to model 3. Consequently, working in a young and small company did not significantly influence the probability of founding a spin-off (c-young/small:  $b = -0.680$ ,  $p = 0.568$ ,  $e(b) = 0.506$ ). The difference might be explained by the differing size definition (with small being defined as 20 or 200, respectively) and the different focus (technical spin-offs versus average population).

Next, it was identified whether company size was mediated by at least one of the proposed measures. Mediation occurs “when the causal effect of an independent variable (X) on a dependent variable (Y) is transmitted by a mediator (M)” (Preacher, Rucker, and Hayes, 2007), and three criteria for mediation have to be fulfilled (Baron & Kenny, 1986): First, the mediated variable has to significantly predict the potential mediator (path a). Second, the potential mediator has to be significantly associated with the dependent variable readiness (path b). Third, the relationship between the mediated variable and dependent variable (path c) has to change once the potential mediator is introduced (path c’). In case of a full mediation, path c’ will become zero. There is ongoing discussion regarding whether path c has to be significant before the potential mediator is included (Collins, Graham, and Flaherty, 1998; Judd & Kenny, 1981; MacKinnon, 2000), which is irrelevant for this study, as c-size has a significant path c.

Table 10: Multinomial logistic regression predicting the decision to found a spin-off

	Model 1				Model 2				Model 3				Model 4			
	B	StDev	P-value	Exp(B)												
age	-1.005***	0.214	0.000	0.366	-1.029***	0.245	0.000	0.357	-0.999***	0.261	0.000	0.368	-0.984***	0.263	0.000	0.374
senior	1.603***	0.417	0.000	4.970	1.861***	0.484	0.000	6.431	2.078***	0.525	0.000	7.988	2.071***	0.524	0.000	7.936
edu	0.209	0.339	0.537	1.233	0.405	0.375	0.279	1.500	0.339	0.401	0.399	1.403	0.326	0.403	0.418	1.385
parentSelf	0.481	0.389	0.216	1.618	0.434	0.425	0.307	1.544	0.565	0.443	0.202	1.760	0.552	0.444	0.214	1.737
c-age	-0.487	0.425	0.252	0.615	-0.032	0.517	0.951	0.969	-0.297	0.539	0.582	0.743	0.252	1.101	0.819	1.287
c-size	0.975**	0.365	0.008	2.651	1.720***	0.448	0.000	5.583	1.817***	0.460	0.000	6.151	1.914***	0.492	0.000	6.783
workYoung					-1.753***	0.487	0.000	0.173	-1.756***	0.500	0.000	0.173	-1.778***	0.502	0.000	0.169
netwS					-0.674***	0.190	0.000	0.510	-0.666**	0.199	0.001	0.514	-0.654**	0.200	0.001	0.520
netwQ					1.233**	0.410	0.003	3.433	1.224**	0.430	0.004	3.400	1.202**	0.432	0.005	3.326
roles					0.139	0.190	0.466	1.149	0.139	0.198	0.482	1.150	0.131	0.199	0.511	1.139
jobSec									-0.385*	0.204	0.059	0.681	-0.382*	0.203	0.061	0.683
expProm									0.318	0.224	0.156	1.374	0.326	0.225	0.147	1.385
jobSatisf									-0.398*	0.215	0.063	0.671	-0.406*	0.214	0.058	0.666
c-youngSmall													-0.68	1.191	0.568	0.506
Intercept	-3.014***	0.455	0.000		-4.089***	0.638	0.000		-4.352***	0.700	0.000		-4.344***	0.699	0.000	
Log-likelihood ratio X	62.904		0.000		98.746		0.000		110.176		0.000		110.500		0.000	
Log-likelihood	205.025				197.591				186.160				185.836			
Log likelihood ratio test					35.84***		0.000		11.430**		0.010		0.324		0.500	
Pseudo R-Square (Nagelkerke)	0.315				0.463				0.506				0.508			

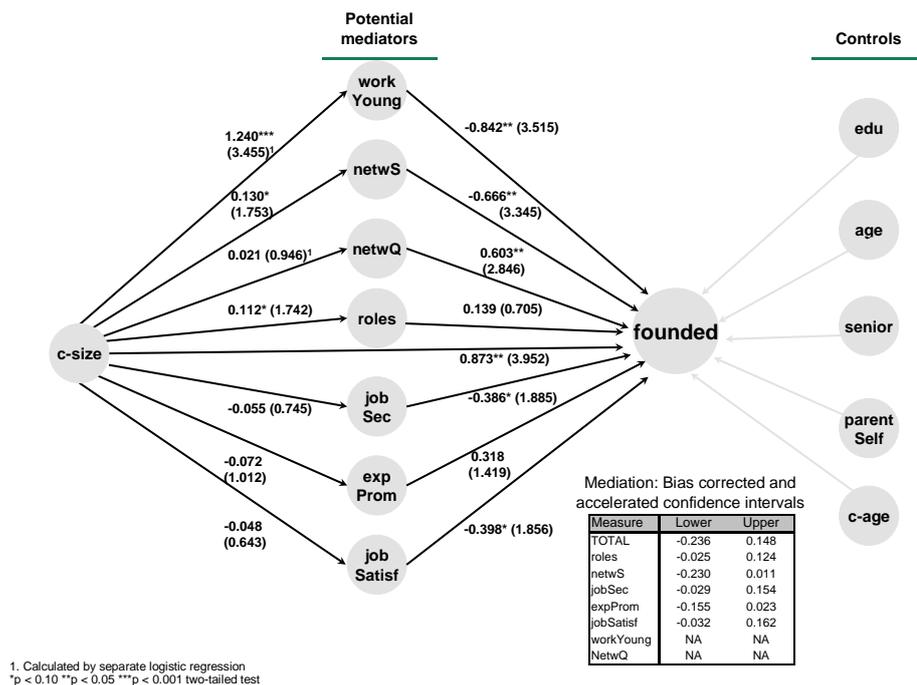
\*p < 0.10 \*\*p < 0.05 \*\*\*p < 0.001 two-tailed test

Reference is employment without fulfilling any of the dummy-coded measures

NetwS, roles, jobSec, expProm, jobSatisf, workYoung, and netwQ (the latter two as controls) were simultaneously tested for mediating company size on founding a spin-off (figure 5). The total indirect effect of company size was not statistically significant, as the confidence interval contained a zero (-0.236 to 0.148). Consequently, the tested variables together could not explain a significant part of the effect of company size on the probability of founding a spin-off. Despite this, there might be a significant indirect effect, which could, for example, be suppressed (MacKinnon, 2000). However, none of the tested specific indirect effects were statistically significant. WorkYoung and netwQ were assessed separately due to their nominal nature. While the relationship of company size to the latter was not significant (b = 0.021, p = 0.946, e(b) = 1.022), its relationship to the former was (b = 1.240\*\*\*, p < 0.001, e(b) = 3.455). Yet, when paths a (c-size to workYoung) and b (workYoung to founded) were multiplied, the sign was negative, which contradicted the stylized fact. Thus, workYoung

could only reduce the positive effect of company size on founding a spin-off<sup>6</sup> and not explain the stylized fact. As a result, none of the hypotheses were supported.

Figure 5: Standardized parameter estimates for mediation of c-size on spin-off founding



When the confidence intervals do not include a zero, the indirect effect is significant at  $p < 0.05$ . The results were controlled for by edu, age, senior, parentSelf, and c-age. Five thousand bootstrap samples were applied.

To ensure the validity of the results, the statistical power was calculated with G\*power 3.1 and tested for common method bias (CMB). Based on a two-tailed alpha error of 5% for medium-sized effects (odds ratio 2) and a high cross-correlation of 0.5, the sample size of 263 had a statistical power (0.863) sufficiently above the critical barrier (0.8) (Cohen, 2009). In addition, simple mediation is usually reliable with a sample size above 200 (Chin, Wynne W, and Newsted, 2000; Hoyle & Kenny, 2000). The relationship between the variables in this study could be artificially inflated based on a common source, because all variables were

<sup>6</sup> The alpha of 5% was reduced to 2.5% for each regression to ensure a combined significance of 5%. Both regressions were below this; thus, a mediation was at work.

measured with a single questionnaire filled out by one person at the same point in time (Kemery & Dunlap, 1986). Despite limiting the influence of CMB by employing several different types of response category along the questionnaire (7-point scale, yes/no, number of) (Podsakoff, MacKenzie, Lee, and Podsakoff, 2003), CMB could still exist. Consequently, CMB was tested with a carefully selected marker variable (netwQ), which is theoretically unrelated to at least one variable in the study (edu) (Lindell & Whitney, 2001). CMB was assessed based on the measured correlation between the marker variable and the assumed unrelated variable (table 6 in the appendix). Education had only a very minor effect on the probability of knowing a recent founder (edu  $\rightarrow$  netwQ:  $b = 0.063$ ,  $p = 0.813$ ,  $e(b) = 1.065$ ). Thus, CMB is unlikely to be a serious concern as long as the method factor does not vary strongly across the model (Podsakoff et al., 2003).

### **3.5 Discussion**

Company size is a significant factor in the probability of founding a spin-off, supporting the stylized fact. Across the analyzed models, the effects of strength and size were relatively stable despite the simultaneous inclusion of seven measures selected for their mediating potential. This signals the independence of most measures and their limited capability of explaining the stylized fact. Each explanation will now be discussed in detail.

Having experience working in a young company was mediated by company size on the probability of founding a spin-off, but in the opposite direction from what was expected and thus was not an explanation for the stylized fact. In line with the theory, employees who worked in a small company had more often worked in a young company. However, this reduced the probability of founding. The theory assumed that learning from an employer as a

role model and experiencing the entrepreneur process should ease the transition toward one's own spin-off. However, the evidence suggests that learning is not one-way; rather, positive and negative experiences can be learned (Phillips, 2002). One example is that of serial founders who could be discouraged by negative experiences caused by a prior closure or failure (Westhead, Ucbasaran, Wright, and Binks, 2005). Working in a recently founded company may not always be a pleasant experience due to a lack of resources and stability, higher job insecurity, and lower wages (Wagner, 1997). Having experienced this while working in a young company might reduce the interest in founding one's own company and explain why the probability of founding a spin-off is reduced.

Network size was not a mediator in explaining the stylized fact due to low significance, small regression coefficients, and an opposite direction. As expected, those working in small companies had a larger network of close business contacts—but contrary to the prediction, a larger network decreased the probability of founding. This might be explained by higher job satisfaction due to the larger business network at the current employer, which might be reduced if the employee leaves the company.

Network quality did not act as a mediator in explaining the stylized fact, either, in spite of a strong effect of knowing a recent founder. Knowing a recent founder always increased the probability of founding, except for employees in small companies,<sup>7</sup> probably because those individuals already had the founder (employer) as a role model and could participate in his/her experience. Consequently, they did not need to establish contact with and observe other entrepreneurs (Minniti, 2004). The reason for the insignificant mediator

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<sup>7</sup> Moderator analysis is not reported in this article but can be obtained from the author; see the additional appendix 3.7.1.

effect was that company size had no effect on the likelihood of knowing a recent founder. Neither the regional clustering of small companies nor the selection mechanism (more entrepreneurs leave small companies; hence, employees in small companies more often know an entrepreneur) seemed relevant.

The number of roles was also excluded as a mediator for the stylized fact, in spite of the fact that employees in small companies held more roles. The number of roles simply did not have a significant effect on the probability of founding, which contradicts theoretic and empirical evidence (Lazear, 2005; Wagner, 2004). However, the aforementioned empirical evidence is related to the general population and participants of an MBA program and is thus very different from the sample applied throughout this study, which consists of technically oriented employees who had applied for a patent. These individuals may not have the time to spread into different fields, as they have to focus sharply on their technical field, or they may not consciously diversify, as founding a spin-off is not part of their plan, but rather results from an unexpected need to develop their ideas. In addition, the detailed knowledge acquired from a long and intense investment in a single field might offer a competitive advantage for a future spin-off, instead of having superior management skills. Otherwise, there may be some kind of selection at work—individuals interested in the technical field may possess a smaller skill set, qualifying them for only a limited number of roles. Thus, they do not vary significantly in regard to their experience working in different roles, because their qualification limits them to a small number of roles.

Job security was also not a mediator in explaining the stylized fact. A weak decrease of the effect of the level of job security on the probability to found was identified.

Consequently, those experiencing job insecurity were more likely to found a spin-off, which is in line with the arguments of an increased push motivation and a higher discomfort, leading to increased readiness for a change. Employees in small companies did not, however, have a significantly lower job security, which might again be explained by the specific characteristics of the sample. The technically oriented patent applicant may fear for his/her job last, having just developed a relevant patent for his/her employer and having high-quality outside options. As a result, his/her job insecurity could be rather independent of company size.

Expecting a promotion did not act as a mediator in detailing the stylized fact, either. Neither was expecting a promotion less likely for small company employees, nor did the expectation of a promotion influence the probability of founding at all. The former might be explained by a stronger reward culture in small companies. Those developing the few patents for which a small company applies could expect a stronger reward, as they are seen as the future of the company, which is probably less likely in large companies. The latter could be explained by the dual nature of a promotion. It is a reward for employees (Lee, Mitchell, Sablinski, Burton, and Holtom, 2004), but also a sign of above-average human capital (Bhagavatula, Elfring, van Tilburg, and van de Bunt, 2010; Milgrom & Oster, 1987), which could also better qualify someone for entrepreneurship (Davidsson & Honig, 2003; Gimmon & Levie, 2009). Both have opposite directions on the founding probability and might, thus, explain the insignificant effect.

Job satisfaction also failed to explain the stylized fact. As expected, having higher job satisfaction resulted in a lower founding probability, but the level of job satisfaction was

independent of company size. Neither the arguments for better working conditions in large companies nor the less bureaucratic style in small companies were supported. The literature also provided mixed experience of the company size-dependence of job satisfaction (Clark, 2001), which means that the finding is not implausible.

All control variables showed the expected directions, and age and senior were significant. The explained variance of founding a spin-off was relatively small despite the fact that this study included 11 measures and relied on a relatively homogenous group, with its focus on male patent applicants in Germany. Only approximately 41%<sup>8</sup> of the cases were better sorted when all of the factors were applied. However, a low explanatory power is very common for studies in this field (Tett & Meyer, 1993).

### **3.6 Conclusion**

This study empirically analyzed the effectiveness of the seven explanations derived from the ELT and VTT for the stylized fact that more spin-off founders have previously worked in small companies. Despite the five significant influences—network size, network quality, experience working in a young company, level of job satisfaction, and level of job security—on the probability of founding a spin-off, none of the explanations were significant. Two of them, being a Jack of all trades (Lazear, 2005) and expecting a promotion (Wagner, 2004), failed to explain the dependent variable, as they did not have a significant relationship, which might be due to the specific characteristics of the sample. All 264 respondents had in 2006/07 applied for a patent and worked in rather technology-related fields, where specialization is

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<sup>8</sup> The use of the measures increased the number of correctly identified cases by 10.2%. This is a 41% increase when compared to the null hypothesis (all respondents are employed and have not founded a spin-off Hoetker (2007)).

more often required (limited time to acquire a broader skill set) and is a success factor. Some alternative reasons might be a lower endowment difference or the specifics of the spin-off, e.g., founding due to neglect. Promotional expectations could also be a sign of the above-average human capital qualifying for entrepreneurship. The remaining explanations failed because company size had a significant influence only on workYoung, netwS, and roles. In other words, working in a small company had no significant effect on knowing a recent founder, the level of job security, expecting a promotion, and job satisfaction.

Only experience working in a young company and network size had the required significant relationships for mediation, but they also had a different direction than expected. Work experience did not as predicted increase the probability based on learning about the entrepreneur process and from the employer as a role model. Instead, it decreased, which might be explained by negative learning experiences (Phillips, 2002; Westhead et al., 2005) caused by limited resources, instability, and lower wages in young companies (Wagner, 1997).

Network size also failed to increase the probability of founding as was expected due to the opportunity to receive more relevant knowledge from more sources. On the contrary: Having a large network reduced the probability, most likely because those with an extended network received satisfaction from having it and feared losing this by leaving the company. As both of these factors acted, if at all, in the opposite direction of the stylized fact, neither offered an explanation for it.

Consequently, despite the significant influence on the probability to found, none of the explanations was able to account for the stylized fact, requiring alternative explanations. Three of those, which should be detailed in the future, will be presented in the following.

A selection bias could be the reason for the stylized fact, either because individuals aspiring to be entrepreneurs could self-select to work in small companies, believing that they will receive better education there, or because employees in small companies are preselected due to their higher entrepreneurial abilities (Fiet, 1996). On the one hand, this could be due to a preference by small companies for specific skills (e.g., flexibility), which also increases entrepreneurial abilities. On the other hand, this could be caused by the stronger involvement of founders in the recruiting processes of small companies, resulting in the selection of employees with an attitude similar to their own (entrepreneurial). The results of the survey cast some doubts on the self-selection by aspiration into working in small companies, as there was no company size-dependence for aspiration in the currently employed individual sub-sample ( $t = 1.361$ ,  $p = 0.175$ ).

The better resources of large companies could also explain the stylized fact, as they increase the ability to finance internal ventures, thus reducing the number of spin-offs. As opposed to spin-offs, large companies have internal ventures and, hence, more spin-offs are founded from small companies (Hyytinen & Maliranta, 2008). Again, the results of the questionnaire cast some doubt on whether the argument will hold, since the belief of the currently employed sub-sample in receiving an offer for an internal venture is stronger in small companies than in large ones ( $t = 4.324$ ,  $p < 0.001$ ).

An additional explanation for the stylized fact is offered by the IONexus theory, which assumes that identifying an entrepreneurial business opportunity (EBO) is an important step toward founding and that the identification depends on the information surrounding an individual (Eckhardt & Shane, 2003). This information could be better in small companies, as they have more in-depth knowledge (Garvin, 1983), lower financial resources (limiting the possibility to exploit all BOs at the same time), and less specialization (Hyytinen & Maliranta, 2008). Consequently, the reason for the stylized fact could be knowledge about more unexploited EBOs in small companies. The survey showed some promising results here, as the ratio of employees knowing of at least one unexploited EBO was significantly higher for employees in small companies than for those in large ones ( $t = 2.056$ ,  $p = 0.042$ ).

In addition, this study has some limitations which should also be analyzed by additional research. One concern is that founders were asked to remember the time before founding and answer the questionnaire from that perspective. Remembering cognitive processes may create reliability issues (i.e., recall bias) (Ericsson & Simon, 1984; Golden, 1992). To reduce the influence where possible, the respondents relied on hard facts that were easier to remember, such as whether they had worked in a young company before founding the spin-off. This, in combination with the more conservative two-tailed tests, should lower the reliability problems. In addition, the direction and significance were analyzed rather than the exact value of the regression.

Another concern is the oversampling of small companies by limiting the number of addressed patent applicants to 15 per company, which was necessary to avoid firm effects, as more than 20% of the patents came from a single company, Siemens. This could influence

the size of the measured effects and the direction, especially if there was a response bias on company size. However, except for network quality, none of the relationships were moderated by company size. For netwQ, the effect was also negligible, as mediation failed due to an insignificant relationship between company size and the probability of knowing a recent founder, which was not affected by oversampling. Both limitations should be overcome by reanalyzing with a longitudinal data sample in industries that are not prone to agglomeration risk.

The sample applied in this study consisted only of males who had applied for a patent in Germany in certain categories, which limited the result (Blanchflower & Oswald, 1998; Hayton, George, and Zahra, 2002). Additional research is required to verify whether the results hold in a different context and with more differentiated measures for company size, such as continuous scales or split by fewer employees or assets. Comprehensive additional research to understand the stylized fact is required, which should include advancing the spin-off theory, as the most common explanations derived from the ELT and VTT failed to deliver a result.

### **3.7 Appendix**

Table 11: Scales/measures and their respective items

Measure	Question (abridged translation from the German questionnaire)	Type	Source
c-size	How many employees does your current employer have?	1 = ≤ 200 0 = > 200	(Leptien, 1996; Vega-Jurado et al., 2009)
workYoung	Have you ever been employed in a company that was younger than 10 years old when you started to work there?	1 = yes 0 = no/don't know	Adapted based on (SOEP; Wagner, 2004)
netwS	With how many individuals do you regularly discuss important business topics?	Number of contacts—above 6 coded as 6	Adapted from (Singh, Hills, Hybels, and Lumpkin; SOEP)
netwQ	Do you personally know someone who has started a business in the two years preceding this survey? Please do not consider elemental services such as a snack stall.	1 = yes 0 = no/ don't know	(Arenius & Maria Minniti, 2005)
roles	In how many different professional fields have you been active in the past? Similar roles at different companies should be considered as one.	Number of roles—above 6 coded as 6	(Wagner, 2004)
jobSec	V1: This job offers me continued long-term security. V2: I feel that with the opportunities given with this job, I have a sound future. V3: Most people doing this job within this organization have long-term security. V4: I am satisfied with my job security.	Each assessed based on a 1–7 Likert scale	(McKnight et al., 2009)
expProm	V1: I believe I will advance my career within the next two years. V2: <i>I believe I will be downgraded in my profession within the next two years.</i> V3: I believe I will receive an increase in my salary in my current company beyond the overall increase in pay rates. V4: I am satisfied with my promotion prospects.	Each assessed based on a 1–7 Likert scale	(SOEP)
jobSatisf	I am satisfied <ul style="list-style-type: none"> <li>• with my total pay</li> <li>• with my relationships with supervisors</li> <li>• with my relationships with co-workers</li> <li>• with my work content</li> <li>• with the use of initiative</li> <li>• overall</li> </ul>	Each assessed based on a 1–7 Likert scale and then added	(Leptien, 1996; Clark, 2001; SOEP)
founded (a spin-off)	<ul style="list-style-type: none"> <li>• Are you currently self-employed or selling goods or services to others, or do you fully or partially own a company in which you are involved in the management?</li> <li>• Did you become self-employed by participating in a family business, a management buyout, or a university/research institute spin-off?</li> </ul>	1 = first question yes, second no 0 = all other cases	Adapted based on (Brixy et al., 2009; SOEP)
age	Year of birth	Years since birth	(Leptien, 1996)
edu	Highest educational level	1= university educat.	(Leptien, 1996)
senior	Current position	1= managerial level	(Leptien, 1996)
parentSelf	Was at least one of your parents ever self-employed?	1 = yes	(SOEP)

Please note that the questionnaire was administered in German and the translations of the questions shown above are only there for explanation. For more details and the exact wording, see the abovementioned sources. The question shown in italics was removed due to a lack of internal consistency. The Cronbach alpha was 0.851 for jobSec, 0.731 for expProm, and 0.743 for jobSatisf, and principal axis factor analysis showed one explaining factor with an eigenvalue above 1.

Table 12: Overview of empirical literature covering c-size and company creation

c-age	How old is the company you are currently working for?	1 = ≤ 10 years	(Leptien, 1996)
	Study	Investigated area	Findings
	(Utterbeck, Reitberger, and Martin, 1984)	Sweden	~ 75% of technical entrepreneurs worked in companies with less than 500 employees before
	(Bruno & Tyebjee, 1985)	US high tech start-ups	~ 77% of founders worked in companies with less than 100 employees before
	(Johnson & Cathcart, 1979)	Production companies in the north of the UK	Companies with less than 10 employees have a six times higher founding rate compared to the average
	(Freedman, 1983)	Technology oriented companies in Philadelphia	Only ~ 7% of founders worked in “large” companies before
	(Cooper, 1971)	US high tech	Companies with less than 250 employees have six times as high a founding rate as larger companies
	(Boden, JR, 1996)	The US	~ 2.6 times as many more founders worked in companies with less than 100 employees
	(Cooper, 1985)	Cover stories from 1981–84	41% of founders had worked in the top 500 service/industry companies, which represents a share of 32% of employees
	(Phillips, 2002)	Silicon Valley law firms	Increasing the number of associates increases the probability of a spin-off disproportionately little
	(Liñán Alcalde, Martín, and González Rodríguez, 2002)	Germany 1984–96	Company size of less than 20—and, to a lesser extent, 21–200—increased the probability of becoming an entrepreneur
	(Eriksson & Kuhn, 2006)	Danish companies	Spin-off probability decreases with an increasing number of employees—the average company size resulting in a spin-off is ~ 322 employees
	(Gompers et al., 2005)	US high-tech (NBER 2 and 3)	Companies with less than 100 employees have an increased founding probability
	(Hyytinen & Maliranta, 2008)	Finnish companies	Companies with less than 20 employees have a disproportionately high number of foundings
	(Wagner, 2004)	Germany	Working in young companies with less than 20 employees increases the probability of becoming an entrepreneur
	(Georgellis & Wall, 2005)	West Germany (1984–97)	Employees working in companies with less than 20 employees have a higher probability of becoming self-employed

Please note that most of the studies described in table 12 rely on a mixed sample. They often include companies in which the founder was previously unemployed, worked or studied in the academic field before, or took charge of a family business. Additionally, the founded companies were often diverse in terms of industry and level of technological orientation

Table 13: CMB validation—logistic regression of education to knowing a founder (netwQ)

<b>Logit regression on know a founder (netwQ)</b>				
	<b>B</b>	<b>StDev</b>	<b>P-value</b>	<b>Exp(B)</b>
age	-0.399	0.137	0.004	0.671
senior	0.185	0.270	0.492	1.204
parentSelf	0.307	0.319	0.335	1.359
c-age	0.507	0.370	0.170	1.661
edu	0.063	0.266	0.813	1.065
Intercept	0.054	0.266	0.838	
Log-likelihood ratio X	15.261		0.009	
Log-likelihood	267.836			
Pseudo R-Square (Nagelkerke)	0.076			

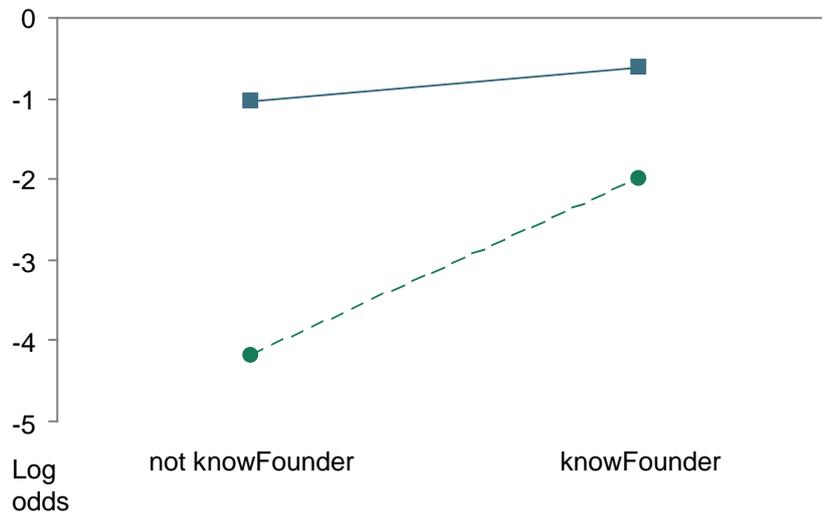
### 3.7.1 Results of the moderation analysis

The regression of Model 3 includes one of the interaction variables each to validate for moderation. Only the interaction with netwQ increases the explanatory power and has a weak significant relationship.

Figure 6: Moderating effect of c-size on netwQ.

Knowing a founder has a much stronger effect on employees in large companies than on those in small companies, as can be seen by the larger slope and the non-significant relationship of netwQ in small companies.

Interaction	Additional X <sup>2</sup> vs. Model 3	b	StDev	Z-score	P-value	Exp(b)
C-size x workYoung	0.072	-0.060	0.222	-0.271	0.786	0.942
C-size x netwS	0.224	-0.086	0.181	-0.472	0.637	0.918
C-size x netwQ	4.118**	-0.422	0.217	-1.946	0.052	0.656
C-size x roles	0.462	-0.122	0.179	-0.681	0.496	0.886
C-size x jobSec	0.186	-0.072	0.167	-0.430	0.668	0.931
C-size x expProm	0.185	0.075	0.174	0.431	0.667	1.078
C-size x jobSatisf	0.571	0.125	0.166	0.756	0.450	1.133



	b	StDev	Z-score	P-value	Exp(b)	LLCI	ULCI
NetwQ in large comp.	1.084	0.354	3.062	0.002	2.760	0.390	1.778
NetwQ in small comp.	0.207	0.284	0.729	0.466	0.656	-0.350	0.764

C-size could act as a moderator on workYoung, netwS, netwQ, roles, jobSec, expProm, and jobSatisf. Moderation is at work when a third variable divides the independent variable into subgroups, and those have a significantly different effect on a given dependent variable (Baron & Kenny, 1986). A bootstrap approach based on interaction effects was applied – test procedure developed by Hayes & Matthes (2009)<sup>9</sup>. The effect of the moderator (c-size) was calculated separately for each proposed moderation. Unlike in regressions based on ordinary least squares, in logistic models, the effect of the interaction varies with the values not only of the interacting variables, but of all the other variables in the model. Thus, to understand an interaction, it is necessary to analyze the complete effect of the moderator variable instead of exploring just the interaction term (Hoetker, 2007; Jaccard, 2005).

To identify moderation, two requirements have to be analyzed. The first condition is that adding the moderator as a product term needs to significantly enhance the explanatory power of the model. This can be analyzed by hierarchical logistic regression to determine whether the addition of one product term significantly improves the model fit (Jaccard, 2005). A chi-square difference test with one degree of freedom comparing Model 3 as baseline to a model with one additional interaction effect was applied. Appendix 3 presents the results. Only the interaction of c-size with netwQ had a significant chi-square difference test ( $\Delta\chi^2=4.118^{**}$ ). Hence, only netwQ fulfills one of the requirements for being significantly moderated by c-size.

The second condition is a significant interaction effect (Jaccard, 2005). The bootstrap results also presented in appendix 3 show that only the interaction of c-size with netwQ had a

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<sup>9</sup> The SPSS macro that accompanies Hayes & Matthes (2009), available for download at <http://www.comm.ohio-state.edu/ahayes/>, was used to analyze the mediator effect.

significant effect ( $b = -0.426^*$ ,  $z = 1.946$ ,  $e(b) = 0.656$ ). All other proposed interactions were not significant.

Typically effects are analyzed one standard deviation above and below the mean (Preacher et al., 2007). However as *netwQ* is a dummy variable the effect of *c-size* on *netwQ* is illustrated in both situations. Figure 13 presents the plot. The slopes for *netwQ* are much steeper for individuals in large companies than for those in small companies. The effect of *netwQ* on the probability of founding a spin-off is much stronger for individuals currently working in large companies than for those currently working in small companies. While the log odds for founding a spin-off increase by  $\sim 8.1$  times in large companies when the individual knows a recent founder, in small companies, the increase is only  $\sim 1.3$  times. Thus, only knowing a founder is significantly moderated by *c-size*.

### **3.7.2 Non-response bias**

In general, a personal mail survey has to consider three groups of individuals: those who are not contacted, those who do not respond, and those who respond (Armstrong & Overton, 1977). The first group consists of those who were not contacted for the survey at all. This group is usually the vast majority, as research is often based on only a sample of the total population, due to resource limitations. However, as long as the sample is representative and the statistics are used adequately, the total population is considered similar to those who received the survey (Gujarati, 2002; Pavalko & Lutterman, 1973). This leaves two groups, and if they differ significantly from each other, the validity of the analytical results will be limited. The results are based only on those who respond and are thus valid only for this particular group and groups with high similarity. Consequently, if those who responded are significantly different from those who did not, a

generalization is invalid and a non-response bias is at work (Armstrong & Overton, 1977). Individuals who do not respond to the survey despite having received it could differ significantly from those who respond. Individuals who answer could, for example, be more interested in the topic, have a stronger emotional relation, or just have more time to answer.

Mail surveys are generally at risk of non-response bias because the number of non-responses is typically high, and response is driven by personal motivation (Pace, 1939). One method for determining whether a mail survey has a non-response bias is extrapolation (Ferber, 1949). The method is based on the assumption that those who answer late have a greater similarity to non-respondents. They are less willing to answer and are thus similar to those who do not answer at all. A non-response bias is likely if those who respond to the survey early differ strongly from those who respond later. Thus, the non-response bias is tested by comparing two groups, i.e., those who answered first and those who answered last.

The final version of the mail survey applied across this study was sent out to all participants on November 5, 2009. The responses were returned between November 9, 2009 and December 29, 2009. The answers were split into three groups based on return time. The first group included 84 responses arriving between November 9 and 12, the second 95 responses arriving between November 13 and 24, and the third 83 responses arriving between November 25 and December 29. The groups had slightly different numbers of responses because the arrivals on one date could not be split between groups. To establish whether the responses differed depending on their date of arrival, the first and third groups were compared.

A t-test was applied to compare the mean of the two groups along all relevant variables assessed in the survey. In other words, it was investigated whether those who answered early (first

group) had a different mean (e.g., age) than those who answered last (third group). Two variables, company size and company age, had to be adjusted because the sample relied on values from the past for those who had already founded a spin-off. When comparing the respondents, however, the current company size and company age were more relevant. Thus, for those who had founded, these two factors were adjusted to their current company status, resulting in a total of 122 (46%) small companies and 63 young companies (24%).

As presented in table 14, no significant differences between the first and the third group were identified ( $p > 0.05$ ). Thus, the later respondents were not significantly different from the earlier ones, which indicates that the non-responding individuals were most likely not significantly different from those who did complete the survey. Hence, a non-response bias was unlikely for the survey applied throughout this study.

Table 14: Comparing early and late survey responses to identify non-response bias. No part of the t-test was significant at the 5% level, indicating that a non-response bias was unlikely.

Variables	Comparison of 1st and 3rd group based on standardized coefficients						
	1. group (09-12.11)		3. group (25.11-29.12)		ΔMean	T-value	P-value
	Mean	SD	Mean	SD			
founded	0.298	0.460	0.325	0.471	-0.028	0.384	0.701
age	0.046	9.468	-2.032	7.732	2.079	1.555	0.122
senior	-0.096	0.449	-0.021	0.480	-0.076	1.052	0.294
edu	-0.001	0.498	0.052	0.503	-0.053	0.689	0.492
parentSelf	-0.030	0.436	-0.057	0.450	0.027	0.395	0.693
c-age (cur)	0.238	0.428	0.337	0.476	-0.099	1.417	0.158
c-size (cur)	0.500	0.503	0.590	0.495	-0.090	1.170	0.244
workYoung	-0.007	0.482	-0.096	0.500	0.089	1.166	0.245
netwS	-0.002	1.644	-0.090	1.618	0.088	0.350	0.727
netwQ	-0.041	0.485	0.000	0.495	-0.041	0.535	0.593
roles	-0.017	1.372	-0.040	1.452	0.022	0.102	0.919
jobSec V1	0.013	1.543	0.048	1.650	-0.035	0.140	0.888
jobSec V2	0.053	1.318	-0.010	1.372	0.062	0.300	0.765
jobSec V3	-0.015	1.446	-0.103	1.521	0.088	0.384	0.702
jobSec V4	-0.021	1.565	0.117	1.613	-0.138	0.563	0.574
expProm V1	-0.151	1.872	0.196	2.024	-0.347	1.150	0.252
expProm V3	-0.118	1.988	0.040	1.889	-0.158	0.526	0.599
expProm V4	0.127	1.788	-0.081	1.900	0.208	0.728	0.468
jobSatisf V1	0.004	1.475	0.023	1.567	-0.019	0.082	0.935
jobSatisf V3	-0.145	1.161	0.175	0.972	-0.320	1.931	0.055
jobSatisf V5	0.070	1.654	-0.230	1.623	0.300	1.183	0.239
jobSatisf V6	0.013	1.313	-0.075	1.689	0.088	0.375	0.708
jobSatisf V7	0.176	1.663	-0.056	2.023	0.232	0.810	0.419
jobSatisf V8	-0.032	1.136	-0.004	1.261	-0.028	0.150	0.881
N	84		83				

#### **4 Chapter – Paper III**

### **Why have spin-off founders more often worked for small companies before? Eight explanations tested for the explanation route readiness to found a spin-off**

#### **Abstract**

*This paper analyzes why some employees have a higher readiness to found a spin-off than others and examines whether readiness could be the missing link explaining the stylized fact that founders are more likely to have worked for small companies before. The readiness to found a spin-off is an intermediate step between aspiring to self-employment (long-term goal of self-employment) and currently setting up a new venture (nascent entrepreneurship). It has the advantage of being more holistic and directly linked to the actual founding rather than the aspiration, and is less dependent on additional influences, e.g., knowledge about a business opportunity, than later stages. Based on a sample of individuals who applied for a patent in Germany in 2006/07, eight explanations derived from the Employee Learning Theory and the desirability pillar of the Voluntary Turnover Theory were tested for their explanation power of the stylized fact. Despite some significant effects on readiness to found a spin-off (knowing a recent founder, aspiration for self-employment, and job satisfaction), none were capable of explaining the stylized fact. Instead, no significant influence of company size on readiness was detected at all, indicating that the unexplained effect of company size on the actual founding is not induced by readiness to found. Alternative explanation routes are identified for consideration in future research.*

#### **4.1 Introduction**

The question of why some employees become entrepreneurs and found spin-offs while others do not is an important field of research for management scholars (Klepper, 2001; Venkataraman, 1997). On the one hand, entrepreneurs are a major driver of economic growth (Audretsch et al., 2008), employment (Thurik et al., 2008) and a prerequisite for economic development (Schumpeter, 1942; van Stel et al., 2005). On the other hand, spin-offs represent a very successful (Colombo et al., 2005; Dietrich & Gibson, 1990; Hunsdiek, 1987; Lindholm, 1994; Sleeper, 1998; Szyperski & Klandt, 1980; Walsh et al., 1984; Klepper, 2002; Agarwal et al., 2004; Chatterji, 2009) and significant share (approx. 30% in Germany) of newly created ventures (Bhide, 2000; Koch, 2006) and require a separate analysis, as they consistently differ significantly from other *de novo* companies (see chapter 2).

The empirical literature on spin-off founding has established a stylized fact across countries and industries: As a rule, the founders of new companies disproportionately often worked for companies with fewer employees (i.e., small companies) before starting a spin-off—see, e.g., (Boden, 1996; Eriksson & Kuhn, 2006; Georgellis & Wall, 2005; Gompers et al., 2005 for details see table 22 in the appendix. Understanding this finding will increase the predictability of entrepreneurship and advance the entrepreneurship theories. Therefore it has been highlighted by several authors, often leading to speculations on explanations (e.g., Cooper, 1985; Feeser & Willard, 1989; Gompers et al., 2005; Mason, 1991; Mueller, 2006; Wagner, 2004). To the best knowledge of the authors, consensus has yet to be reached on how this stylized fact can be explained, and as Hyytinen & Maliranta (2008 p.18) stated, “distinguishing between these alternative explanations is left for future work.” Thus, according to the literature, there exists a

stylized fact regarding founding without an agreed-upon explanation—and understanding this stylized fact is important to advance entrepreneurship research.

Consequently, the objective of this study is to investigate the effectiveness of some of the explanations regarding the stylized fact. For this purpose, an explanatory model is developed on the basis of two complementary theories: the Employee Learning Theory (ELT) and the Voluntary Turnover Theory (VTT). This newly developed model will be used to empirically test the explanations for the relationship between former company size and the founding of a spin-off. While a forthcoming paper (chapter 3) focuses on the actual founding, the present paper will focus on the readiness to found as an intermediate step between those who only aspire to set up their own company and those who are currently in the process of setting up a company (nascent). The readiness to found is defined as the willingness to become a nascent entrepreneur in a situation where the current employer is not interested in a business opportunity (BO). Analyzing this allows testing for additional explanations and identifying whether company size acts via this path to readiness to found.

The two major, unique contributions of this paper are thus the simultaneous empirical investigation of eight explanations for the stylized fact, and the determination of whether the stylized fact is induced via readiness for the actual founding. In addition to the readiness to found, a new lever is introduced into the entrepreneurial process, which will be discussed in detail.

The paper is structured as follows: The theory chapter describes the entrepreneurial process to integrate readiness and details the research model applied to develop the hypotheses. Next, the statistics portion of the paper describes the measures and presents the empirical

evidence. This is followed by a discussion of the empirical evidence. Finally, the conclusions are drawn, the limitations identified, and future research direction recommended.

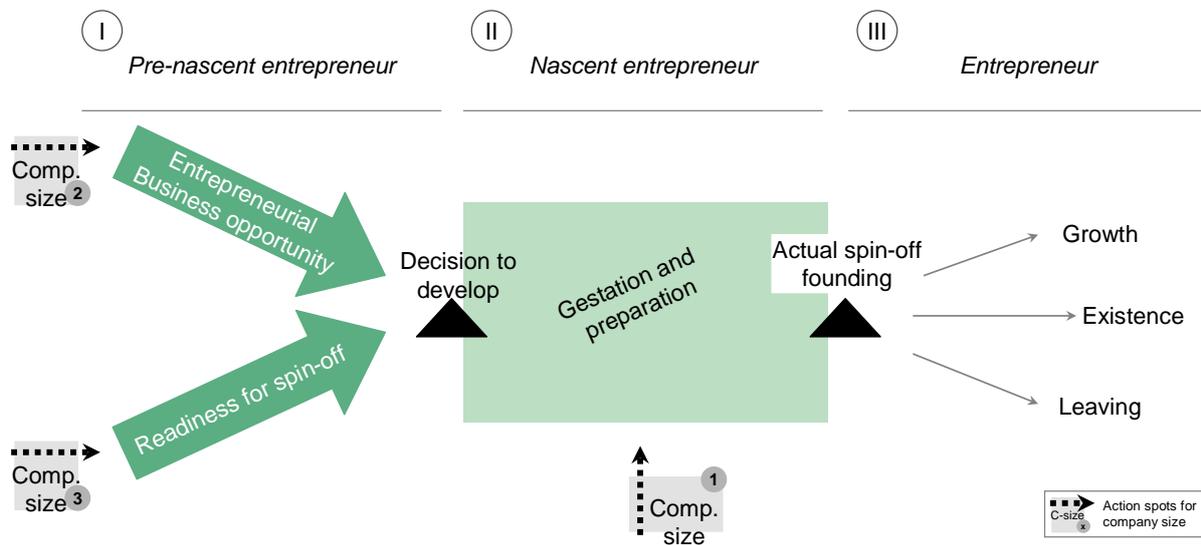
## **4.2 Theory**

### **4.2.1 The entrepreneurial process**

There are various models that explain the process of starting a business (e.g., Carroll & Mosakowski, 1987; Carter, Gartner, and Reynolds, 1996; Carter et al., 2003; Henley, 2007; Katz, 1990; Parker & Belghitar, 2006; Reynolds & Miller, 1992; Rotefoss & Kolvereid, 2005). Most of them are based on the “three hurdles model” of Katz (1990) with its three hurdles: aspiring, preparing, and entering. The first is the declared intention to become self-employed; the second is a phase during which the evaluation of the environment, gathering of resources, and other preparatory activities take place; and once the business begins active operation, it has passed the entry hurdle.

This paper is based on a very similar three-phase model (see figure 7). In the first phase, the future spin-off founder (pre-nascent entrepreneur) is exposed to an initial idea. Once the decision to develop the initial idea toward founding a spin-off has been made, the employee becomes a nascent entrepreneur. Here, the idea is refined and the spin-off founding is prepared. The actual founding marks the start of the third phase, where the founder becomes an entrepreneur and the spin-off can develop within the market.

Figure 7: Three-phase entrepreneurship process for spin-off founding, Adapted from Katz (1990). Three interaction spots for company size



The only difference between Katz's three-hurdle model and the model described above pertains to the first phase, where the decision to develop the initial idea is also dependent on one's knowledge about a BO (separate requirement) and aspiration is replaced by the readiness to found. The former is included because without knowledge about a BO, there is nothing to develop, and spin-offs often rely on ideas that are developed while working for the previous employer (Bhide, 2000). Aspiration was replaced by readiness to found because it should be a better (more holistic) approximation for the actual founding. Individuals who currently and in the long term aspire to become self-employed should have a high readiness to found, as it would fulfill their short- and long-term goal. For those cases, a positive relationship between aspiration and readiness is highly likely. In some cases, however, despite a long-term interest in self-employment, the current interest might be limited, e.g., due to the recent birth of a child, or an interesting new job. Those cases would be more correctly assessed by the current interest in

founding than the long-term goal of self-employment. Similarly, there are cases where the aspiration to self-employment is low but, due to compelling circumstances (e.g., job loss), self-employment becomes highly interesting. Capturing all future founders based on their aspiration has shown severe limitations. An analysis of US wage and salary earners in 1986 indicated that 2.5% of the employees became self-employed within the next three years without having expressed any aspiration to be self-employed (Katz, 1990).

Given a BO, those with a higher readiness should more often actually become an entrepreneur, but the correlation between the two should not be perfect, due to the following nascent entrepreneur phase during which some ideas might fail to offer the expected potential, the preparation might be unsuccessful, or the level of readiness could change. Empirical evidence directly analyzing readiness to found is as yet lacking. There is only support for the former lever of aspiration, which had a positive relationship to the actual founding. The founding rate in the study mentioned above for those who expressed aspiration was approx. seven times higher compared to those who did not state this (Katz, 1990), and having an entrepreneurial aspiration increased the probability of becoming self-employed by approx. 10% in Finland (Hyytinen & Ilmakunnas, 2007b), in Great Britain from 1998 to 2002 (Henley, 2007), and across the EU (Grilo & Thurik, 2005b). Aspiration is one of the explaining factors of readiness; it is therefore highly likely that readiness and founding have the expected positive correlation. The relationship can also be explained from a psychological perspective, where intention very accurately predicts planned, rare behavior. Founding a venture is typically seen as a planned behavior and as such should be rather accurately predicted by the intention (readiness) for it (Krueger, Reilly, and Carsrud, 2000).

As mentioned in the introduction, despite the absence of an agreed explanation, the empirical evidence across the literature points to the stylized fact that founders of new companies have disproportionately often worked for small companies before. To the best knowledge of the authors, no theory links former company size directly to spin-off founding. Instead, the explanations typically assume that the former company size has an effect on founding via intermediates. The entrepreneurial process offers three points at which company size could be an influence:

1. The nascent entrepreneur. To prepare for founding (e.g., securing resources), the nascent entrepreneur often has to rely on social capital and networks (Birley, 1985; Johannisson, 1988; Saxenian, 1994; Stinchcombe, 1965), which are partially inherited from the former company via personal transfer (Boeker, 1989; Koster & van Wissen, 2004). The former company size might reduce the probability of securing financial and complementary resources, since resource owners might, for example, have less confidence in the entrepreneurial skills of employees of large than those of small companies. Furthermore, the social network of employees in large companies might be less supportive, as it could be less entrepreneurial and more focused on topics pertaining to large companies.
2. The knowledge about an entrepreneurial business opportunity (EBO). Employees in small companies are often better and earlier informed compared to those in larger companies because they have a wider scope of tasks due to limited economies of scale in small companies (Hyytinen & Maliranta, 2008), and their small companies often have a more in-depth knowledge of their limited market segment (Garvin, 1983). In addition, small

companies might at the same time be unable to develop as many EBOs due to resource limitations, thus increasing the share of unexploited EBOs.

3. The readiness to found a spin-off. Generally speaking, employees in small companies could have a higher readiness to found a spin-off due to their better qualification for being an entrepreneur (Hyytinen & Maliranta, 2008). This option will be detailed in this article. A supplementary article to come will validate the described effect on knowledge about EBOs.

#### **4.2.2 Explanatory model**

To explain why employees found a spin-off, the Employee Learning Theory (ELT) is applied, as it resonates best with the empirical results on spin-off founding across industries and the literature (Klepper, 2001). The literature provides two models of spin-off founding that feature employee learning in an industry evolution context. Both assume that the employee can learn from the company he or she works for and will profit from this by founding. In Franco & Filson (2006)'s model, the employee can only capitalize on his/her knowledge by founding a spin-off, and the success of the spin-off is dependent on the level of knowledge the founder acquired from his/her former employer. In Klepper & Sleeper (2005)'s model, each company offers an optimal set of product variants, which leaves no room for profitable entrance by non-spin-offs. However, due to learning, an employee can found a spin-off at a lower cost based on a product variant of his/her former employer's—the spin-off can thus be sustained in the existing smaller niches.<sup>10</sup> Hence,

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<sup>10</sup>The employer did not develop additional variants to close those smaller niches because the cost of doing so would exceed the benefits. Basically, he is better off gambling on the non-appearance of a spin-off as long as the probability of having employees with the required organizational skills and inclination is low.

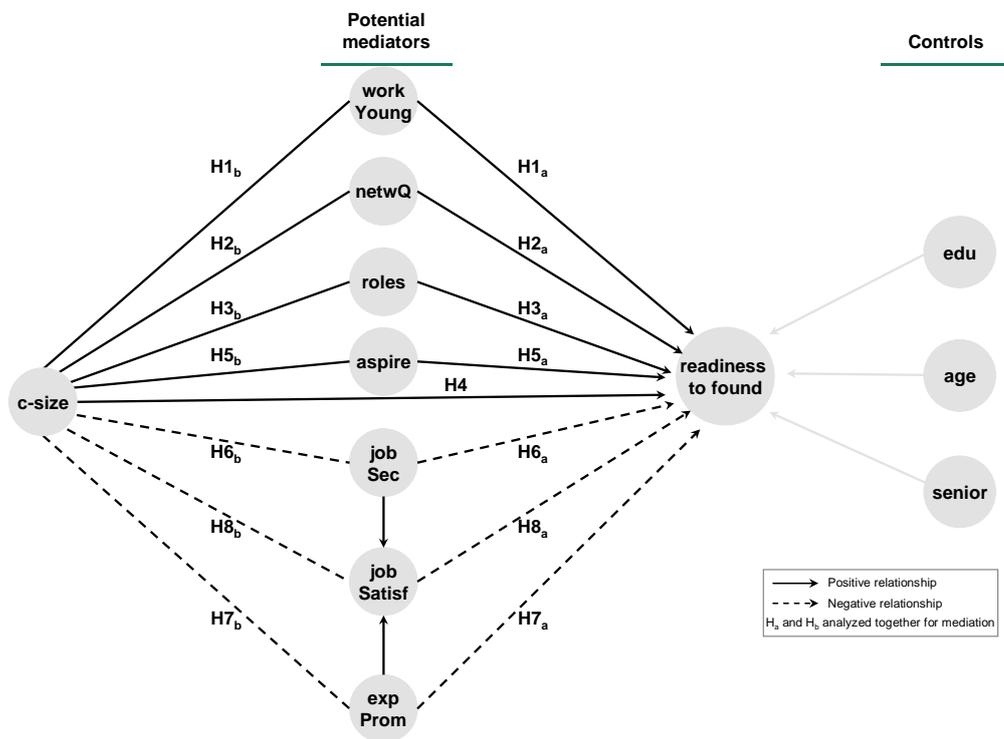
according to the ELT, individuals will found a spin-off once they have learned sufficiently and possess the necessary organizational skills and inclination (Bankman & Gilson, 1998).

However, the ELT lacks details on what or how the employee learns while being employed (Chatterji, 2009; Klepper & Sleeper, 2005). Learning is thus operationalized by three learning methods—having an employer as a role model, having a relevant network, and being a Jack of all trades. Each will be discussed when the respective hypothesis is developed. The theory also lacks a precise definition of what is meant by inclination; therefore, the Voluntary Turnover Theory (VTT) is applied. According to that theory, the decision to leave the current job is dependent on an inducement-contribution utility balance, which in turn is based on two pillars: the perceived ease of moving on and the perceived desirability (March & Simon H. A., 1958). Ease is often conceptualized as the quality of the alternative, and desirability is described by job satisfaction and organizational commitment (Felps et al., 2009). In the context of spin-offs, ease describes not only the quality of the alternative, but also what has been learned and the level of organizational skills that make a transfer easier, hence resonating very well with the Employee Learning Theory. Desirability, in contrast, compares the current situation with the opportunity. It includes inclination but goes beyond this by also considering external “pressure” such as job security. For more details on VTT, see Griffeth et al. (2000). Based on these two theories, the research model is derived (figure 8).

### 4.2.3 Hypothesis development

Figure 8: Overview of the research model.

H1-H8 determine which of those measures act as mediators for the relationship of company size to spin-off founding. The exception is H4, which validates the direct influence of company size. Three control variables are included in the model



#### 4.2.3.1 Explanations derived by the ELT

The current employers can be role models for their employees by serving as a social model (example) to be emulated (Johnson, 1986; Mason, 1991). Learning from a role model, however, is dependent on the proximity of the interaction, which should be best in young companies (Wagner, 2004). In addition, while working there, the employee has the opportunity to gather information about the transition from employment to entrepreneurship and the challenges—and their respective solutions—faced in the course of the founding and establishment process (Sorensen &

Audia, 2000). Thus, work experience in a young company should facilitate the establishment of a spin-off and should therefore increase the readiness to found.

Small company employees might more often have work experience in a young company because small companies are often also young companies (Wagner, 1997). In addition, those employees more often change their job, which increases the likelihood of their having worked in a young company at one time (Moblely, 1982). As a consequence, having experience in a young company could be an explanation for the stylized fact.

*H1: Company size is positively mediated towards the readiness to found a spin-off by work experience in a young company*

Working in a company will expose the employee to a network of suppliers of labor, goods, and capital, as well as to a network of customers and competitors (Hite, 2005), which eases the transition to founding (Saxenian, 1994). The network is a source of information on new opportunities (Baron & Ensley, 2006) and allows employees—in the absence of a track record—to rely on personal credibility to receive the required complimentary resources (Birley, 1985; Johannisson, 1988). In addition, the network established while working as an employee becomes part of the social capital inherited by the spin-off (Higgins & Gulati, 2003). Both reduces the liabilities of newness (Stinchcombe, 1965) and thus helps the founding. The effectiveness is dependent on the quality and the fit with the task. A network of high-quality suppliers may not be very helpful in securing capital, but would be in designing the supply chain. Having access to a recent founder might be helpful when considering founding a spin-off due to the opportunity to

learn from the experience (Davidsson & Honig, 2003). Alternatively, observing an entrepreneur may increase the interest in becoming one due to the role model effect (Baron, 2000). Empirical evidence confirms that the probability of becoming self-employed increases with each additional entrepreneur known to an employee (Arenius & Maria Minniti, 2005; Minniti, 2004). Thus, knowing a recent founder should increase the readiness to found a spin-off.

Employees in small companies could have more contact to entrepreneurs due to regional clustering of new ventures (Fosfurua & Rønde, 2004; Santarelli & Vivarelli, 2007) or due to selection—more entrepreneurs leave small companies; hence, employees in small companies are more likely to know an entrepreneur. Both would indicate that company size is strongly correlated with knowing a recent founder (network quality), which in turn could be the real reason for the stylized fact.

*H2: Company size is positively mediated towards the readiness to found a spin-off by the employee's network quality*

Entrepreneurs must incorporate, manage, and delegate several different resources, which is easier if they have at least a basic knowledge of a large number of business areas, being a Jack of all trades. Even when hiring others to perform the task some knowledge is required to judge the quality of applicants. The standard way to develop relevant knowledge is through work experience in a variety of roles (Lazear, 2005). Individuals with the goal of becoming an entrepreneur could consciously try to work in different roles in order to acquire the varied background favorable for founding. This explanation seems to dominate the literature and

resonates well with the ELT. Alternatively, endowment differences in the general skill set across people could allow those with more skills to work in more roles and thus qualify them better for entrepreneurship. Empirical studies on Stanford MBA students and the German population are aligned, as the number of roles positively influenced the probability of becoming an entrepreneur (Lazear, 2005; Wagner, 2004).

Small company employees have a wider range of tasks and as a result are less specialized (Hyytinen & Maliranta, 2008) and exposure to more detailed knowledge (Garvin, 1983). This could allow employees in small companies to learn a broader set of skills, which in turn could explain the stylized fact.

*H3: Company size is positively mediated towards the readiness to found a spin-off by number of roles held*

Employees in small companies could be pre-selected based on their entrepreneurial abilities, either because a different ability and attitude mix is actually required or because of founder-specific selection criteria. The mix of abilities and skills required for working in a small company could be more similar to that valued by an entrepreneur. For example, high flexibility could be required more in small companies, but is also very handy for an entrepreneur. Alternatively, the employees could be selected based on the similarity attraction paradigm (Byrne, 1971) involving similarities with the recruiter, especially if the two have to work closely together (Glaman, Jones, and Rozelle, 2002). In small companies a direct recruiting involvement of the founder—who has entrepreneurial abilities and attitudes—is more likely. As a consequence, the selected employee

should also be above average in those categories. Either way, employees in small companies could be preselected based on above-average entrepreneurial abilities and attitudes, which should increase their readiness for founding.

*H4: Working for a small company increases the readiness to found a spin-off*

#### 4.2.3.2 Explanations derived by the VTT

No explanations were derived from the ease pillar of the VTT, as it resonates very well with the ELT. Based on desirability, four promising measures were selected. Each will be explained in the following, accompanied by the respective hypothesis.

Being self-employed instead of an employee is a long-term aspiration for some individuals. The number of people expressing this aspiration varies strongly across countries and questionnaires. The Global Entrepreneurship Monitor 2005 reports values ranging from 2% in Hungary to 25% in Venezuela and 5-10% for advanced economies such as Germany (Minniti, Bygrave, and Autio, 2006). Alternative studies indicate much higher rates, e.g., 45% for Great Britain and 39% for Sweden (Blanchflower, Oswald, and Stutzer, 2001). In addition, there is a discrepancy between those who aspire to and those who actually become self-employed. For example, in 1997, approx. 8% of those surveyed in Finland aspired to self-employment, but only approx. 3% actually became self-employed within the next five years (Hyytinen & Ilmakunnas, 2007b). Despite these facts, employees who aspire to become self-employed should have a higher readiness to found a spin-off, as it would meet their long-term employment goal. Aspiration and readiness to found should not overlap completely, as there are those for whom long- and short-

term employment goals differ significantly (e.g., recent birth of a child, or forced self-employment due to job loss).

Individuals aspiring to self-employment could self-select to work in small companies because they expect to find a better learning environment there (Hyytinen & Maliranta, 2008) and to be surrounded by more unexploited business opportunities. Empirical evidence is as yet limited, with the exception of one study, which did not identify any size dependencies of aspiration for Finnish employees (Hyytinen & Ilmakunnas, 2007a). However, according to the theory, self-selection of working in a small company by employees aspiring to be self-employed could explain the stylized fact.

*H5: Company size is positively mediated towards the readiness to found a spin-off by aspiration for self-employment*

Job security—the subjective perceived likelihood of involuntary job loss (de Witte, 1999)—reflects the difference between experienced and preferred job security (Hartley et al., 1991). A low level of job security is a source of stress, creating fear and anxiety (Greenhalgh & Rosenblatt, 1984). The intention to leave one's current job increases either to avoid this stress completely (Arnold & Feldman, 1982) or because, for people worried about job continuity, it is rational to look out for more secure opportunities (Greenhalgh & Rosenblatt, 1984). A low level of job security could also be a weak form of forced self-employment, where those expecting unemployment become entrepreneurs to avoid it (Brixy et al., 2009; Brockhaus & Nord, 1979). Empirical evidence collected by meta-analysis shows that people with a lower level of job

security have a higher turnover intention and turnover rate (Sverke et al., 2002)—they are more open to other options.

Small companies have a more variable growth rate and a higher rate of attrition than large companies (Brock & Evans, 1986; Evans, 1987), resulting in a lower overall level of job security (Wagner, 1997). This effect is partially countered by the fact that individuals with a lower interest in job duration or stability should also be more attracted to those jobs (Evans & Leighton, 1989), thus increasing the subjective level of job security.

*H6: Company size is positively mediated towards the readiness to found a spin-off by the level of job security*

A promotion is a reward in itself and a source of status and additional income—besides leading to more interesting work, increased responsibility, and a greater use of knowledge and abilities (Childs, 1985). Employees expecting a promotion should have a lower desire to leave their current company (Wagner, 2004). Small companies usually have fewer levels of hierarchy and fewer positions at each level, resulting in lower overall career advancement opportunities once an employee has reached managerial level (Mueller, 2006). Hence, in small companies, employees have less reason to believe in a promotion in the near future.

*H7: Company size is positively mediated towards the readiness to found a spin-off by expecting a promotion*

Low job satisfaction, i.e., the difference between an individual's level of aspiration and the conditions of the current employment situation (Benkhoff, 1997), is the motivation for seeking opportunities beyond the current job (Herron & Sapienza, 1992). The lower the level of job satisfaction, the more extensive the search for new opportunities, due to emotionally driven avoidance, attraction to alternatives, or other motives arising from dissatisfaction (Mobley, 1977). Empirical evidence supports this hypothesis, as a reduced level of job satisfaction increases voluntary turnover intention, turnover, and the interest in becoming self-employed (Hyytinen & Ilmakunnas, 2007b; Tett & Meyer, 1993).

There is also support for assuming a relationship between company size and the level of job satisfaction. Employees founding a spin-off often report frustration due to neglect of their proposed idea (Garvin, 1983), which could have been induced by the limited resources of small companies. However, in contrast, (Schiller, 1986) reports a higher job satisfaction of young employees in small companies. Thus, company size should have an influence on the level of job satisfaction, but the direction is open for discussion. For this discussion is a positive mediation assumed.

*H8: Company size is positively mediated towards the readiness to found a spin-off by the level of job satisfaction*

### **4.3 Research design**

This paper analyzes both the direct and the indirect effect of company size on readiness by means of a three-step approach—the first step establishes the direct effect, the second step investigates whether company size is mediated on readiness (indirect), and the final step validates the results.

#### **4.3.1 Sample and data collection**

This study is focused on German technology-based spin-off foundings—a significant and economically important subgroup (Brixy et al., 2009). Individuals of interest were required to be male and have a minimum of one German patent application filed together with a company in 2006/07 in international patent classifications H04, G10L, C02, B09, H61B, H61C, H61F, H61G, H61H, H61J, or H61M, which govern the clean-tech, medical technology, and communication industries. Patent applications were excluded if the individual did not file together with a company to avoid free inventions, and if the address of either the company or the individual was not within Germany. To limit company effects, only 15 individuals per company were randomly selected if more than 15 different researchers from the same company had filed a patent in 2006/07 in those patent classifications. In total, the sample consisted of 1,650 individuals, who were addressed personally by a mail survey. Those were selected as they work currently at the technological edge in their respective fields, very likely have a good grasp of the market, are very valuable for companies (Capon, Farley, and Hoenig, 1990) and work in industries, which have seen many new ventures recently. Consequently they have good starting conditions to be classical spin-off founders (Almeida & Kogut, 1999).

Of the 324 questionnaires returned (19.6%), 60 were dropped because 3 of the respondents were female, thus having a lower founding probability (Blanchflower & Oswald, 1998), 30 respondents became self-employed without founding a spin-off, and 27 had extensive missing responses or clear indications of misunderstandings. Identifying these unfitting cases before was not possible due to missing information. Of the remaining 264 valid observations, 66 had already founded a spin-off and were thus not assessable regarding their readiness to found, leaving 198

observations for the majority of the analysis. In total, those had 52 missing values (1.19% of the total values), all missing completely at random, since Little's MCAR test (Little & Rubin, 1987) for non-random distribution of missing values showed no significance ( $p > 0.05$ ). The few missing values were reinstated by mean replacement.

#### **4.3.2 Variable operationalization**

The questionnaire employed in this study had not yet been used in the context of patent applicants and readiness for spin-off founding and thus included instruments created or adapted for this purpose. Nomology and content were therefore validated by means of a proven two-stage pretest (see, e.g., Enns et al., 2003). First, seven academics (faculty members and PhD students) reviewed the survey and research model; then, ten individuals randomly selected from the sample were asked to respond to the questionnaire in detail. Follow-up telephone interviews confirmed that each question was meaningful, understood correctly, and that no important dimensions were omitted.

Despite this rigorous approach, 4 out of 25 items did not provide adequate levels of reliability, exhibiting loadings of less than 0.7, and therefore had to be eliminated. This is relatively common when new or standard scales are used for the first time in a novel context (Barclay, Thompson, and Higgins, 1995). Eliminating one item each from readiness and promotion expectation and two items from the level of job security partially reduced the number of remaining items per scale to less than the recommended three or more items (Cohen, 2009). However, studies with fewer items are also common (e.g., Enns et al., 2003; Gefen, D. & Straub, 1997) and are generally considered acceptable for explanatory analysis.

Job satisfaction was measured as a sum score, because two satisfaction dimensions (promotion and job security) were measured separately—thus excluding formative measurement—and the remaining dimensions showed high multicollinearity. The resulting Cronbach alpha was 0.702, and a principal axis factor analysis showed one explaining factor with an eigenvalue above 1. Table 15 provides a complete overview of measures, scales, and their respective questions. For reasons of brevity, only the dependent variable is discussed in the following.

*Readiness [to found a spin-off]*. This study is different from most others as it provides the respondents with a situation before asking any questions. The respondents have to imagine that they have found an unexploited, promising BO within their field of expertise. They are then asked how ready they would be to consider founding a spin-off based on that BO if their current employer did not express interest. Readiness was measured initially by means of a three-item reflective Likert scale (1-7), and was revised as one of the items (asking for an alternative behavior) did not load well onto the latent variable.

The research model consists not only of the hypothesized relationships described above, but also includes two additional relationships: The first is between job security and job satisfaction, as individuals fearing for their job typically show low job satisfaction (Ashford, Lee, and Bobko, 1989; Clark, 2001; Kuhnert & Palmer, 1991). The other is between expectation of a promotion and job satisfaction, as better career advancement opportunities within the current organization usually increase the level of job satisfaction (Rad & De Moraes, 2009). In addition, several control variables are included in the model and briefly discussed in the following. For more details, see the cited literature.

The first of these control variables, age, decreases the probability of turnover (Arnold & Feldman, 1982) and founding (Eriksson & Kuhn, 2006), and thus also the readiness to found. The second, education, and the third, seniority, also have a positive effect on founding (Blanchflower, 2004; Cooper et al., 1991; Hyytinen & Ilmakunnas, 2007a), which is explained by a better preparation for the wide range of problems confronting founders of new ventures (Stuart & Abetti, 1987). For some of the analyses, two additional controls are applied: a self-employed parent, which should increase the probability of founding a spin-off due to first-hand experience (Dunn & Holtz-Eakin, 2000), and corporate age, because young companies could be hotbeds of founding (Wagner, 2004).

#### **4.3.3 Method**

Partial least squares (PLS) regression, a nonparametric approach to evaluating relationships and variance explained by a structural equation model, was mainly applied for analysis. The major advantages are its ability to deliver robust results despite a small sample size, a non-normal distribution, and a mix of construct types (Henseler, Ringle, and Sinkovics, 2009). The procedure relies on bootstrapping and runs several regressions for the weights of different parts of the model to achieve a convergence solution. For more details, see the literature mentioned in (Henseler et al., 2009). To calculate PLS, the software Smart PLS was applied with a 95% one-tailed test for hypothesis and a two-tailed test for controls and Sobel (Ringle, Wende, and Will, 2005).

To highlight different aspects, several models were calculated. The first two evaluated whether the stylized fact was present for the actual founding and for the readiness to found. The third detailed the direct effect of the measures on readiness, and the fourth validated the existence of common method bias (CMB) by including the relationship of aspiration to the logarithmic

number of patents. This was followed by a simultaneous test for the indirect effect of company size by expanding the model with relationships of company size to each measure. The results were validated by a subgroup analysis (models 5 and 6).<sup>11</sup> The significance of the differences was calculated by the number of times a regression coefficient differed between subsamples based on a bootstrap of each subsample while accounting for the regression means—basically a “Mann-Whitney-Wilcoxon test applied to the bootstrap values corrected for the original parameter values” (Henseler et al., 2009). To increase ease of interpretation, all variables were standardized, except in models 5 and 6, in which no standardized items were required to compare the subsamples (Chin, Marcolin, and Newsted, 2003).

#### 4.3.4 Descriptive statistics

Table 15 presents descriptive statistics for the employee sample and a split by company size showing the mean differences between the two groups—in 141 cases, the employee worked for a company with more than 200 employees, and in 57 cases for a smaller one. Respondents in small companies were younger ( $\Delta$ mean  $-3.78^{**}$  years  $t = 2.85$ ), held a lower number of patents ( $\Delta$ mean  $-0.347^{***}$   $t = 4.881$ ), and were less likely to have attended university ( $\Delta$ mean  $-17.0\%^{**}$   $t = 2.142$ ). However, they more often had a higher level of seniority ( $\Delta$ mean  $17.7\%^{**}$   $t = 2.288$ ) and

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<sup>11</sup> There is currently a discussion on the merits of subgroup analysis ongoing, which will only be described briefly. Some authors claim that a moderated multiple regression approach is more capable of detecting moderating effects than the subgroup analysis Cohen (2009), Stone-Romero & Anderson (1994). Their two main arguments are a loss of information occurring when researchers artificially dichotomize a continuous variable and a higher statistical power when interaction effects are used. In this study, company size is tested as a moderating variable. This variable was initially not measured continuously, because the majority of pretests showed an inability to answer the question of number of employees with an exact figure. A loss of information through dichotomization will not occur, as the information does not exist in the original data. The hypothesis requires testing for seven moderations at the same time. This would require using seven additional interaction terms. Introducing that many will reduce the statistical power by approx. 4% (post hoc calculation for multiple linear regression with G\*power 3.1 showed a reduction in statistical power from 0.972 to 0.934 if seven additional predictors were included) and at least partially counter the advantage of the interaction effect method. Accordingly, this study follows the example of Ahuja & Thatcher (2005) and applies subgroup analysis.

work experience in a young company ( $\Delta$ mean 48.5%\*\*\*  $t = 6.942$ ). Both groups lacked highly significant differences in knowing a recent founder ( $\Delta$ mean 13.2%\*  $t = 1.684$ ) and aspiration for self-employment ( $\Delta$ mean -9.8%  $t = 1.361$ ).

The measurement details were assessed separately for each model showing high similarities, which is necessary for subgroup analysis (Carte & Russell, 2003). For reasons of brevity, the statistical requirements are only reported for model 3 in the tables 18-20 in the appendix. Additional information can be obtained from the authors.

Table 15: Descriptive statistics of the total employee sample and the difference between employees in small and large companies

	Total sample		Split by company size					
			≤ 200 employees		> 200 employees		ΔMean	T-value
	Mean	StDev	Mean	StDev	Mean	StDev		
age	44.072	8.946	41.375	8.096	45.158	9.068	-3.783**	2.850
edu	57.7%		45.5%		62.4%		-17.0%**	2.142
senior	55.8%		68.4%		50.7%		17.7%**	2.288
roles	3.111	1.347	3.333	1.456	3.021	1.295	0.312	1.409
workYoung	37.4%		71.9%		23.4%		48.5%***	6.942
netwQ	52.0%		61.4%		48.2%		13.2%	1.684
aspire	29.7%		22.8%		32.6%		-9.8%	1.361
c-size	28.8%							
Log_Anz_Pat	0.739	0.508	0.490	0.426	0.837	0.506	-0.347***	4.881
Number	198		57		141			

Convergent validity was established based on the matrix of loadings and cross-loadings, where items loaded strongly on the constructs they intended to describe—all loadings were above 0.7, as recommended (Huber, Herrmann, Meyer, Vogel, and Vollhardt, 2007). In addition, cross-loadings higher than 0.5 were not observed, providing evidence of discriminant validity (Barclay et al., 1995) at the item level. The constructs have a composite reliability greater than 0.7 and an average variance extracted (AVE) above 0.6, as required (Huber et al., 2007), indicating reliability and

convergence validity at the construct level. To establish construct discriminant validity, the average variance shared between a construct and its measures must be greater than the variance shared between the construct and other constructs (Huber et al., 2007), which was fulfilled as reported in table 13 in the appendix. The square root of the average variance extracted (diagonal) was higher than any corresponding inter-construct correlation.

G\*power 3.1 was applied to calculate power values for each of the PLS models based on an alpha error of 5% for medium-sized effects (0.15) and 11 predictors for the total sample and 10 for the subgroups. The whole sample (0.972) and the large company sample (0.885) were above the power threshold of 0.8 (Cohen, 2009). The small company sample, however, was below (0.385) for medium-sized effects and again above for large effects (0.808). Thus, from an insignificant relationship in the small company subsample can only be concluded that a strong effect is unlikely—a medium-sized or small effect might still exist despite the lack of significance.

#### **4.4 Results**

To establish that the stylized fact also holds for the sample industries, a logistic regression was calculated based on the total sample including 66 spin-off founders (table 16). Company size had the expected significant effect on the probability of actually founding a spin-off ( $B = 0.975^{**}$  Wald = 7.119), supporting the stylized fact.<sup>12</sup> A comparable PLS regression did not reveal a significant effect of company size on readiness, indicating that the stylized fact might not hold for

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<sup>12</sup> The responses of the spin-off founders were remembered, which might induce a recall bias (Ericsson & Simon, 1984; Golden, 1992). However, the applied information was based on hard facts and was therefore much easier to remember, reducing the reliability issues.

readiness.

Table 16: Influence of company size on the actual founding and readiness to found. Logistic regression on the actual spin-off founding and standardized PLS regression on readiness to found a spin-off

	Logistic regression on actual spin-off founding				Standardized PLS regression on readiness for spin-off founding		
	Log reg coeff	StDev	T-value (wald)	Exp(B)	Reg coeff	StDev	T-value
age	-1.005***	0.214	22.132	0.366	-0.342***	0.063	5.437
senior	1.603***	0.417	14.766	4.970	0.160**	0.068	2.352
edu	0.209	0.339	0.381	1.233	0.035	0.046	0.760
parentSelf	0.481	0.389	1.532	1.618	0.101	0.064	1.574
c-age	-0.487	0.425	1.313	0.615	-0.027	0.056	0.484
c-size	0.975**	0.365	7.119	2.651	0.049	0.058	0.841
Intercept	-3.014***	0.455	43.809				
Log-likelihood ratio X	62.904***						
Log-likelihood	205.025						
R <sup>2</sup>	0.315	Pseudo R-Square (Nagelkerke)			0.137		
N	264				198		

\*p < 0.10 \*\*p < 0.05 \*\*\*p < 0.001 two-tailed test

Reference category: not founded, not senior, not been at university, no self-employed parent, not currently working in a young or small company

Table 17 presents the estimates obtained from PLS regression for four models analyzing the direct effect of each measure on readiness. All models report medium-sized explained variance (R<sup>2</sup>) between 0.266 and 0.425. The results from model 3 will be presented next as the starting point for the discussion. In line with the results presented before but contrary to the expectation, company size did not significantly influence readiness directly (company size: b = 0.033, t = 0.717). Thus, hypothesis 4 is not supported. Similarly, neither employment experience in a young company (workYoung: b = 0.050, t = 0.925) nor a broader level of experience (roles: b = 0.063, t = 1.109) had a significant association with readiness. Knowing a recent founder, on the other hand, significantly increased the readiness (netwQ: b = 0.111\*\* t = 1.900). Aspiration for self-employment showed a strong positive correlation with readiness (aspire: b = 0.318\*\*\* t = 4.793). Neither promotion expectation (expProm: b = -0.019, t = 0.355) nor the level of job security

(jobSec  $b = 0.042$ ,  $t = 0.858$ ) had a significant direct influence on readiness. However, both measures showed significant correlation with job satisfaction ( $b = 0.222^{***}$   $t = 3.379$ / $b = 0.427^{***}$   $t = 7.875$ ), with higher job satisfaction significantly reducing readiness (jobSatisf:  $b = -0.107^{**}$ ,  $t = 1.520$ ). A Sobel coefficient, calculated to measure the significance of the indirect effect of each via job satisfaction on readiness, was insignificant ( $p > 0.05$ ) and thus neither had an indirect effect. The control variables age, seniority, and education were all significant in the expected direction. Older researchers were less interested in spin-offs, and researchers with a better education and/or a higher seniority were more ready to found a spin-off.

Table 17: Results of PLS models on readiness to found a spin-off

	Model 3: Standard			Model 4: Test for CMB			Model 5: Subgroup large companies			Model 6: Subgroup small companies			Subgroup comparison	
	Reg coef	StDev	T-value	Reg coef	StDev	T-value	Reg coef	StDev	T-value	Reg coef	StDev	T-value	P-value	of Δ
age	-0.330***	0.068	4.866	-0.330***	0.066	4.979	-0.268***	0.083	3.245	-0.558***	0.124	4.497	0.031**	
senior	0.131**	0.063	2.064	0.131**	0.062	2.114	0.155**	0.076	2.048	-0.037	0.079	0.475	0.022**	
edu	0.093*	0.057	1.644	0.093*	0.060	1.541	0.028	0.048	0.587	0.324**	0.128	2.536	0.018**	
c-size	0.033	0.047	0.717	0.033	0.052	0.648								
workYoung	0.050	0.054	0.925	0.050	0.052	0.963	0.095*	0.070	1.351	-0.137*	0.092	1.488	0.006**	
netwQ	0.111**	0.058	1.900	0.111**	0.061	1.828	0.084*	0.063	1.331	0.230**	0.115	2.006	0.128	
roles	0.063	0.057	1.109	0.063	0.058	1.095	0.026	0.056	0.469	0.233**	0.126	1.840	0.065	
aspiration	0.318***	0.066	4.793	0.318***	0.065	4.882	0.342***	0.075	4.556	0.298**	0.129	2.310	0.386	
jobSec	0.042	0.049	0.858	0.042	0.046	0.913	-0.002	0.055	0.028	0.044	0.083	0.533	0.369	
expProm	-0.019	0.054	0.355	-0.019	0.051	0.381	0.065	0.075	0.864	-0.143	0.115	1.242	0.01**	
jobSatisf	-0.107*	0.070	1.520	-0.107**	0.063	1.689	-0.220**	0.089	2.478	0.240**	0.135	1.785	< 0.001***	
jobSec -> jobSatisf	0.222***	0.066	3.379	0.222***	0.068	3.287	0.174**	0.072	2.430	0.348**	0.143	2.441	0.141	
expProm -> jobSatisf	0.427***	0.054	7.875	0.427***	0.054	7.982	0.439***	0.062	7.121	0.388***	0.123	3.143	0.372	
aspire -> LogNumPat				-0.028	0.064	0.595								
R <sup>2</sup>		0.266			0.266			0.287			0.425			
N		198			198			141			57			

\*p < 0.10 \*\*p < 0.05 \*\*\*p < 0.001 one-tailed test for hypothesis, all other two-tailed

Next, it was identified whether company size was mediated by at least one of the proposed measures. Mediation occurs “when the causal effect of an independent variable (X) on a dependent variable (Y) is transmitted by a mediator (M)” (Preacher et al., 2007, p. 186). Three criteria have to be fulfilled for mediation (Baron & Kenny, 1986): First, the mediated variable (company size) has to significantly predict the potential mediator (e.g., expProm) (path a). Second, the potential mediator has to be significantly associated with the dependent variable (readiness) (path b). Third, the relationship between mediated variable (company size] and dependent variable (readiness] (path c) has to change once the potential mediator is introduced (path c’). In case of a full mediation, path c’ will become zero. The significant relationship for path c implied by this approach has been questioned by several authors, for example (Collins et al., 1998; Judd & Kenny, 1981; MacKinnon, 2000). According to these authors, a factor might mediate without having a prior overall significant relationship to the dependent variable. Following such an approach, the insignificant influence of company size on readiness (path c), established for this sample, does not limit a potential mediation.

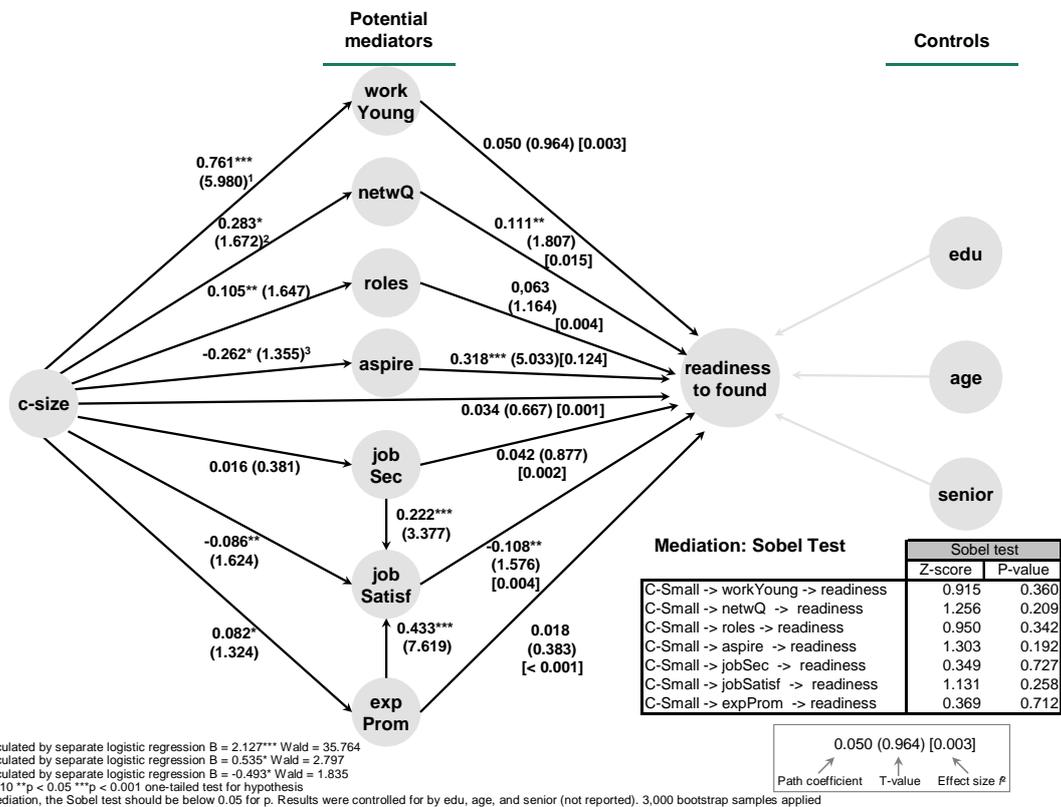
Figure 9 shows that workYoung, roles, expProm, and jobSec did not fulfill the second requirement for mediation, i.e., a significant relation to readiness—hence, none of these can act as a mediator, and hypotheses 1, 3, 6, and 7 are not supported, leaving jobSatisf, netwQ, and aspire. The latter two were partially assessed separately by logistic regression and transferred into coefficients comparable to PLS results (MacKinnon & Dwyer, 1993).<sup>13</sup> Accordingly, company size was weakly related to netwQ ( $b = 0.283^*$ ,  $t = 1.672$ ) and aspire ( $b = -0.262^*$ ,  $t = 1.355$ ) and, consequently, all three fulfilled both requirements for mediation. However, the Sobel test, a final

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<sup>13</sup> A spreadsheet, which can be downloaded at <http://nrherr.bol.ucla.edu/Mediation/logmed.html>, was applied.

test for mediation, did not reveal a significant result ( $p > 0.05$ ) due to the low level of significance and effect strength. As a result, hypotheses 2, 5, and 8 were not supported, and neither a direct nor an indirect effect of company size on readiness was identified.

Figure 9: Regression estimates and Sobel test for mediation of company size



The results could be distorted by an oversampling of small companies resulting from the limitation to 15 applicants per company to avoid firm clustering effects (for example, Siemens had more than 20% of all applications). This would be especially significant if the relationship between measures and readiness were dependent on company size and changed direction across subgroups. The moderating effect was detailed based on subgroup analysis (models 5 and 6 of table 10). The explained variance ( $R^2$ ) is 0.287 for employees in large companies, compared to

0.425 in small ones, signaling a moderation effect which will be discussed across subgroups in the following.

Company size did not reveal a significant moderating effect on the relation between jobSec ( $p = 0.369$ ), aspire ( $p = 0.386$ ), netwQ ( $p = 0.128$ ), and roles ( $p = 0.065$ ) and readiness, despite the fact that, for the latter two, a significant relationship with readiness was established only for small companies. Company size did have a strong moderating effect on workYoung ( $p = 0.006$ ), expProm ( $p = 0.01$ ), and jobSatisf ( $p < 0.001$ ). In each case, the direction of the relationship towards readiness changed across the subsamples. Job satisfaction reduced the readiness for a spin-off as expected for employees in large companies ( $b = -0.220^{**}$ ,  $t = 2.478$ ) but increased the readiness for those in small companies ( $b = 0.240^{**}$ ,  $t = 1.785$ ). Similarly, while working for a large company and having employment experience in a small company increased the readiness ( $b = 0.095^*$ ,  $t = 1.351$ ) as predicted, the opposite was established for employees in small companies ( $b = -0.137^*$ ,  $t = 1.488$ ). A similar result was evidenced for an expected promotion, which reduced the readiness only in small companies ( $b = -0.143$ ,  $t = 1.242$ )—in large companies, it increased the readiness ( $b = 0.065$ ,  $t = 0.864$ ). However, both regression coefficients were not statistically significant and should be interpreted with some caution.

The relationship between variables in this study could be artificially inflated based on a common source because all variables were measured based on a single questionnaire filled out by one person at the same point in time (Kemery & Dunlap, 1986). Despite limiting the influence of common method bias (CMB) by employing several different types of response categories along the questionnaire (seven-point scale, yes/no, number of) (Podsakoff et al., 2003), CMB could still exist. Consequently, CMB was tested with a carefully selected marker variable (logarithmic

number of patents—LognumPat), which is theoretically unrelated to at least one variable in the study (aspire) (Lindell & Whitney, 2001). CMB was assessed based on the measured correlation between the marker variable and the assumed unrelated variable (model 4 in table 17). Aspiring to self-employment had only a very minor, non-significant effect on the logarithmic number of patents ( $b = -0.028$ ;  $t = 0.595$ ). Thus, CMB is unlikely to be a serious concern as long as the method factor does not vary strongly across the model (Podsakoff et al., 2003).

#### **4.5 Discussion**

The stylized fact is prevalent in the analyzed industries because more spin-off founders have previously worked in small companies. However, there was no support for a direct influence of company size on readiness to found, despite being a preliminary step for the actual founding and the predicted selection by entrepreneurial abilities. Based on the result, it cannot be determined whether small company employees had no better entrepreneurial abilities, or whether they actually did, but these did not lead to a higher readiness. Company size could still affect readiness without a significant overall effect by an indirect effect via other measures. When simultaneously testing several factors, a significant indirect effect despite an insignificant direct one is not uncommon (MacKinnon, 2000). Consequently, the indirect effects will be discussed next.

Work experience in a young company was no mediator for company size on readiness—even though small company employees had a higher probability of this work experience—because having work experience in a young company did not have an overall effect on readiness. Only the subgroups showed some weak effects in opposite directions, which might be explained by differences in experience. Employees currently working in small companies might more strongly recall or experience the difficulties related to working in a young company—for example, lack of

resources and stability, higher job insecurity (Wagner, 1997), as they are partially present also in their current small company. The effect of oversampling can be neglected, as working in a small company increases the probability of work experience in young companies, which in turn decreases readiness. Consequently, working in a small company could only reduce the readiness via working experience, which lacks explanation power for the stylized fact, as it is directed in the opposite direction.

Network quality was not a mediator for company size on readiness, either. In line with the theory, small company employees were more likely to know a recent founder, and knowing one increased readiness to found—thus, two requirements for mediation were fulfilled. However, due to the low level of significance and effect sizes ( $f^2$ ), the Sobel test was insignificant. Oversampling would have rather reduced the significance further, as the effect was stronger in small companies.

The number of different roles was also excluded as a mediator for company size on readiness, despite small company employees having more roles, because having more roles had no significant overall effect on readiness. The results might be explained by the fact that the sample consisted mainly of technically oriented employees, who may not have had the time to spread into different fields, as they had to focus on their technical field, or they might not consciously diversify, as founding a spin-off is not their plan, but rather a surprisingly arising need due to a neglect of their ideas. In addition, the significant relationship in small companies might be dependent on the level of difference between roles. Switching roles in the technical field in large companies increases the number of roles but does not make someone a Jack of all trades, as the broader understanding is still limited to the technical world. Consequently, role changes in small companies could be of higher quality and thus significant due the higher probability of

leaving the technical field. Oversampling is again negligible, as it only reduces the relationship's strength.

Aspiration for self-employment was not a mediator for company size on readiness, either, in spite of having by far the largest effect size ( $f^2$ ) on readiness. However, employees in small companies had a lower probability of aspiration—consequently, self-selection into small companies is not at work. The results are explainable, as employees in small companies with aspiration for self-employment might already have founded. The mediation was again not significant due to limited significance and not aggravated by oversampling, as aspiration had a similar effect across all groups.

Job security, too, was no mediator for company size on readiness—neither was the subjective level of job security in small companies lower, nor did job security influence the readiness to found. Both results could depend on specifics of the sample. The technically oriented patent applicant might fear for his/her job least, having just developed a relevant patent for his/her employer and having high-quality outside options. As a result, his/her job insecurity is rather size-independent, and the push motivation of job insecurity into founding is limited due to the good alternative job offers. Oversampling is again negligible, as the values do not vary significantly across the analysis.

Expectation of a promotion was not a mediator for company size on readiness, either. Contrary to the theory, small company employees were more likely to expect a promotion, which might be due to a stronger reward culture for patent applicants there. Expecting a promotion, however, did not have a significant overall effect on readiness. The dual nature of a promotion, i.e., being a reward (Lee et al., 2004) and a sign of above-average human capital (Bhagavatula et

al., 2010; Milgrom & Oster, 1987), might explain the insignificant finding as above-average human capital could also increase the qualification for entrepreneurship (Davidsson & Honig, 2003; Gimmon & Levie, 2009). The significant difference between subgroups could be due to different importance of both levers in-between groups. However, additional research is required, especially on the subgroup difference, as—due to missing power—a medium-sized effect in the small company size sample cannot be ruled out, which might also have an effect on the as yet negligible oversampling.

Job satisfaction was also not a mediator for company size on readiness. Despite the fact that both a lower job satisfaction for small company employees and a negative influence of job satisfaction on readiness were in line with the predictions, the Sobel test did not indicate mediation—again due to low significance and effect size ( $f^2$ ). The subgroup analysis identified that, contrary to the theory, job satisfaction increased readiness for those working in small companies. This might be explained by the fact that employees who are satisfied with working in small companies are more ready to found in order to ensure a continuation of the satisfaction stemming from small companies. The opposite effect in small companies also reduces the oversampling influence.

The results discussed above indicate that company size is not mediated by any of the proposed measures and that the interference effect of the oversampling on the indirect effect of company size is limited. Thus, the stylized fact was present neither directly nor indirectly for readiness to found a spin-off, despite being relevant for the actual founding.

## **4.6 Conclusion**

This study had the objective of validating eight explanations for the stylized fact of more founders coming from small companies, based on readiness, one of three promising explanation routes. Consequently, eight measures derived from ELT and VTT and three controls were empirically analyzed for their effect on readiness to found a spin-off based on a sample of employees who applied for a patent in Germany in 2006/2007.

Of the four explanations derived from the ELT, none explained the stylized fact. Neither work experience in a young company, nor knowing a recent founder, nor being a Jack of all trades, nor selection by entrepreneurial abilities explained why founders have more often worked in small companies before. The only factor with a significant overall effect on readiness was knowing a recent founder, but even this was not identified as a mediator due to its limited significance and effect size.

Similarly, the four explanations derived from the VTT also failed to explain the stylized fact—neither an aspiration for self-employment, nor the level of job security, nor expecting a promotion, nor job satisfaction showed a relevant significance. Only aspiration and job satisfaction had the expected significant effect on readiness—however, there was no evidence of self-selection into small companies among those aspiring to self-employment, and working in small companies had only a limited effect on job satisfaction. Accordingly, neither mediated company size.

In summary, it can be concluded that ELT and VTT have an influence on readiness, but both failed to explain the stylized fact, as it was neither directly nor indirectly present for readiness. Company size had only an unexpected moderating effect, which should be detailed

further. Therefore, company size must influence the founding of a spin-off on a route other than readiness.

The two most promising routes for explanations (both discussed above) are more knowledge about unexploited EBOs in small companies and the nascent entrepreneur phase, where company size might influence resource availability. In addition, there are alternative measures offering potential for an explanation, which have not yet been tested. For example, realization of employee ideas as an internal venture might be easier for large companies due to their superior resource base, reducing the number of spin-offs in large companies (Hyytinen & Maliranta, 2008). However, the belief in receiving an offer for an internal venture is stronger among small company employees ( $t = 4.324$ ,  $p < 0.001$ ), which is no proof against the argument, but is an indication. Further explanations based on psychological factors, the size of the reward, financial constraints, or the company patent policy (Kim & Marschke, 2005) should also be detailed to explain the stylized fact.

Furthermore, the limitations of this study should be considered and validated by additional studies. The two major concerns have been touched on at various points throughout this paper and will thus only be mentioned briefly. The first is that the positive relationship of readiness towards the actual founding is not controlled for in this paper and consequently might—despite theoretic and empirical evidence from other industries—not exist in the analyzed industries. The second is oversampling, which might interfere with some of the results. The severe effects were analyzed in detail; however, there might still be an additional effect. In the future, industries without agglomeration problems (too many applicants from one company) should be analyzed with a longitude data sample to address these two concerns.

The sample applied in this study consists only of males who have applied for a patent in Germany in certain categories, which limits the result, as country of origin, industry, and gender are known for their influence on entrepreneurship (Blanchflower & Oswald, 1998; Hayton et al., 2002). Thus, additional research is required to verify whether the results hold in a different context. In addition, the study differentiates between small and large companies by the number of employees, a small company being defined as one with 200 employees or less. A more differentiated measure could improve the understanding further, either by analyzing the effect of company size at different sizes (e.g., below 20 employees) or by splitting the companies by other means (e.g., assets).

## 4.7 Appendix

Table 18: Convergence validity. Loadings of the indicator variables above 0.6, composite reliability above 0.7, and average variance extracted (AVE) above 0.6

Construct	Composite reliability	AVE	Cronbach alpha	Indicator	Typ	Loading	T-value
expProm	0.844	0.644	0.730	expProm V1	Scale 1-7	0.794	15.713
				expProm V3	Scale 1-7	0.793	17.452
				expProm V4	Scale 1-7	0.821	22.020
readiness	0.935	0.879	0.862	readiness V1	Scale 1-7	0.938	72.587
				readiness V3	Scale 1-7	0.937	69.434
jobSec	0.923	0.858	0.834	jobSec V1	Scale 1-7	0.923	50.777
				jobSec V4	Scale 1-7	0.929	51.126
jobSatisf	NA	1.000	1.000	Sum_jobSatisf	Scale 1-7	1.000	NA
All remaining	NA	1.000	1.000	NA	Nominal	1.000	NA

Table 19: Discriminant validity—correlation between constructs. Fornell-Lacker criterion: square root of AVE (bold) has to be larger than each correlation coefficient

	age	senior	edu	c-size	work Young	netwQ	roles	aspire	jobSec	expProm	jobSatisf	readiness
age	<b>1.000</b>											
senior	0.100	<b>1.000</b>										
edu	0.149	0.109	<b>1.000</b>									
c-size	-0.191	0.162	-0.152	<b>1.000</b>								
workYoung	-0.153	0.120	-0.035	0.454	<b>1.000</b>							
netwQ	-0.161	-0.011	-0.017	0.119	0.073	<b>1.000</b>						
roles	0.280	0.332	0.147	0.105	0.053	0.087	<b>1.000</b>					
aspire	-0.002	0.029	-0.160	-0.097	-0.115	0.030	0.023	<b>1.000</b>				
jobSec	0.051	0.017	-0.103	0.016	0.057	-0.029	-0.025	0.054	<b>0.926</b>			
expProm	-0.169	0.211	0.065	0.082	0.181	0.066	0.183	-0.101	0.304	<b>0.803</b>		
jobSatisf	0.009	0.111	0.125	-0.047	0.056	0.069	0.006	-0.163	0.352	0.495	<b>1.000</b>	
readiness	-0.314	0.133	-0.011	0.119	0.096	0.174	0.046	0.325	-0.010	0.029	-0.121	<b>0.937</b>

Table 20: Item loading and cross-loading. Item should load with < 0.6 on its respective construct and significantly lower on other constructs

	age	senior	edu	c-size	work Young	netwQ	roles	aspire	jobSec	expProm	jobSatisf	readiness
age	1.000	0.100	0.149	-0.191	-0.153	-0.161	0.280	-0.002	0.051	-0.169	0.009	-0.314
senior	0.100	1.000	0.109	0.162	0.120	-0.011	0.332	0.029	0.017	0.211	0.111	0.133
edu	0.149	0.109	1.000	-0.152	-0.035	-0.017	0.147	-0.160	-0.103	0.065	0.125	-0.011
c-size	-0.191	0.162	-0.152	1.000	0.454	0.119	0.105	-0.097	0.016	0.082	-0.047	0.119
workYoung	-0.153	0.120	-0.035	0.454	1.000	0.073	0.053	-0.115	0.057	0.181	0.056	0.096
netwQ	-0.161	-0.011	-0.017	0.119	0.073	1.000	0.087	0.030	-0.029	0.066	0.069	0.174
roles	0.280	0.332	0.147	0.105	0.053	0.087	1.000	0.023	-0.025	0.183	0.006	0.046
aspire	-0.002	0.029	-0.160	-0.097	-0.115	0.030	0.023	1.000	0.054	-0.101	-0.163	0.325
jobSec V1	0.047	0.027	-0.114	0.003	0.025	-0.032	-0.043	0.065	0.923	0.302	0.320	-0.013
jobSec V4	0.048	0.005	-0.077	0.025	0.080	-0.021	-0.005	0.035	0.929	0.262	0.333	-0.006
expProm V1	-0.294	0.115	-0.002	0.104	0.185	0.095	0.051	-0.084	0.270	0.794	0.318	0.118
expProm V3	-0.185	0.220	0.093	0.061	0.143	0.066	0.168	-0.010	0.258	0.793	0.359	0.117
expProm V4	0.010	0.169	0.057	0.044	0.122	0.014	0.196	-0.134	0.218	0.821	0.483	-0.114
jobSatisf	0.009	0.111	0.125	-0.047	0.056	0.069	0.006	-0.163	0.352	0.495	1.000	-0.121
readiness V1	-0.297	0.134	-0.035	0.120	0.110	0.238	0.036	0.284	-0.001	0.029	-0.098	0.938
readiness V3	-0.291	0.115	0.014	0.103	0.069	0.088	0.050	0.326	-0.017	0.025	-0.129	0.937

Table 21: Scales/measures and their respective items

Measure	Question (abridged translation from the German questionnaire)	Type	Source
company size	How many employees does your current employer have?	1 = ≤ 200 0 = > 200	(Leptien, 1996; SOEP)
workYoung	Have you ever been employed in a company which was younger than 10 years when you started to work there?	1 = yes 0 = no/don't know	Adapted based on (SOEP; Wagner, 2004)
netwQ	Do you personally know someone who has started a business in the two years preceding this survey? Please do not consider elemental services such as a kiosk or snack stall.	1 = yes 0 = no/don't know	(Arenius & Maria Minniti, 2005)
roles	In how many different professional fields have you been active in the past? Similar roles at different companies should be considered as one.	Number of roles—above 6 coded as 6	(Wagner, 2004)
aspire	Imagine for a second that you could pick your ideal working situation. Would you prefer to be self-employed or employed?	1 = prefer self-employed 0 = prefer employed/don't know	(Blanchflower et al., 2001)
jobSec	V1: This job offers me continued long-term security. V2: <i>I feel that with the opportunities given with this job, I have a sound future.</i> V3: <i>Most people doing this job within this organization have long-term security</i> V4: I am satisfied with my job security	Each assessed based on a 1-7 Likert scale	(McKnight et al., 2009)
expProm	V1: I believe I will advance my career within the next two years V2: <i>I believe I will be downgraded in my profession within the next two years</i> V3: I believe I will receive a salary increase in my current company beyond the overall increase in pay rates V4: I am satisfied with my promotion prospects	Each assessed based on a 1-7 Likert scale	(SOEP)
satisf	I am satisfied <ul style="list-style-type: none"> <li>• with my total pay</li> <li>• with my relations with supervisors</li> <li>• with my relations with co-workers</li> <li>• with my work content</li> <li>• with the use of initiative</li> <li>• overall</li> </ul>	Each assessed based on a 1-7 Likert scale and then added up	(Leptien, 1996; Clark, 2001; SOEP)
readiness	Imagine that you believe to know of a profitable BO, and your current company is not interested. How likely is it that within the next two years you would ... V1: ... detail an own self-employment (e.g., business case, financing) V2: ... <i>undertake nothing and continue on a new idea</i> V3: ... consider self-employment	Each assessed based on a 1-7 Likert scale	Adapted based on (Mueller, 2006)
age	Year of birth	Years since birth	(Leptien, 1996)
edu	Highest educational level	1 = university education	(Leptien, 1996)
senior	Current position	1 = managerial level	(Leptien, 1996)

Table 22: Overview of literature covering company size and company creation

Study	Investigated area	Findings
(Utterbeck et al., 1984)	Sweden	~ 75% of technical entrepreneurs worked in companies with less than 500 employees before
(Bruno & Tyebjee, 1985)	US high-tech start-ups	~ 77% of founders worked in companies with less than 100 employees before
(Johnson & Cathcart, 1979)	Production companies in the northern UK	Companies with less than 10 employees have a six times higher founding rate compared to the average
(Freedman, 1983)	Technology-oriented companies in Philadelphia	Only ~ 7% of founders worked in “large” companies before
(Cooper, 1971)	US high tech	Companies with less than 250 employees have six times as high a founding rate as larger companies
(Boden, JR, 1996)	US	~ 2.6 times as many founders worked in companies with less than 100 employees
(Cooper, 1985)	Cover stories from 1981-84	41% of founders worked in the top 500 service/industry companies, which represent a share of 32% of employees
(Phillips, 2002)	Silicon Valley law firms	Increasing the number of associates increases the probability of a spin-off disproportionately little
(Liñán Alcalde et al., 2002)	Germany 1984-1996	Company size of less than 20—and, to a lesser extent, 21-200—increased the probability of becoming an entrepreneur
(Eriksson & Kuhn, 2006)	Danish companies	Spin-off probability decreases with an increasing number of employees—the average company size resulting in a spin-off is ~ 322 employees
(Gompers et al., 2005)	US high tech (NBER 2 and 3)	Companies with less than 100 employees have increased founding probability
(Hyytinen & Maliranta, 2008)	Finnish companies	Companies with less than 20 employees have a disproportionately high number of foundings
(Wagner, 2004)	Germany	Working in young companies with less than 20 employees increases the probability of becoming an entrepreneur
(Georgellis & Wall, 2005)	West Germany (1984-97)	Employees working in companies with less than 20 employees are more likely to become self-employed

Please note that most of the studies described in table 22 rely on a mixed sample. They often include companies in which the founder had previously been unemployed, had worked or studied in the academic field, or took charge in a family business. Additionally, the founded companies were often diverse in terms of industry and level of technological orientation.

## 5 Chapter – Comparison of papers II and III

This chapter compares the empirical results of papers II and III and draws overall conclusions. The comparison is possible because the two papers share a common idea—explaining the stylized fact that a disproportionately high number of founders have worked for a small company before—and because the measures analyzed in the two papers are similar. They were derived from the same theories: the Employee Learning Theory (ELT) and the Voluntary Turnover Theory (VTT). The resulting overlap allows the results to be validated, thus providing a more comprehensive answer to the research question. The papers have not only similarities but also substantial differences, which have to be considered first before comparing the results (table 23).

Table 23: Methodical differences across paper II and III

Difference in:	Paper II	Paper III
<b>Dependent variable</b>	<ul style="list-style-type: none"> <li>• Actual founding</li> <li>• Binary data level</li> </ul>	<ul style="list-style-type: none"> <li>• Readiness to found (pre step of actual founding)</li> <li>• Ratio data level</li> </ul>
<b>Statistic method</b>	<ul style="list-style-type: none"> <li>• Logistic regression solved with SPSS</li> <li>• Excluded measures: <ul style="list-style-type: none"> <li>– Aspire</li> <li>– Pre-selection</li> </ul> </li> <li>• One-tailed test</li> </ul>	<ul style="list-style-type: none"> <li>• Structural equation model solved with PLS</li> <li>• Excluded measures: <ul style="list-style-type: none"> <li>– Corporate age</li> <li>– Parent self-employed</li> <li>– Network size</li> </ul> </li> <li>• Two-tailed test</li> </ul>
<b>Data structure</b>	<ul style="list-style-type: none"> <li>• All 264 eligible participants</li> <li>• Reliability issue: Recall bias</li> <li>• Only one item excluded</li> </ul>	<ul style="list-style-type: none"> <li>• 198 participants (employed) as 66 founders were excluded</li> <li>• Reliability issue: Limited statistical power in small company sub sample</li> <li>• Four item excluded</li> </ul>

### **5.1.1 Different dependent variable**

A major difference between the two papers is the different dependent variable. The dependent variable of the second paper is the actual founding of spin-offs. In other words, the analysis is based on the difference between those who have founded and those who have not yet founded. The third paper, in contrast, investigates the readiness to found—a preliminary step to the actual founding. The two independent variables are related, as employees with a high readiness (aspiration) to found a spin-off will, given a business opportunity, more often found a spin-off (Grilo & Thurik, 2005b; Henley, 2007; Hyytinen & Ilmakunnas, 2007b; Katz, 1990). However, measures affecting the preliminary step, readiness to found, need not have the same influence on the actual founding (the final step), due to interactions with other intermediate steps also influencing the final step. For the same reasons, measures significantly influencing founding also do not have to have the same effect on readiness to found. Taken together, a measure can have an influence on founding but not on readiness to found and vice versa. A different effect across studies does not indicate that the results are wrong. Instead, it only indicates that the results are inconclusive and that interpretation requires some caution.

### **5.1.2 Different statistics**

Papers II and III apply two different statistical methods. The latter is calculated based on a structural equation model and solved with PLS, which was possible due to the ratio data level of the dependent variable. Paper II, on the other hand, had a binary dependent variable—either the respondent had founded a spin-off or he/she hadn't. As the scale level required for OLS regression was not fulfilled, a logistic regression method was applied throughout paper II. Its non-linear nature makes interpretation more complicated since the effect of a measure is dependent on the

overall probability, which in turn is dependent on the values of the other measures (Hoetker, 2007). Or, to be more specific, knowing a founder is much more likely to change the decision to found a spin-off for those who are insecure (e.g., equal propensities) than for those who already have a 90% likelihood to found. Due to the differences, comparing the size and strength of the logistic regression results with the PLS results is not appropriate (Cohen, 2009). In addition, the direction and significance of the logistic regression are based on the response level of an “average” observation—all variables set to their mean (Hoetker, 2007). The effect might actually be different for those with a lower or higher probability. Comparing the direction and significance of the logistic and the PLS results also requires additional caution.

Papers II and III also differ with regard to measures. Aspire and pre-select were excluded in the model on founding due to data reliability limitations. For example, establishing the level of entrepreneurial skills in the past has a strong recall bias, especially if the respondent has become an entrepreneur in the meantime. Moreover, the empirical investigation in paper III is based on a sample size of 198 cases. For one of the subgroup analyses, the sample size is even lower, at 57. The small sample size has a negative effect on the empirical power. In order to reach appropriate power level, control variables for corporate age and parents’ self-employment, which were not significant in paper II, were excluded from the analysis. For the same reason, network size was also excluded. A separate test revealed that neither had any significant effect on readiness or the overall research model.

In addition, papers II and III have a different test value. Both target an alpha error of 5% for the hypothesis testing. However, the tests in paper III are one-tailed test, whereas the ones in paper II are two-tailed. The different test statistics were applied to be more conservative with the

less reliable data of paper II. However, if the results are compared across papers, it has to be taken into account that the p-values are based on different t-values, thus having a slightly different meaning.

### **5.1.3 Differences in data structure**

Despite the fact that both papers are based on the same mail survey, some differences in the underlying data exist. While paper II applies all cases, paper III relies only on those who are currently employed and have not founded a spin-off. On the one hand, this reduces power, as the sample size is reduced by 66 to 198. The resulting power when detailing the small company subgroup was only enough to reject the existence of large effects in the PLS analysis. On the other hand, this also increases the data reliability. The excluded cases are the ones prone to the recall bias, as they include answers about past occurrences. All remaining cases were answered from the current position without the risk of a recall bias. As a consequence, the results of paper II, especially on the VTT, have to be treated more carefully than those of paper III as long as the power is above the threshold of 0.8 (Cohen, 2009).

The PLS method applied in paper III allows the use of reflective measures, where each item receives the weight most appropriate to it. This procedure even permits the exclusion of items which do not load well on the construct. As mentioned in paper III, four measures were excluded for that reason. Interestingly, the logistic regression applied in paper II provided each item of a construct with an equal weight. Cronbach alpha and principal axis factor analysis implied that only one item had to be removed. Thus, despite the same name and the same items used in the questionnaire, the reported measures differ slightly across the two studies, which should be taken into account when explaining differences.

## **5.2 Comparison of the effects across papers II and III**

As mentioned above, the results of the two papers have to be compared carefully, as there are substantial differences between the two analyses. The significance and the direction of each measure will be reported first, followed by the mediation analysis.

### **5.2.1 Comparing direction and significance of measures across studies**

Table 24 shows the regression results for the logistic regression (paper II) and the PLS regression (paper III). For an additional perspective, the results of the subgroup PLS analysis are also presented. The subgroup results for the logistic regression are not included, as the only difference was netwQ, being relevant only for the total sample and for employees in large companies.

Three measures showed a very similar behavior across all analyses. Those are age, aspiration, and expectation of a promotion. Each will be discussed briefly in the following. The age of an individual is always highly significant. An increasing age reduced the readiness and decreased the probability of founding a spin-off. Having the aspiration to self-employment in the long run then again had a significantly positive effect on readiness across all groups. The effect was not tested on the actual founding due to data limitations reducing the strength of the evidence. Furthermore, expecting a promotion did not have any significant effect, neither on the readiness nor on the actual founding. However, due to power limitations, a medium-sized effect on readiness for employees in small companies cannot be ruled out.

In addition to the three aligned measures, there were four measures which were aligned in all but one analysis. The misalignment was always for the subgroup analysis of small companies. Here, the results were either insignificant or pointed in the opposite direction.

Table 24: Comparison of actual founding and readiness to found

	Logistic regression for actual founding			PLS regression on readiness to found a spin-off													
	B	StDev	P-value	Logistic regression: total sample			PLS: total sample				PLS: subgroup large				PLS: subgroup small		
				Exp(B)	Reg Coef	StDev	T-value	Reg Coef	StDev	T-value	Reg Coef	StDev	T-value	Reg Coef	StDev	T-value	
age	-0.999***	0.261	0.000	0.368	-0.330***	0.068	4.866	-0.268***	0.083	3.245	-0.358***	0.124	4.497				
senior	2.078***	0.525	0.000	7.988	0.131**	0.063	2.064	0.155**	0.076	2.048	-0.037	0.079	0.475				
edu	0.339	0.401	0.399	1.403	0.093*	0.057	1.644	0.028	0.048	0.587	0.324**	0.128	2.536				
parentSelf	0.565	0.443	0.202	1.760													
c-age	-0.297	0.539	0.582	0.743													
c-size	1.817***	0.460	0.000	6.151	0.033	0.047	0.717										
workYoung	-1.756***	0.500	0.000	0.173	0.050	0.054	0.925	0.095*	0.070	1.351							
netwS	-0.666**	0.199	0.001	0.514													
netwQ	1.224**1	0.430	0.004	3.400													
roles	0.139	0.198	0.482	1.450													
aspiration					0.111**	0.058	1.900	0.084*	0.063	1.331							
jobSec	-0.385*	0.204	0.059	0.681	0.063	0.057	1.109	0.026	0.056	0.469	0.230**	0.115	2.006				
expProm	0.318	0.224	0.156	1.374	0.318***	0.066	4.793	0.342***	0.075	4.556	0.233**	0.126	1.840				
jobSatisf	-0.398*	0.215	0.063	0.671	0.042	0.049	0.858	-0.002	0.055	0.028	0.298**	0.129	2.310				
jobSec -> jobSatisf					-0.019	0.054	0.355	0.065	0.075	0.864	0.044	0.083	0.533				
expProm -> jobSatisf					-0.107*	0.070	1.520	-0.220**	0.089	2.478	-0.143	0.115	1.242				
Intercept	-4.352***	0.700	0.000		0.222***	0.066	3.379	0.174**	0.072	2.430	0.240**	0.135	1.785				
Log-likelihood-ratio X	110.176		0.000		0.427***	0.054	7.875	0.439***	0.062	7.121	0.348**	0.143	2.441				
Log-likelihood	186.160																
Log Likelihood ratio test	11.430**		0.000														
R <sup>2</sup>	0.506	Pseudo R <sup>2</sup> (Nagelkerke)			0.266			0.287			0.425						
N	263				198			141			57						

\* p < 0.10 \*\* p < 0.05 \*\*\* p < 0.001 two-tailed test  
 Reference is employment without fulfilling any of the dummy coded measures

1) Significantly relevant only for the total sample and employees in large companies

A typical example is job satisfaction, which significantly reduced the readiness and the actual founding. Individuals with a higher job satisfaction were less ready to found and had a lower probability of founding a spin-off. However, for employees in small companies the opposite was found to be true—higher job satisfaction increased the readiness to found a spin-off. Similarly, having a management position (senior) always significantly increased the readiness and the probability of founding, except for employees in small companies. Here, seniority had no significant effect on the readiness to found. Again, before drawing any conclusions it has to be highlighted that, due to statistical power problems, an existing medium-sized effect might not have been detected. Knowing a recent founder (netwQ) showed a similar pattern by significantly increasing the readiness to found and the probability for founding along all analyses except for employees in small companies, who did not show a significant effect on the probability to found. Interestingly, there was one measure, roles, which was only significantly positive for employees in small companies. Having broader experience did not have an effect—neither on readiness nor on the actual founding—except for employees in small companies. Here, having worked in many different roles had the expected positive effect.

The remaining four measures showed stronger variation across analyses. Having a higher education had a significant influence primarily on the readiness of employees in small companies. Here, a higher education was found to significantly increase the readiness to found a spin-off. This resulted in a weak positive relationship for the total sample. The other analyses also showed a positive sign but were not significant. Thus, if at all, rather a positive effect of education is to be expected. Job security, on the other hand, had only a weak influence on the probability to found a

spin-off and did not have any significant effect on readiness. Thus, the empirical evidence rather suggests that the effect of job security is weak, if existing at all.

A very interesting result was found in work experience in a young company, which showed a strongly negative relation to the actual founding and had a weak negative influence on the readiness of employees in small companies. But for employees in large companies, the effect on readiness was weakly positive, resulting in an overall insignificant effect for the total sample. Hence, the effect is inconclusive. Company size, as detailed in paper III, only had an effect on the actual founding, but not on the readiness to found. The remaining factors were only analyzed in one study and thus cannot be compared with other results.

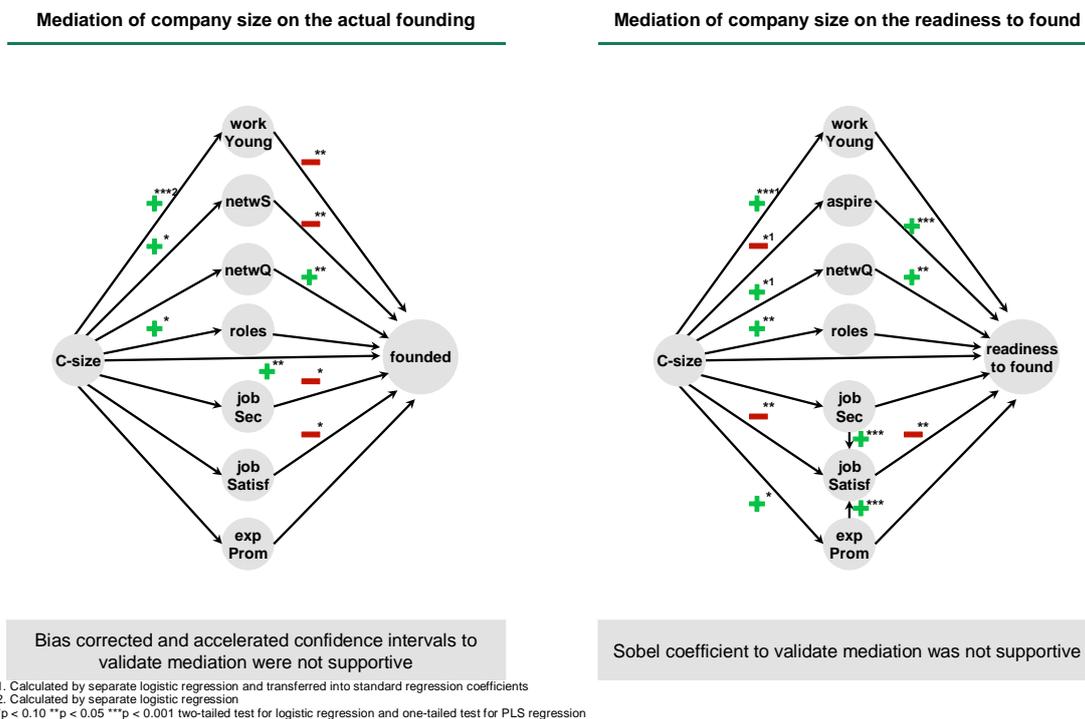
### **5.2.2 Comparing mediating analysis results**

Both papers independently came to the same conclusion—company size is not mediated by any of the proposed mediators neither on readiness nor on the actual founding. The Sobel analysis and the bootstrapped confidence intervals did not show an indication for mediation, partially due to an insignificant association of company size with the proposed measures, which will be briefly discussed next.

Three measures showed a comparable relationship to company size across both papers. The first two, work young and roles, both showed a significant positive relationship with company size, as can be seen in figure 10. Thus, employees in small companies were more likely to have work experience in a young company and had worked in more different roles so far. In addition, both analyses showed that job security was independent of company size. The remaining measures differed across studies. Company size had a significant effect on each when analyzing

the readiness to found but did not have a significant effect when analyzing the actual founding—making the effects at least partially inconclusive.

Figure 10: Comparison papers II/III: simplified overview of mediation results



### 5.3 Discussion of the comparison

The measures applied were based on two theories, the ELT and the VTT. The approach allows differentiating which measures are empirically supported as driving factors of each theory. Thus, the focus of this discussion is on identifying the “best” measures detailing the theories.

### **5.3.1 The ELT measures**

As mentioned in papers II and III, the ELT does not explicitly explain how and what the founder of a company has learned while he or she was employed. Five measures were applied in parallel to differentiate the learning methods and find the most effective ones. Of the five measures tested, only network quality showed a high significance and a stable direction and was in line with the literature across most analyses, indicating that an employee learns from knowing a recent founder. Either that person acts as a role model or individuals interested in entrepreneurship try to establish contact to entrepreneurs, for example, to learn from their experience.

In addition, the study offered no support for roles and selection: Neither the broadness of the knowledge nor the selection of employees by entrepreneurial skills had any influence on spin-off founding. Only for employees in small companies was the expected positive relationship of roles established. Learning by working in a large number of different roles is not the path taken by future spin-off founders from the technical field. Other studies based on MBA students (Lazear, 2005) and representative population surveys (Wagner, 2004) report a strong effect. The result could be influenced by specifics of the sample, i.e., technical founders and an exclusive focus on spin-offs. Additional research comparing the different groups more closely is required to validate the findings.

The explanation behind selection assumes that employees in small companies have better entrepreneurial skills, which would induce a higher readiness to found and, as a consequence, more spin-off founding. Empirical results showed no indication for a higher readiness to found in small companies, leading to two possible explanations: Either those employees actually were no better prepared for self-employment (pre-selection by their skills) or they did have better skills,

but those skills did not lead to a higher readiness. Determining which explanation is more accurate is left for future research.

The size of the network and having work experience in a young company had some explanation potential, but the results were inconclusive. Often, they were contrary to the expectations and not consistent across the analyses. Thus, additional research is required to further detail the influence of those factors.

### **5.3.2 The VTT measures**

Four measures derived based on the VTT were tested in parallel to evaluate their explanatory potential. The first, expecting a promotion, did not have any direct or indirect effect on either the readiness or the actual founding of spin-offs. Expecting a promotion does not decrease the interest in founding a spin-off, which is very surprising, as most patent applicants see a promotion as the best reward for their work (Leptien, 1996). Individuals expecting this reward should have little interest in losing it by leaving their current employer. But despite being the mayor motivational factor for employed patent applicants, it does not reduce their interest in founding a spin-off.

Job satisfaction had the expected effect across the study. A higher job satisfaction reduced readiness and the probability of actually founding a spin-off. However, the opposite was found to be true in small companies, where a higher satisfaction increased the readiness to found. One explanation is that those comfortable in a small company are more ready to found one themselves in order to stay in one. Overall, job satisfaction seems to be a driving force for the decision to found a spin-off. A similar result was shown by aspiration: Employees with the long-term employment goal of self-employment were more ready to found a spin-off given the opportunity.

The result is not as convincing, since only one analysis was applied. A more detailed validation is left for future research.

Job security showed mixed results by being weakly associated with the probability of founding but being insignificant for readiness. The results point towards a weak or negligible influence of job security. One explanation could be that the rather technically oriented employees analyzed in this study seem to have strong alternative job opportunities, reducing the push motivation into self-employment induced by job insecurity.

### **5.3.3 Mediation**

Taken together, the two papers clearly indicate that the stylized fact is present in the industries analyzed. However, it cannot be explained by the measures of the ELT or VTT theory. Thus, neither work experience in a young company nor the employee network nor the broadness of experience is the reason for the fact that founders have more often worked in small companies before. The same holds for selection and self-selection by aspiring individuals, job security, expecting a promotion, and job satisfaction. Thus, the theories currently suggested and speculated upon in the literature offer some explanation for readiness and probability of founding, but do not explain the stylized fact. A new or advanced theory is therefore required.

## **6 Chapter – Alternative theory to explain the stylized fact**

### **6.1 Introduction**

This work has so far determined that the stylized fact that more founders have previously worked for small companies is present in the analyzed industries. However, although the measures derived from the ELT and the VTT (particularly netwQ, jobSatisf, and aspire) have some influence on the readiness to found and on the actual founding, these theories are not capable of explaining the stylized fact. Thus, employees in small companies are no more “ready” to found a spin-off than their counterparts in large companies. To understand the stylized fact, alternative explanations have to be evaluated.

One promising route is found in the pre-nascent entrepreneur phase, where the decision to detail an entrepreneurial business opportunity (EBO) towards founding a spin-off is dependent not only on readiness, but also on knowledge of a relevant EBO. The latter could vary across company size. Employees in small companies could more often know of an unexploited EBO, as they have more access to information and their small employers have fewer financial resources, limiting their ability to exploit all identified EBOs. Following this explanation, employees in small companies may have a disproportionately high likelihood of founding a spin-off because they learn of more unexploited relevant entrepreneurial business opportunities there. This explanation will be tested next.

### **6.2 Theory on knowledge of an entrepreneurial business opportunity (EBO)**

The theory on EBO is arranged along four research questions:

- How is EBO defined?
- How do EBOs arise?
- How are EBOs discovered?
- Which factors affect knowledge of an EBO?

These four research questions will be detailed in the following.

### **6.2.1 How is EBO defined?**

The literature on the topic of business opportunities is very diverse and widespread. There are three directions of thought for entrepreneurial business opportunities (EBOs). Each emphasizes a different dimension and consequently has a different definition of EBO (Gaglio, 2004).

The first argues that the timing of the pursuit distinguishes an EBO: Only novel ideas that are first to the market are true EBOs (Kirzner, 1979, 1985). The second focuses on the way in which an opportunity is pursued: Only ideas that lead to a new venture are identified as EBOs (Gartner, 2001; Timmons, Muzyka, Stevenson, and Bygrave, 1987). The third relates to the type of opportunity identified and pursued, with mainly those deemed wealth-creating, innovative, or radical by society or industry being recognized as EBOs (Gaglio & Katz, 2001; Schumpeter, 1934; Shane & Venkataraman, 2000). As a consequence, there is no agreed-upon definition of EBO and most likely will not in the near future, either (McMullen, Plummer, and Acs, 2007). Instead, several authors suggest that the best way going forward is to “take a stance and clearly articulate the position and definition” (McMullen et al., 2007 p. 279; DeTienne & Chandler, 2007).

In this work, a business opportunity is defined as an economically relevant change, which can be an innovation (new), an improvement, or even an imitation in an unsaturated market. This definition is originally based on Singh (2001) and adapted based on the questionnaire feedback. Entrepreneurial business opportunities are those business opportunities which can theoretically be implemented in a self-contained, profit-oriented venture. The definition thus does not require an EBO to be first to the market, novel, radical, or already introduced as a new venture. Instead, employees merely have to believe that they know of an economically relevant change which is sustainable in an independent venture.

### **6.2.2 How do entrepreneurial business opportunities arise?**

There are three theories with varying assumptions on how EBOs arise: the neoclassical equilibrium theory, the psychological theory, and the Austrian theory. Each will be briefly outlined in the following; for more details, see Fiet (1996), Shane (2000) and the authors mentioned in the next paragraphs.

**Neoclassical equilibrium theory.** The essence of this theory is that individuals are rationally acting maximizing agents who operate in a market in equilibrium. This setup does not allow anyone in particular to recognize opportunities for entrepreneurial profit, as everyone would know about each opportunity at the same time (Shane, 2000). As a consequence, only fundamental attributes of people distinguish founders from non-founders. For example, people with a greater appetite for uncertainty will develop entrepreneurial business opportunities, thus becoming entrepreneurs, while those with a greater aversion to uncertainty will remain employed (Khilstrom & Laffont, 1979).

**Psychological theory.** This theory assumes that discovering an EBO is dependent on relative differences between people, especially with regard to their search ability and their willingness (Shane & Venkataraman, 2000). Those individuals with a superior information processing ability, search technique, or scanning behavior will more often identify EBOs (Shaver & Scott, 1991). Consequently, EBOs exist in some way and are identified by those with superior fundamental attributes and willingness.

**Austrian theory.** Here, the main assumption is that markets are in disequilibrium and that, as a consequence, individuals possess different information (Hayek, 1945). Due to an idiosyncratic information distribution, some people can identify specific opportunities while others cannot. Thus, each individual can only recognize EBOs for which she/he has the right information (Shane & Venkataraman, 2000). Therefore, the level and type of information distinguishes those who identify an EBO from those who do not.

This work is based on the Austrian theory, because both other theories have severe limitations. The neoclassical view of public knowledge of all EBOs by everyone is contrary to the research question at hand. If everybody knows of every EBO, then employees in small companies cannot know of more EBOs—thus, the whole explanation would fail from the start. The psychological theory has very little empirical support, as robust results indicating that individual attributes or behaviors differ significantly between entrepreneurs and other individuals have not been established (Busenitz & Barney, 1997). In addition, only the Austrian theory consistently distinguishes between opportunity exploitation and opportunity discovery (Shane, 2000), which is required to fulfill the definition of EBO applied throughout this work.

Following the literature on the Austrian theory, esp. Eckhardt & Shane (2003) and Drucker (1985), typical origins of EBO are information asymmetry (Kirzner, 1973), supply and demand changes, i.e., new methods, new materials, new products, and preference changes (Kirzner, 1973; Schumpeter, 1934), and exogenous shocks (Schumpeter, 1934). In line with this, Holcombe (2003) characterizes origins of EBO as factors that disequilibrate the market, enhance production possibilities, or result from prior entrepreneurial activity.

### **6.2.3 How are entrepreneurial business opportunities discovered?**

So far, EBOs have been defined and it was described how EBOs come into existence. The next logical step is to detail how EBOs are discovered. However, two interlinked heated discussions are currently ongoing in the literature—one is on whether opportunities are discovered or created by entrepreneurs (Acs & Audretsch, 2003; McMullen et al., 2007), the other on whether individuals search for opportunities or whether they recognize them (Baron, 1999; Kaish & Gilad, 1991; Kirzner, 1973; Shaver & Scott, 1991). So far, the literature has failed to provide an answer to any of those questions; however, it is highly likely that all process types exist in reality (Short, Ketchen, JR, Shook, and Ireland, 2010). While some individuals discover EBOs by actively looking for them, others will recognize one by chance. In addition, some EBOs might be essentially ready to be exploited (Short, Ketchen, JR, Shook, and Ireland, 2010), while others will need a lot of polishing before they shine (Ardichvili, Cardozo, and Ray, 2003).

To completely avoid this ongoing discussion, it is not the discovery of an EBO that is detailed but rather knowledge of an EBO. By shifting the focus in this way, it is more or less

irrelevant whether EBOs are sought, recognized, discovered, or created, as long as some individual knows of an EBO while others do not.

#### **6.2.4 Which factors affect knowledge of an EBO?**

The predominant theory for knowledge of EBOs in the context of the Austrian theory is the Individual-Opportunity Nexus (ION) theory (Shane, 2005), an interdisciplinary framework distinguishing the research field of entrepreneurship from other research fields (Venkataraman, 1997). One of its postulations, in short, is that identification of opportunities is dependent on access to information and cognitive abilities (Shane, 2005).

In line with the Austrian theory, having certain information will allow an individual to identify EBOs. For example, only those who possess information about the German grain market have a chance to discover an EBO resulting from a disequilibrium in supply and demand in this particular market. According to (Eckhardt & Shane, 2003), different individuals' access to information is best described along three characteristics: the knowledge corridor, the search process, and the social network. Each will be discussed in the following.

**Knowledge corridor.** Every day, each individual gathers information through “occupation on the job, routines, social position, and daily life” (Venkataraman, 1997 p.122). These experiences determine the basic knowledge stock of each individual. In essence, depending on their personal circumstances, everybody has some specific knowledge (Hayek, 1945) which could be required to identify an EBO. For example, a painter knows better than most which colors are preferable for old wooden windows. This information could be required to identify an EBO regarding a new color.

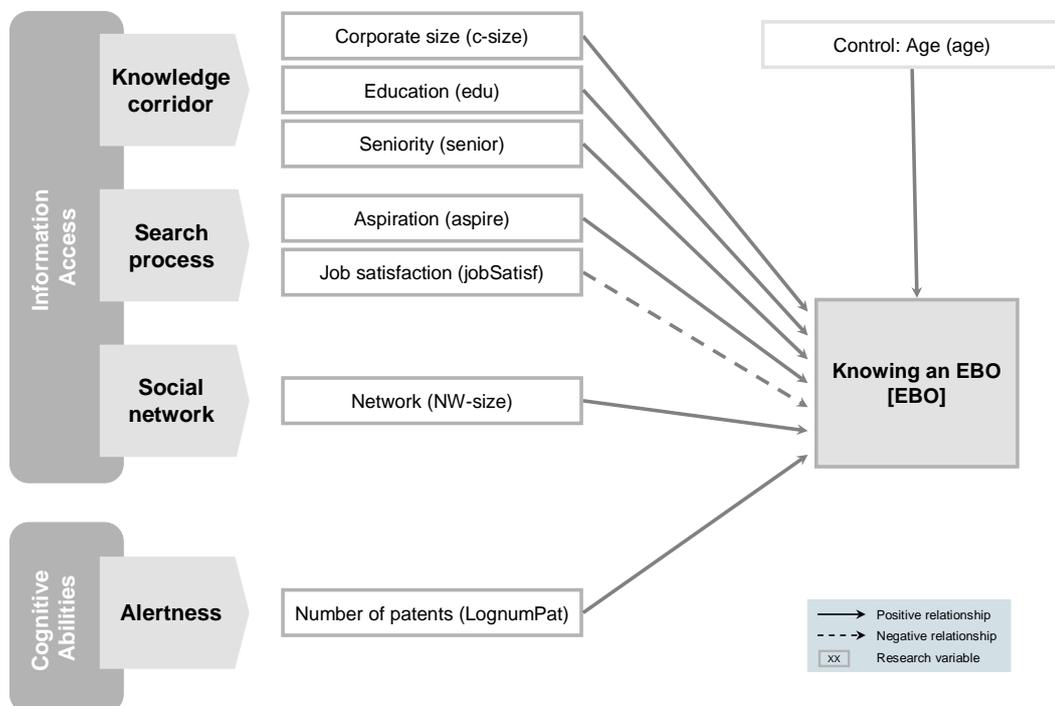
**Search process.** Knowing of an EBO is also at least partially dependent on the time spent searching. Individuals will search as long as the marginal benefits exceed the marginal cost (Stigler, 1961). The marginal cost should be lower with information someone already possesses (Eckhardt & Shane, 2003). As people have different information to begin with, the cost of searching for specific knowledge varies, resulting in highly diverse access to information. However, not only the cost of searching, but also the benefits from searching should vary. For example, those dissatisfied in their current employment situation could benefit more from finding an EBO. Consequently, different motivations for searching should also drive the extent of the search process.

**Social network.** Individuals profit from their personal network by receiving information related to the identification of EBOs (Singh et al.). The structure of the social relationships influences the quality and quantity of information and the respective learning speed (Granovetter, 1973; Johannisson, 1988). Some authors even believe that individuals can design their social network to receive more information relevant to EBOs (Minniti, 2004).

Even with the same information, two individuals may not identify the same EBO, because identifying it requires more than the bare information. The EBO is frequently not “neatly packed” (Shane & Venkataraman, 2000); instead, connections between different pieces of information often have to be drawn, resulting in a new means-ends framework (Eckhardt & Shane, 2003). Consequently, the cognitive abilities often described as the **alertness**, individual ability, and receptiveness to apply information in order to build new means-ends frameworks (Kirzner, 1997) influence the identification of EBOs (Corbett, 2005; Dimov, 2007).

Based on the abovementioned theory, the following research model (figure 11) is applied. Knowledge of EBOs is influenced both by information access through the knowledge corridor, the search process, and the social network and by cognitive abilities via alertness. All variables applied to operationalize the theoretic categories have a positive influence on knowledge of EBOs, with the exception of job satisfaction, which has a negative effect. Each of the variables will be described in detail in the research design section.

Figure 11: Research model regarding knowledge of an EBO  
Adapted based on Individual-Opportunity Nexus (ION) theory of Eckhardt & Shane (2003)



### **6.3 Hypothesis on knowing of an EBO**

Working in a small company could offer advantages regarding information access. Those working in a small company should have a broader knowledge corridor because they have a more diversified work environment. This originates from the lower specialization of small companies due to their limited ability to leverage economies of scale (Hyytinen & Maliranta, 2008) and the more decentralized and flat hierarchies (Dubini & Aldrich, 1991). Consequently, small-company employees have a high variety of tasks on their everyday agenda. This will often involve contact to customers, suppliers, sub-contractors, and across functions within the company (Hite, 2005). As a result, those employees have broader access to information from a variety of sources. Furthermore, small companies should provide employees with better information. To survive in their often limited market segments, small companies usually have detailed knowledge about customer demands, the competitor landscape, economically relevant changes, and supply alternatives (Garvin, 1983). The level of information is often more comprehensive than in large companies that serve a variety of markets and customers with different products. Thus, better information, combined with more diversified day-to-day work, should increase the information access for employees in small companies.

In addition to the “hard” information, a small-company employee often has access to “soft” information via the relationship with the founder, which might be similarly relevant for knowing of an EBO. The founder can act as a role model (Johnson & Cathcart, 1979; Mason, 1991) or as a mentor (Dubini & Aldrich, 1991), for example, by providing information on how to find or develop an EBO. In addition, the employee might receive important information regarding the founding process (Sorensen & Audia, 2000), which might also be relevant for an EBO.

Consequently, working in close proximity to the founder can be an information advantage (Davidsson & Honig, 2003). Obviously, this is much more likely if the company is small.

Employees who know of an EBO often present it to their employer (Klepper, 2001). Only when neglected by the current employer or withheld from the employer is the EBO considered “unexploited.” Small companies usually lack the financial and human resources of larger companies and might therefore be forced to leave more EBOs unexploited (Hyytinen & Maliranta, 2008). This could furthermore explain why small-company employees more often know of unexploited EBOs.

Thus the hypothesis is:

*Employees currently working in small companies have a higher probability of knowing of an unexploited EBO than those working in larger companies.*

## **6.4 Research design**

Next, the research design will be presented, starting with the sample and data collection, followed by the variable operationalization and a short description of the research method, and ending with descriptive statistics.

### **6.4.1 Sample and data collection**

This analysis is based on the same survey among German patent applicants as in chapters 3 and 4. Again, participants were required to be male and to have submitted at least one German patent application together with a company in 2006/07 in international patent classifications H04, G10L,

C02, B09, H61B, H61C, H61F, H61G, H61H, H61J, or H61M, resulting in 324 returned questionnaires. For this analysis, 172 answers were excluded for various reasons:

- 116 because the respondent was currently self-employed— those have already realized an EBO and might therefore have a different perspective regarding EBOs which could interfere the result
- 13 because the responses had extensive missing values or the Pearson residual showed values above 2, indicating outlier problems
- 43 because the respondents were uncertain as to whether or not they knew of an EBO— including those cases could again interfere with the results.

This procedure resulted in 152 valid responses for the analysis. An identification of the unfitting cases before was impossible due to a lack of information. The missing values (~1,1%) were, as before (see chapter 3 and van Buuren & Oudshoorn 1999), replaced by Multivariate Imputation by Chained Equations (MICE), which was feasible, as Little's MCAR test (Little & Rubin, 1987) for the non-random distribution of missing values showed no significance ( $p > 0.05$ ).

#### 6.4.2 Variables

Before being applied, the questionnaire was tested extensively (see chapter 3 and 4). The variables relevant for this analysis will be briefly described in the following. For more information, see table 25 and review chapters 3 and 4, where most of the variables have already been detailed. The following variables were dummy coded: corporate size (c-size), education (edu), seniority (senior), aspiration to self-employment (aspire), and the dependent variable knowing of an EBO (EBO). The latter was defined by the question of whether the sum of the unexploited EBOs

known to you is sufficient for founding an independent, profit-oriented company. The answer “yes” translated to the value of 1 and “no” to the value of 0. Those who responded “don’t know” were excluded in this analysis to avoid mixed results. The following variables had continuous scales: employee’s age (age), network size (NW-size), and number of patents (lognumPat). The major difference between NW-size and NetwS in chapter 3 is that NW-size includes not only the number of people to discuss business topics with, as NetwS does, but also the number of people to discuss private topics with. Private discussions are also a source of information regarding EBOs; thus, this more holistic variable should provide better results. The number of patents is applied as a logarithmic value to decrease the effect of outliers (the number of patents ranged from 1 to 110). Job satisfaction was assessed based on eight individual questions regarding different job satisfaction areas that had already been applied by Leptien (1996), Clark (2001) and SOEP. Those 7-scale Likert answers were added into one sum score, which was feasible as the Cronbach alpha was 0.767, and a principal axis factor analysis showed only one explaining factor.

Table 25: Scales/measures and their respective items

Measure	Question (abridged translation from the German questionnaire)	Type	Source
c-size	How many employees does your current employer have?	1 = ≤ 200 0 = > 200	(Leptien, 1996; Vega-Jurado et al., 2009)
edu	Highest educational level	1 = university education 0 = education below university level	(Leptien, 1996)
senior	Current position	1 = managerial level 0 = below managerial level	(Leptien, 1996)
aspire	Imagine for a second that you could pick your ideal working situation. Would you prefer to be self-employed or employed?	1 = prefer self-employed 0 = prefer employed/don't know	(Blanchflower et al., 2001)
jobSatisf	I am satisfied <ul style="list-style-type: none"> <li>• with my total pay</li> <li>• with my relationships with supervisors</li> <li>• with my relationships with co-workers</li> <li>• with my work content</li> <li>• with the use of initiative</li> <li>• with my job security</li> <li>• with my promotion prospects</li> <li>• overall</li> </ul>	Each assessed based on a 1–7 Likert scale and then added	(Leptien, 1996; Clark, 2001; SOEP)
NW-Size	With how many individuals do you regularly discuss important business topics or important private topics?	Number of contacts—above 15 coded as 15	Adapted from (Singh, Hills, Hybels, and Lumpkin; SOEP)
lognumPat	How many patents have you been granted in Germany so far (including co-authorship)?	Log of number of patents	(Leptien, 1996)
age	Year of birth	Years since birth	(Leptien, 1996)
EBO	Is the sum of the to you known unexploited EBOs sufficient for founding an independent, profit-oriented company	1 = yes 0 = no Don't know was excluded	Adapted based on (Singh, 2001)

Please note that the questionnaire was administered in German and the translations of the questions shown above are for explanation purposes only. For more details and the exact wording, see the abovementioned sources. The Cronbach alpha for jobSatisf was 0.767, and principal axis factor analysis showed one explaining factor.

### 6.4.3 Research model

The research model (figure 11) consists of eight measures, each directly influencing the dependent variable knowing of an EBO. It is assumed that working for a small company has a positive influence on knowing of an EBO, as it increases the knowledge corridor (hypothesis). The same effect is assumed for education and seniority. A longer and higher education should increase the knowledge corridor because more is learned during the time at university (Blanchflower et al., 2001; Gaglio, 1997). Those with a higher seniority should be granted access to more relevant information, either because of their extensive number of direct reports or due to more access to restricted information (Cooper et al., 1991; Hyytinen & Ilmakunnas, 2007a). As mentioned above, searching for information is dependent on the marginal costs and the benefits. Those aspiring to self-employment or dissatisfied with their current job should invest more into searching, as they would benefit disproportionately highly (Gaglio, 1997; Herron & Sapienza, 1992; for more details, see the bachelor thesis of Felix Buchholz, to be published shortly). The size and type of the social network also plays an important role in knowing of an EBO (Hills, Lumpkin, and Singh, 1997; Singh et al., 1999). It is assumed that a larger network has a positive effect on knowing of an EBO. The entrepreneurial alertness is not measured directly in this work due to measurement limitations. However, the number of patents someone has been granted is applied as a proxy for their cognitive abilities. Patents are only granted for the development of something “new”; thus, they require a new means-ends framework distilled out of information. This has a high similarity to the cognitive abilities required for identifying an EBO from given information. To rule out alternative solutions, the age of a person was included as a control variable.

#### 6.4.4 Method

Due to the binary scale of the dependent variable (knowing of an EBO), a maximum-likelihood logistic regression was applied (Long & Freese, 2006). The likelihood ratio test and chi-square test were calculated to validate the rejection of the null hypothesis and the explanatory power. To facilitate interpretation, all non-binary variables except for the dependent variable were standardized before and held to their mean when not discussed (Cohen, 2009). The calculation was supported by SPSS version 17. The statistical power calculated by G\*power 3.1 indicated that, for two-tailed alpha errors of 5%, a medium-sized effect (odds ratio 2), and a medium cross-correlation of 0.25, the sample size of 153 had a statistical power (0.807) sufficiently above the critical barrier (0.8) (Cohen, 2009). Consequently, as no relationship was identified, it can be concluded that a relationship of medium or larger size is unlikely.

#### 6.4.5 Descriptive statistics

Table 26 presents the descriptive statistics including mean and standard deviation and Pearson correlations. Some figures in particular are noteworthy:

- 33.6% of the respondents claim to know of at least one unexploited EBO
- 25% work currently in small companies
- Each respondent has on average been granted ~ 5.5 patents.

The respondents are characterized by often having university education (56.6%), being at least head of department (56.6%), and having an average age of ~ 45.5 years. The Pearson correlations showed mainly expected relationships. According to the descriptive statistics, knowing of an EBO is positively influenced by working in a senior position, aspiring to self-employment, and the

number of patents someone has been granted. Small-company employees are more often senior and have been granted significantly fewer patents. Both findings can be explained by specifics of small companies. Applying and holding patents is expensive; thus, small companies often lack the resources to apply for a patent for each developed detail (Leptien, 1996). In addition, while large companies have many research experts at the non-managerial level to develop and apply for patents, those tasks are rather assigned to the managerial level in small companies due to a lower specialization (Leptien, 1996). Thus, more senior employees are connected to patents in small companies. Employees with a higher education develop more patents and less often aspire to self-employment. The reason for the latter is left for future research. Less of a surprise is the negative relationship between aspiring to self-employment and job satisfaction. Both dissatisfaction leading to looking for outside options (EBO) and wanting to be self-employed and therefore being dissatisfied with the current employment is supported in the literature (Herron & Sapienza, 1992; Hyytinen & Ilmakunnas, 2007b; Tett & Meyer, 1993). Also unsurprising, older employees have been granted more patents, probably because they had more time for development. Multicollinearity is not a serious concern, as the VIF average was 1.124 (maximum 1.245), and no Pearson correlation was above 0.4.

Table 26: Descriptive statistic on knowing of an EBO  
Mean, standard deviation, and Pearson correlation for all applied measures

	Mean	StDev	1	2	3	4	5	6	7	8	9
EBO	0.336	0.474	1								
c-size	0.250	0.434	0.137	1							
edu	0.566	0.497	0.117	-0.138	1						
senior	0.566	0.497	0.370**	0.230**	0.143	1					
aspire	0.336	0.474	0.292**	-0.153	-0.165*	0.032	1				
jobSatisf	41.296	6.835	-0.076	-0.012	0.067	0.048	-0.243**	1			
NW-size	8.408	4.921	0.154	0.033	-0.049	0.070	-0.036	-0.045	1		
LognumPat	0.743	0.521	0.207*	-0.269**	0.216**	-0.005	0.021	-0.042	0.046	1	
age	45.487	8.798	-0.055	-0.206*	0.113	0.048	0.053	0.045	-0.019	0.191*	1

\* =  $p < 0.05$ ; \*\* =  $p < 0.01$

Mean LognumPat of 0.743/0.521 relates to ~ 5.5 patents and a standard deviation of ~ 3.3 patents

## 6.5 Results and discussion

The results of the logistic regression on knowing of an EBO (table 27) were more or less in line with the expectations. All measures except for job satisfaction (jobSatisf:  $b = 0.038$ ,  $p = 0.865$ ,  $e(b) = 1.039$ ) had a significant influence on the probability of knowing of an EBO. All measures showed the expected direction, with the exception of the measure age (age:  $b = -0.523^{**}$ ,  $p = 0.0044$ ,  $e(b) = 0.593$ ). Having a higher age significantly reduced the probability of knowing of an EBO. This could be explained either by a lower interest in EBOs, as it is more difficult to realize those in later life stages, or by more experience or a lower risk appetite, reducing the number of EBOs identified as sufficient for an independent, profit-oriented venture. Deciding between those alternatives is left for future research. The strongest effect on the probability of knowing of an EBO in terms of both significance and effect size was evidenced by aspiration to self-employment (aspire:  $b = 2.409^{***}$ ,  $p = < 0.001$ ,  $e(b) = 11.119$ ) and seniority (senior:  $b = 2.147^{***}$ ,  $p = < 0.001$ ,  $e(b) = 8.557$ ). Those aspiring to self-employment either spend more time searching for EBOs or more often identify EBOs suitable for an independent, profit-oriented venture. As expected, the higher seniority seems to increase access to information, thus increasing the

probability of knowing of an EBO. Network size (NW-size:  $b = 0.417^{**}$ ,  $p = 0.032$ ,  $e(b) = 1.517$ ) and level of education (edu:  $b = 0.840^*$ ,  $p = 0.084$ ,  $e(b) = 2.317$ ) also have the expected positive impact on the probability of knowing of an EBO, probably via improved information access (Davidsson & Honig, 2003). The cognitive abilities assessed by the logarithmic number of patents (LognumPat:  $b = 0.910^{**}$ ,  $p = 0.001$ ,  $e(b) = 2.485$ ) also had a strongly positive effect on the probability of knowing of an EBO, which is in line with the ION concept.

Table 27: Logistic regression results on knowing of an EBO

	Knowing an EBO (EBO)			
	B	Std.Error	P-value	Exp(B)
c-size	1.332**	0.545	0.015	3.787
edu	0.840*	0.486	0.084	2.317
senior	2.147***	0.555	< 0.001	8.557
aspire	2.409***	0.571	< 0.001	11.119
jobSatisf	0.038	0.223	0.865	1.039
NW-size	0.417**	0.194	0.032	1.517
LognumPat	0.910**	0.264	0.001	2.485
age	-0.523**	0.260	0.044	0.593
Intercept	-4.000***	0.726	< 0.001	
Log-likelihood-ratio X	61.100***		< 0.001	
Log-likelihood	132.860			
Pseudo R-Square (Nagelkerke)	0.459			

Working in a small company (c-size:  $b = 1.332^{**}$ ,  $p = 0.015$ ,  $e(b) = 3.787$ ) has a positive impact on the probability of knowing of an EBO, supporting the hypothesis. The effect is reasonably strong, as the odds of knowing of an EBO are approx. 3.8 times as high if someone works in a small company, while all other variables are held constant. 45.9% of the cases are explained better as compared to a standard model, indicating a rather good explanatory power of the model.

## 6.6 Conclusion

This analysis has empirically shown that working in small companies significantly increases the probability of knowing of an EBO. Consequently, those working in small companies more often know of at least one unexploited EBO. The reasons for this relationship are probably the improved information access in small companies due to a more diversified day-to-day work and the more detailed information existing in small companies. An additional explanation is offered by the resource restriction of small companies, which might limit the exploitation of identified EBOs more strongly in small companies. Thus, given the fact that readiness to found a spin-off on a known EBO is independent of corporate size, the size-dependence of knowing of an EBO could be the missing link in explaining the stylized fact that more founders of spin-offs have previously worked for small companies. Instead of being better prepared in small companies, as was the hypothesis in chapters 3 and 4, the small-company employee more often knows of an unexploited EBO. Thus, this knowledge advantage in small companies explains the so far puzzling stylized fact.

However, there are also some doubts and limitations regarding this finding. The analysis does not prove that knowing of an EBO more often increases the probability of founding a spin-off. It is only reasonable to assume that knowledge of an EBO is a relevant preliminary step in the pre-nascent entrepreneur phase; but again, this has been proven neither in this study nor in any other study in the literature to the best knowledge of the author. In addition, there is also the question of whether the small-company employees and the large-company employees have the exact same definition of an EBO. This was not tested within this study. Knowledge of an unexploited EBO was self-assessed by each respondent. It may very well be that employees in

small companies, for example, due to their unique work experience there, assess EBOs and the remaining exploitability differently than employees in large companies. Examining this should be the subject of future research. Based on “standardized” EBOs, it could be established how information access and cognitive abilities interlink with EBO types. A first step in this direction could be the knowledge of BOs and their assessment as entrepreneurial—here defined as sufficient for founding an independent, profit-oriented venture—by different types of employees. As before, the abovementioned results are based on a single study among German patent applicants in industries related to the communication, medical technology, and clean technology industries; therefore, additional studies with a broader focus are recommended to verify the results.

## **7 Chapter – Conclusions**

### **7.1 Conclusions**

This work analyzed the explanatory power of ELT and VTT on spin-off founding—both on the probability and on the preliminary step readiness to found a spin-off. After validating that the stylized fact reported in the literature (a disproportionately high number of founders have worked in small companies before) was present in the analyzed industries, it was detailed whether measures derived from ELT or VTT could explain it. The empirical results were based on a mail survey conducted with patent applicants of the years 2006/07 in Germany in patent classes related to clean-tech, medical technology, and communication. Both empirical analyses had high reliability, good explanatory power, and sufficient statistical power.

Of the five factors derived to describe the ELT— having work experience in a young company, the network size, the network quality, knowing a recent founder, and having a broad knowledge—only knowing a recent founder (network quality) was continuously supported<sup>14</sup>. Thus, an employee seems to learn from a recent founder either because the founder is a role model or because individuals interested in entrepreneurship try to establish contact to other entrepreneurs, for example, to learn from their experience. Contrary to the expectations, having a broader knowledge did not increase spin-off activities<sup>15</sup>. As the study is only based on technically oriented individuals and there exists strong positive empirical evidence for other groups such as MBA students, further validation is required before the results can be generalized. Based on this

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<sup>14</sup> Except for employees in small companies on the probability to actually found a spin-off

<sup>15</sup> An exception were employees currently working in small companies, where the expected positive effect on readiness was observed

study, it can only be concluded that the number of roles is irrelevant for technically oriented individuals and their interest in founding a spin-off. There was also no evidence established for a pre-selection of employees with better entrepreneurial skills in small companies. Whether the employees actually do not have better entrepreneurial skills or whether the skills gap exists but does not lead to a higher readiness is left for future research. Network size and work experience in a young company did reveal some significant effects; however, they were inconclusive. Thus, a strong effect in line with the expectations was not established and additional research to further detail the results is required. Taken together, knowing a recent founder seems to be the most relevant learning method.

Of the four measures derived from the VTT—aspiration for self-employment, job satisfaction, expectation of a promotion, and job security—only the first two were strongly supported. Employees who aspired self-employment in the long term had a higher readiness to found a spin-off, fulfilling their long-term employment goal. In addition, individuals who were satisfied with their current job were less interested in founding a spin-off. Expecting a promotion did not show any relevant influence on readiness or the actual founding. Thus, contrary to the literature, promising a promotion is not an effective countermeasure to convince employees to stay at their current employer. The results on job security were inconclusive, indicating a limited effect, if any.

Based on the results of papers II and III, it can be concluded that the stylized fact (a disproportionately high number of founders have worked in a small company before) is present in the analyzed industries. However, neither the measures derived from the ELT nor those from the VTT were capable of explaining the stylized fact because none of them mediated company size.

Thus, the explanations often speculated upon in the literature are insufficient. Paper III identifies a reason for this unexpected result: Company size is not only not mediated, it does not have an effect on readiness at all<sup>16</sup>, indicating that company size does not act on the actual founding via readiness. Instead, company size must act via a different path, which is probably based on a theory other than the ELT and VTT.

Taken together, the major finding of this study is that, although the measures derived from the ELT and the VTT (particularly netwQ, jobSatisf, and aspire) have some influence on the readiness to found and on the actual founding, these theories are not capable of explaining the present stylized fact. Thus, the theory so far identified as the best theory to explain spin-off founding (Klepper, 2001) fails to explain a very common stylized fact. Therefore, a new or expanded theory is required to incorporate the stylized fact. Developing this new theory will not only advance the understanding of why spin-offs are founded, it will also help to identify and quantify levers influencing spin-off founding. Based on this information, employers, governments, and even individuals interested in becoming self-employed can foster entrepreneurship in the future.

One promising alternative explanation is found in the pre-nascent entrepreneur phase (tested in chapter 5). The decision to detail an EBO towards founding a spin-off is dependent not only on readiness, but also on knowledge of an unexploited EBO. This knowledge of an EBO, however, varies across company size according to the survey. Employment in small companies increases the probability of knowing of an unexploited EBO, probably due to more and better access to information and exploitation restrictions in small companies because of resource

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<sup>16</sup> Except for an unexpected moderating effect, which should be detailed in future research.

limitations. Consequently, employees in small companies may have a disproportionately high likelihood of founding a spin-off because they learn of more unexploited relevant business opportunities while working in small companies. This theoretically and empirically explains the stylized fact; thus, the ION theory offers a promising route for further developing the Employee Learning Theory on spin-off founding in the future.

## **7.2 Future research recommendation**

The focus of this work is on spin-off creation—a highly important topic for management research (see, e.g., Klepper, 2007; Klepper & Simons, 2000). Despite a recent popularity, there is still a lot unknown. A good starting point for identifying future research recommendations is the literature review (paper I), which highlighted several research areas and questions lacking empirical validation. The most promising are:

- Does a character variation exist between spin-off founders, start-up founders, and employees?
- Are spin-off founders driven by a different motivation than start-up founders?
- What effect does corporate diversity have on spin-off spawning—which of the two diametric arguments is more appropriate and why?
- Identification of additional specific company events increasing spawning, for example, disruption of the organization
- In addition, the empirical results are still scattered and lack depth across industries and countries.

Papers II and III have also highlighted some puzzling research questions. The most important concerns the stylized fact, which, despite detailed analysis in papers II and III, none of the common measures and theories were able to explain. Thus, the most prominent theory for spin-off founding is as yet unable to explain a stylized fact found in practically every empirical analysis. Consequently, a new explanation and theory is required. One promising route is offered by the prerequisite knowledge of EBOs, which is more probable for employees in small companies (chapter 5). Obviously, this analysis was only the first, and more studies are necessary before a reliable theory can be expanded in this direction.

An alternative explanation is offered by the nascent entrepreneur phase, where the success of potential spin-off founders could be influenced by the former company size. An important step towards founding a spin-off is receiving financial and complementary resources, which is at least partially dependent on the social capital (Johansson, 2007). The social capital in turn is to a degree inherited from the former company via personal transfer. Thus, the former company size might have an influence on social capital. For example, resource owners might have more doubt regarding the entrepreneurial skills of large company employees than those of small company employees. This would reduce the resources of the former group and explain the stylized fact. Furthermore, the social network of employees, which is relevant for founding (Saxenian, 1994), might be different in large and small companies. Nascent entrepreneurs from large companies might receive less support from their network for becoming self-employed, as it is less entrepreneurial and more focused around large company topics.

The two proposed explanations can probably be tested best by a longitude study. However, in a first step, evaluating whether the early nascent entrepreneurs are more often from small

companies, based on a cross-sectional study, could be very helpful. If early nascent entrepreneurs do not vary regarding company size, the effect must be induced during the nascent entrepreneur phase. Once this is established, a further detailing of more specific explanations is required.

Alternatively, an important factor related to the existing or other theories might not have been tested or identified so far. For example, offering the realization of an employee's idea as an internal venture might be easier for large companies due to their superior resource base (e.g., Hyytinen & Maliranta, 2008). This would reduce the number of spin-offs in large companies, as more ideas would be realized internally. However, according to the survey, the belief that the current company will offer an internal venture is stronger for employees currently employed in small companies than in large companies ( $t = 4.324$ ,  $p < 0.001$ ). The result is not conclusive but is a first indication of a limitation of the argument. Other measures that may explain the stylized fact are psychological factors, the size of the reward, financial constraints, or the company patent policy (Kim & Marschke, 2005). Future research should expand the number of measures and evaluate whether those could explain the stylized fact. This could lead to a revision of the spin-off founding theory, as the currently dominating theories seem to have difficulty explaining the stylized fact.

The results of this study should also be validated by additional research, as the study suffers from several limitations. For example, only technically oriented employees and founders were compared. Those are a highly specialized group, which differs substantially from the average employee (e.g., education, income, gender) (Leptien, 1996). Furthermore, the study is focused on Germany, and entrepreneurship rates vary across countries (Blanchflower et al., 2001). As a consequence, additional international studies are advisable. The study also suffers from

being focused on three technically oriented industries (clean-tech, medical technology, and communication), while varying entrepreneurship rates across industries are common (Blanchflower & Oswald, 1998). The study also had to oversample small companies to avoid firm effects. The effect was discussed in detail and judged as limited. However, the effect might still exist, and future studies should validate the results. In addition, the study had some inconclusive results (e.g., network size, work experience in a young company), which should be further detailed in the future to detail the conclusions.

## Survey: Cover letter

**Technische Universität Berlin**



TU Berlin · Sekr. H 92 · Straße des 17. Juni 135 · D-10623 Berlin

Musterfirma GmbH  
Herr Max Mustermann  
Musterstrasse, 30  
12345 Musterstadt

FAKULTÄT VII  
WIRTSCHAFT UND  
MANAGEMENT  
Fachgebiet Strategische  
Führung und Globales  
Management  
Prof. Dr. Dodo  
zu Knyphausen-Aufseß

5. November 2009

Forschungsprojekt: Employee Entrepreneurship: Was bringt Erfinder dazu auszugründen?

Sehr geehrter Herr Mustermann,

nach Auskunft des Deutschen Patentamtes haben Sie in den Jahren 2006/07 ein Patent angemeldet. Damit gehören Sie als ausgewiesener Experte zur Zielgruppe unserer Forschung.  
Wir – Prof. Dr. Dodo zu Knyphausen-Aufseß und Dipl.-Ing. Simon Lindenmann – bitten Sie, unser Forschungsprojekt zum Thema „Employee Entrepreneurship“ an der TU Berlin durch Beantwortung des beiliegenden Fragebogens zu unterstützen.

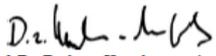
Ziel der Forschung ist zu untersuchen, unter welchen Bedingungen Experten wie Sie ein eigenes Unternehmen gründen oder eine angestellte Beschäftigung bevorzugen. Die Ergebnisse dienen einerseits als Grundlage für die Verbesserung von Mitarbeiterförderprogrammen (Steigerung der Motivation von Experten) und andererseits zur Ermittlung von Einflussfaktoren auf die Bereitschaft zur Unternehmensgründung.

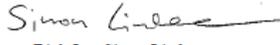
Die Beantwortung des Fragebogens dauert ca. 15 Minuten. Für Ihre Antwort liegt ein adressierter und frankierter Briefumschlag bei. Alternativ können Sie auch online teilnehmen (Link siehe unten). Für Rückfragen steht Ihnen jederzeit Herr Lindenmann unter 0151-20112948 oder [s.lindenmann@mailbox.tu-berlin.de](mailto:s.lindenmann@mailbox.tu-berlin.de) zur Verfügung. Bei Interesse senden wir Ihnen auch gerne die Endergebnisse unserer Forschung zu. Ihre Angaben werden selbstverständlich anonym und vertraulich behandelt.

Bitte helfen Sie uns bei unserer Forschung, damit in Zukunft Forscher- und Entwicklergeist zielgenauer gefördert werden kann.

Für Ihre Unterstützung danken wir Ihnen sehr!

Mit freundlichen Grüßen

  
Prof. Dr. Dodo zu Knyphausen-Aufseß

  
Dipl.-Ing. Simon Lindenmann

Ps. Die Schokolade ist ein kleines Dankeschön und soll die Zeit des Fragebogensausfüllens versüßen  
Onlinefragebogen: <https://www.113.vovici.net/se.ashx?s=13B2588B0E01686C>  
• Telefon: (030) 314-28744 / Telefax: (030) 314-28752 •  
e-mail: [knyphausen@strategie.tu-berlin.de](mailto:knyphausen@strategie.tu-berlin.de) / Internet: [www.strategie.tu-berlin.de](http://www.strategie.tu-berlin.de)

## Survey: Questionnaire

### Fragebogen



Ihre persönliche Meinung ist uns wichtig, d.h. es gibt weder richtig noch falsch.  
Wenn Sie keine genaue Zahl nennen können, ist eine best-mögliche Schätzung besser als keine Antwort.  
Senden Sie uns bitte auch wenn einzelne Fragen nicht beantwortet sind den Fragebogen zu.  
Selbstverständlich werden Ihre Antworten streng vertraulich und anonym behandelt.

**I. Teil: Geschäftsideen und eine mögliche Selbstständigkeit**

**Anfang** 1. Bitte stellen Sie sich für einen Moment vor, Sie könnten sich Ihre ideale Arbeitssituation auswählen.  
Würden Sie eine selbständige oder angestellte Erwerbstätigkeit bevorzugen?

- Bevorzuge angestellte Erwerbstätigkeit
- Bevorzuge selbständige Erwerbstätigkeit
- Unentschieden/Weiß nicht

2. Die Definition für „Geschäftsidee“ lautet:

- eine wirtschaftlich relevante Änderung, die sowohl Innovation (neuartig) als auch Verbesserung als auch Imitation in einem nicht gesättigten Markt sein kann.

Wie viele Geschäftsideen haben Sie sich in den letzten 12 Monaten durchdacht (selbst entwickelte Geschäftsideen und solche, von denen Sie aus anderen Quellen, z.B. Kollegen oder Fachpresse, gehört haben; bitte tragen Sie eine 0 für keine ein)?

\_\_\_\_\_ Anzahl Geschäftsideen  
*(Eine Schätzung ist besser als keine Antwort)*

3. Wie viele der Geschäftsideen, die Sie sich in den letzten 12 Monaten durchdacht haben, könnten hypothetisch in einem eigenständigen, nach Gewinn strebenden Unternehmen umgesetzt werden (ausschlaggebend hierfür ist Ihre persönliche Einschätzung; bitte tragen Sie eine 0 für keine ein)?

\_\_\_\_\_ Anzahl in „eigenständigen Unternehmen verfolgbarer“ Geschäftsideen  
*(Eine Schätzung ist besser als keine Antwort)*

4. Glauben Sie, dass die Summe der Ihnen bekannten ungenutzten Geschäftsideen für die Gründung eines eigenständigen, nach Gewinn strebenden Unternehmens ausreichen würde?

- Ja, Summe der Geschäftsideen ausreichend für eine Unternehmensgründung
- Nein, Summe der Geschäftsideen nicht ausreichend für eine Unternehmensgründung
- Unentschieden/Weiß nicht

5. Wie viele Patente haben Sie bisher in Deutschland angemeldet (inklusive Gemeinschaftsanmeldungen)?

\_\_\_\_\_ Anzahl in Deutschland angemeldete Patente



**II. Teil: Vorlegen einer Selbstständigkeit**

Bitte kreuzen Sie an, in wie weit folgende Aussagen bezüglich Selbstständigkeit auf Sie persönlich zutreffen.

6. Haben Sie in der Vergangenheit bereits, alleine oder mit Partnern, ein Unternehmen gegründet, das Ihnen gehört(e) und in dem Sie in der Geschäftsführung beteiligt sind/waren? (berücksichtigen Sie dabei bitte auch Unternehmen, die nicht mehr existieren)

- Ja, trifft zu
- Nein, trifft nicht zu
- Weiß nicht

7. Versuchen Sie zurzeit, alleine oder mit Partnern, ein neues Unternehmen zu gründen (hierzu zählt jede Art selbstständiger Arbeit oder der Verkauf von Waren oder Dienstleistungen an andere)?

- Ja, trifft zu
- Nein, trifft nicht zu
- Weiß nicht

(→ Bitte weiter mit Frage 7a)

(→ Bitte weiter mit Frage 8)



Bitte nur beantworten, wenn Sie zurzeit ein neues Unternehmen gründen:

7a. Haben Sie in den letzten 12 Monaten irgendetwas zur Unterstützung Ihrer Neugründung unternommen, z.B. nach Ausstattung oder einem Standort gesucht, ein Gründungsteam organisiert, an einem Geschäftsplan gearbeitet, Geld gespart oder irgendeine andere Aktivität, die helfen würde, ein Unternehmen auf den Weg zu bringen?	<input type="checkbox"/> Ja, trifft zu <input type="checkbox"/> Nein, trifft nicht zu <input type="checkbox"/> Weiß nicht
7b. Werden Sie persönlich alleiniger Inhaber des Unternehmens sein oder nur Teile besitzen bzw. kein Inhaber sein?	<input type="checkbox"/> Alleiniger Inhaber <input type="checkbox"/> Teilhaber <input type="checkbox"/> Kein Inhaber <input type="checkbox"/> Weiß nicht

8. Sind Sie zurzeit selbstständig, verkaufen Waren oder Dienstleistungen an andere oder sind Sie In- bzw. Teilhaber eines Unternehmens, bei dem Sie in der Geschäftsleitung mitwirken?

- Ja, trifft zu
- Nein, trifft nicht zu
- Weiß nicht

(→ Bitte weiter mit Frage 9a auf Seite 3)

(→ Bitte weiter mit Frage 8a)



Bitte nur beantworten, wenn sie zurzeit nicht selbstständig bzw. Unternehmer sind

Nehmen Sie bitte an, die Wirtschaft hätte sich von der Finanzkrise erholt und Sie hätten nach langer Forschung eine neue Geschäftsidee innerhalb Ihres Fachgebiets gefunden. Von dieser Geschäftsidee sind Sie völlig überzeugt.

8a. Ihr Arbeitgeber hat trotz aller Argumente kein Interesse an der von Ihnen vorgeschlagenen Geschäftsidee. Wie wahrscheinlich ist es, dass Sie unter diesen Bedingungen innerhalb von zwei Jahren...	wird mit Sicherheit nicht eintreten	unge-wiss	wird mit Sicherheit eintreten
...eine Selbstständigkeit konkret prüfen würden? (z.B. Business case schreiben, Finanzierung prüfen)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
...die Geschäftsidee verwerfen und sich neuen Aufgaben widmen würden?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
...über eine eigene Selbstständigkeit nachdenken würden?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



Fortsetzung von Seite 2: **bitte nur beantworten**, wenn sie zurzeit **nicht selbständig bzw. Unternehmer** sind

Nehmen Sie bitte an, die von Ihnen neu entwickelte Geschäftsidee würde nicht in das aktuelle Produktportfolio Ihres Arbeitgebers passen und müsste im Rahmen einer neu aufzubauenden, internen Einheit realisiert werden.

	wird mit Sicherheit nicht eintreten	unge- wiss	wird mit Sicherheit eintreten
--	-------------------------------------	---------------	-------------------------------

8b. Mein Arbeitgeber würde die Geschäftsidee begrüßen und durch eine neu aufzubauende, interne Einheit realisieren. ======

8c. Um mich im Unternehmen zu halten, würde mein Arbeitgeber einer internen Realisierung meiner Geschäftsidee zustimmen. ======

8d. Mein Arbeitgeber würde in keinem Fall einer Realisierung im Rahmen einer neu aufzubauenden, internen Einheit zustimmen. ======

8e. Würden Sie einer Realisierung Ihrer nicht in das Produktportfolio passenden Geschäftsidee im Rahmen einer neu aufzubauenden, internen Einheit (Verbleib im aktuellen Unternehmen) gegenüber einer Selbständigkeit bevorzugen?

- Ja, ich bevorzuge neu aufzubauende, interne Einheit
- Nein, ich bevorzuge eine Selbständigkeit
- Unentschieden/Weiß nicht

Bei den nun folgenden Fragen möchten wir Sie bitten, **alle Fragen aus aktueller Sicht zu beantworten**. Andere Ausfüllanweisungen gelten nur für Inhaber eines Unternehmens, die in der Geschäftsleitung mithelfen, bzw. Selbständige.

→ Bitte weiter mit Frage 10a auf Seite 5

**Bitte nur beantworten, falls Sie aktuell selbständig bzw. Unternehmer sind (d.h. auf Seite 2 Frage 8 mit „Ja, trifft zu“ geantwortet haben)**

Im Folgenden werden Ihnen einige Fragen zu Ihnen als Unternehmer und Ihrem Unternehmen gestellt (bei mehreren Unternehmen antworten Sie bitte für das älteste noch existierende).

9a. Wie haben Sie Ihr Unternehmen gegründet bzw. sind Sie zur Unternehmensbeteiligung gekommen? (Mehrfachnennungen möglich)

- Übernahme der Verantwortung in einem Familienunternehmen
- Erwerb einer Beteiligung an einem bestehenden Unternehmen
- Komplettkauf eines bestehenden Unternehmens
- Management Buy Out (MBO)
- Ausgründung aus Universität/ Forschungsinstitut
- Gründung mit finanzieller Beteiligung durch den vorhergehenden Arbeitgeber
- Gründung (ohne finanzielle Beteiligung durch den vorhergehenden Arbeitgeber)

9b. In welchem Jahr haben Sie Ihr Unternehmen gegründet bzw. haben Sie sich an ihm beteiligt?

\_\_\_\_\_ Jahr Ihrer Unternehmensgründung bzw. Ihrer Beteiligung

9c. Wie viele Beschäftigte hat Ihr Unternehmen etwa?

- |  |  |
|--|--|
| <input type="checkbox"/> 1 - 4 Beschäftigte    | <input type="checkbox"/> 101 - 200 Beschäftigte                                    |
| <input type="checkbox"/> 5 - 10 Beschäftigte   | <input type="checkbox"/> 201 - 1000 Beschäftigte                                   |
| <input type="checkbox"/> 11 - 20 Beschäftigte  | <input type="checkbox"/> 1001 - 2000 Beschäftigte                                  |
| <input type="checkbox"/> 21 - 50 Beschäftigte  | <input type="checkbox"/> > 2000 Beschäftigte                                       |
| <input type="checkbox"/> 51 - 100 Beschäftigte | <input type="checkbox"/> Trifft nicht zu, da selbständig ohne weitere Beschäftigte |



Fortsetzung von Seite 3: **Bitte nur beantworten, falls Sie aktuell selbständig bzw. Unternehmer sind**

9d. In welchem Bereich waren Sie tätig, bevor Sie selbständig bzw. Unternehmer wurden?  
(Mehrfachnennungen möglich)

- Mitarbeit in einem Unternehmen
  - Mitarbeit in einem Krankenhaus
  - Mitarbeit in Universität/Forschungsinstitut (z.B. Doktorandenzeit)
  - Ausbildung (ohne Doktorandenzeit)
  - Nicht erwerbstätig
  - anderes \_\_\_\_\_ (bitte benennen)
- } (→ Bitte weiter mit Frage 9e)  
} (→ Bitte weiter mit Frage 9f)

**Bitte nur beantworten, falls Sie Mitarbeiter waren**

- 9e. Ist/war Ihr letzter Arbeitgeber in einem ähnlichen oder gleichen Wirtschaftszweig/Branche/  
Dienstleistungsbereich tätig wie Ihr aktuelles Unternehmen?
- Ja, trifft zu
  - Nein, trifft nicht zu
  - Weiß nicht

9f. Hatten Sie vor Gründung bzw. Beteiligung bereits ein Patent angemeldet (inkl.  
Gemeinschaftsanmeldungen)?

- Ja, trifft zu
- Nein, trifft nicht zu
- Weiß nicht

9g. Welche der folgenden Bildungsabschlüsse haben Sie? (Mehrfachnennungen möglich)

- Lehre
- Berufsakademie-Abschluss
- Fachhochschul-Abschluss
- Universitäts-Abschluss
- Promotion
- Habilitation

9h. Mit wie vielen Personen besprechen Sie in der Regel wichtige private und geschäftliche Themen?  
(Berücksichtigen Sie bitte Ihre Frei- und Arbeitszeit; eine Schätzung ist besser als keine Antwort)

\_\_\_\_\_ Anzahl Personen, mit denen Sie wichtige private Themen besprechen  
\_\_\_\_\_ Anzahl Personen, mit denen Sie wichtige geschäftliche Themen besprechen

**Ausfüllanleitung:**

Um ein besseres Verständnis bzgl. Ihrer Entscheidung für die Selbständigkeit zu bekommen, möchten wir Sie bitten, alle folgenden Fragen aus Ihrer vorherigen Situation, bevor Sie selbständig bzw. Unternehmer wurden, zu beantworten.

Dies bedeutet zum Beispiel, dass die Frage „Kennen Sie jemanden, der sich in den letzten zwei Jahren selbständig gemacht hat?“ für Sie eigentlich lautet: „Kamten Sie zum Zeitpunkt, bevor Sie in Ihrem eigenen Unternehmen begonnen haben, jemanden, der sich innerhalb der letzten 2 Jahre selbständig gemacht hatte?“ Einige Fragen werden ein zweites Mal gestellt, um Ihre damalige Situation besser zu verstehen. Zu Ihrer Information: nicht Selbständige /Unternehmer beantworten die Fragen aus aktueller Sicht.

→ Bitte weiter auf Seite 5 mit Frage 10a



III. Teil: Persönliche Einschätzung der eigenen Tätigkeit

- |   | Trifft gar<br>nicht zu  | Trifft voll-<br>ständig zu  |
|---|---|---|
| 10a) Mein aktueller Job bietet mir weiterhin langfristige Arbeitsplatzsicherheit  | <input type="checkbox"/> = <input type="checkbox"/> | <input type="checkbox"/> = <input type="checkbox"/> |
| 10b) Ich glaube, innerhalb der nächsten 2 Jahre werde ich im aktuellen Unternehmen einen beruflichen Aufstieg schaffen  | <input type="checkbox"/> = <input type="checkbox"/> | <input type="checkbox"/> = <input type="checkbox"/> |
| 10c) Mit den mir gestellten Arbeitsaufgaben bin ich zufrieden   | <input type="checkbox"/> = <input type="checkbox"/> | <input type="checkbox"/> = <input type="checkbox"/> |
| 10d) Mit den Aufstiegsmöglichkeiten im Unternehmen bin ich zufrieden  | <input type="checkbox"/> = <input type="checkbox"/> | <input type="checkbox"/> = <input type="checkbox"/> |
| 10e) Ich glaube, dass ich mich innerhalb der nächsten 2 Jahre im aktuellen Unternehmen beruflich verschlechtern werde   | <input type="checkbox"/> = <input type="checkbox"/> | <input type="checkbox"/> = <input type="checkbox"/> |
| 10f) Mit dem Verhältnis zu meinen Arbeitskollegen bin ich zufrieden   | <input type="checkbox"/> = <input type="checkbox"/> | <input type="checkbox"/> = <input type="checkbox"/> |
| 10g) Mit der Sicherheit meines Arbeitsplatzes bin ich zufrieden   | <input type="checkbox"/> = <input type="checkbox"/> | <input type="checkbox"/> = <input type="checkbox"/> |
| 10h) Mit der Höhe der Bezahlung meiner Arbeitsleistung bin ich zufrieden  | <input type="checkbox"/> = <input type="checkbox"/> | <input type="checkbox"/> = <input type="checkbox"/> |
| 10i) Ich glaube, dass ich aufgrund der Perspektive, die mir mein Beruf bietet, eine sichere Zukunft habe  | <input type="checkbox"/> = <input type="checkbox"/> | <input type="checkbox"/> = <input type="checkbox"/> |
| 10j) Mit dem Umgang mit meinen Forschungsergebnissen bin ich zufrieden  | <input type="checkbox"/> = <input type="checkbox"/> | <input type="checkbox"/> = <input type="checkbox"/> |
| 10k) Ich glaube, innerhalb der nächsten 2 Jahre werde ich im aktuellen Unternehmen persönlich eine Lohn- oder Gehaltserhöhung bekommen, die über die allgemeine Tarifierhöhung hinausgeht | <input type="checkbox"/> = <input type="checkbox"/> | <input type="checkbox"/> = <input type="checkbox"/> |
| 10l) Mit meinen direkten Vorgesetzten bin ich zufrieden   | <input type="checkbox"/> = <input type="checkbox"/> | <input type="checkbox"/> = <input type="checkbox"/> |
| 10m) Mit meiner Arbeit bin ich insgesamt zufrieden  | <input type="checkbox"/> = <input type="checkbox"/> | <input type="checkbox"/> = <input type="checkbox"/> |
| 10n) Die meisten Mitarbeiter, die eine vergleichbare Tätigkeit bei meinem Arbeitgeber ausüben, haben langfristig eine hohe Arbeitsplatzsicherheit   | <input type="checkbox"/> = <input type="checkbox"/> | <input type="checkbox"/> = <input type="checkbox"/> |

11. Sind Sie im Allgemeinen ein risikobereiter Mensch oder versuchen Sie, Risiken zu vermeiden?

Gar nicht risikobereit	<input type="checkbox"/> = <input type="checkbox"/>	Sehr risikobereit
	0 1 2 3 4 5 6 7 8 9 10	

12. Sind Sie beruflich ein Generalist oder eher hoch spezialisiert?

Generalist	<input type="checkbox"/> = <input type="checkbox"/>	Spezialist
	0 1 2 3 4 5 6 7 8 9 10	

13. Stellen Sie sich vor, Sie hätten die freie Auswahl bzgl. Ihres Arbeitgebers. Wie groß sollte Ihr Wunscharbeitgeber idealerweise sein? (Eine Selbständigkeit ist zum Auswahlzeitpunkt nicht möglich)

- |  |   |
|--|---|
| <input type="checkbox"/> < 5 Beschäftigte      | <input type="checkbox"/> 101 - 200 Beschäftigte   |
| <input type="checkbox"/> 5 - 10 Beschäftigte   | <input type="checkbox"/> 201 - 1000 Beschäftigte  |
| <input type="checkbox"/> 11 - 20 Beschäftigte  | <input type="checkbox"/> 1001 - 2000 Beschäftigte |
| <input type="checkbox"/> 21 - 50 Beschäftigte  | <input type="checkbox"/> > 2000 Beschäftigte      |
| <input type="checkbox"/> 51 - 100 Beschäftigte |   |



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14. Bei Ihrer eben getroffenen Auswahl bzgl. der erwünschten Unternehmensgröße können verschiedene Gründe eine Bedeutung haben. Geben Sie bitte die 3 wichtigsten Gründe an. Tragen Sie eine 1 für den wichtigsten, eine 2 für den nächstwichtigsten und so weiter ein.

hohe Arbeitsplatzsicherheit  
 gute Aufstiegschancen  
 gute Lernumwelt für eine künftige Selbständigkeit  
 interessante, abwechslungsreiche Aufgabe  
 gute Arbeitsbedingungen/Arbeitsklima  
 hohes Einkommen

15. Auch für die Wahl Ihres aktuellen Arbeitgebers gab es verschiedene Gründe. Welche Rolle spielte dabei die Existenz einer guten Lernumwelt für eine künftige Selbständigkeit?

Unwichtig ====== Sehr wichtig

#### IV. Teil: Angaben bezüglich Ihres Arbeitgebers

Zur Erinnerung:

Als **Inhaber eines Unternehmens** bei dem Sie in der **Geschäftsleitung** mithelfen bzw. **Selbständiger** beantworten Sie bitte die Fragen aus Ihrer Situation vor der Aufnahme Ihrer Tätigkeit im eigenen Unternehmen.  
Als **Angestellter** beantworten Sie die Fragen bitte aus aktueller Sicht.

1. Vor wie vielen Jahren wurde Ihr Arbeitgeber gegründet?

< 1 Jahr     11 - 20 Jahre  
 1 - 5 Jahre     > 20 Jahre  
 6 - 10 Jahre

2. In welcher Branche ist Ihr Arbeitgeber überwiegend tätig? (Mehrfachnennungen möglich)

Medizintechnik (inkl. Pharma- und Gesundheitsprodukte)  
 Nachrichtentechnik  
 Cleantech  
 Andere \_\_\_\_\_ (bitte benennen)

3. Wie hat sich aus Ihrer Sicht Ihr Arbeitgeber in den letzten 2 Jahren im Verhältnis zur Branche entwickelt?

Parallel zur Branche     Deutlich schlechter als die Branche  
 Deutlich besser als die Branche     Weiß nicht

4. Wie viele Beschäftigte hat das Gesamtunternehmen (Ihr Arbeitgeber) etwa?

< 5 Beschäftigte     101 - 200 Beschäftigte  
 5 - 10 Beschäftigte     201 - 1000 Beschäftigte  
 11 - 20 Beschäftigte     1001 - 2000 Beschäftigte  
 21 - 50 Beschäftigte     > 2000 Beschäftigte  
 51 - 100 Beschäftigte



**V. Teil: Angaben zu Ihrer Person**

*Zur Erinnerung:*

Als **Inhaber eines Unternehmens** bei dem Sie in der **Geschäftsleitung mithelfen** bzw. **Selbständiger** beantworten Sie bitte die Fragen aus Ihrer Situation vor der Aufnahme Ihrer Tätigkeit im eigenen Unternehmen. Als **Angestellter** beantworten Sie die Fragen bitte aus aktueller Sicht.

5. Haben Sie in einem Unternehmen gearbeitet, welches zum Zeitpunkt Ihrer Einstellung jünger als 10 Jahre alt war?

- Ja, trifft zu  
 Nein, trifft nicht zu  
 Weiß nicht

6. In welchem Bereich sind Sie tätig? (Mehrfachnennungen möglich)

- Forschung & Entwicklung       Strategieabteilung  
 Produktion                       Geschäftsführung  
 Vertrieb                               Andere \_\_\_\_\_ (bitte benennen)  
 Projektmanagement

7. Bitte geben Sie Ihre hierarchische Stellung im Unternehmen an.

- Sachbearbeiter/Laborant/wissenschaftlicher Mitarbeiter  
 Gruppenleiter/Teilprojektleiter  
 Abteilungsleiter/Projektleiter  
 Geschäftsführer/Bereichsleiter  
 Andere \_\_\_\_\_ (bitte benennen)

8. Wie viele unterschiedliche Positionen (Stellen) haben Sie bisher in Ihrem beruflichen Leben innegehabt? (Dabei sind inhaltlich gleiche Positionen (Stellen) bei verschiedenen Arbeitgebern als eine Position (Stelle) zu berücksichtigen.)

\_\_\_\_\_ Anzahl unterschiedlicher Positionen (Stellen)  
(Eine Schätzung ist besser als keine Antwort)

9. Mit wie vielen Personen besprechen Sie in der Regel wichtige private und geschäftliche Themen? (Berücksichtigen Sie bitte Ihre Frei- und Arbeitszeit; eine Schätzung ist besser als keine Antwort)

\_\_\_\_\_ Anzahl Personen, mit denen Sie wichtige private Themen besprechen  
\_\_\_\_\_ Anzahl Personen, mit denen Sie wichtige geschäftliche Themen besprechen

10. Kennen Sie jemanden persönlich, der in den letzten 2 Jahren ein Unternehmen gegründet hat? (abgesehen von einfachen Dienstleistungen z.B. Kiosk, Imbiss)

- Ja, trifft zu  
 Nein, trifft nicht zu  
 Weiß nicht



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11. Ist/war mindestens einer Ihrer Elternteile selbständig?

- Ja, trifft zu
- Nein, trifft nicht zu
- Weiß nicht

12. Sind Sie verheiratet?

- Ja, trifft zu
- Nein, trifft nicht zu

13. Ihr höchster Bildungsabschluss:

- Ohne Abschluss
- Lehre
- Berufsakademie-Abschluss
- Fachhochschul-Abschluss
- Universitäts-Abschluss
- Promotion
- Habilitation
- Andere \_\_\_\_\_ (bitte benennen)

14. Ihr Geschlecht:

- Männlich
- Weiblich

15. Ihr Geburtsjahr:

19 \_\_\_\_\_ Geburtsjahr

16. Heutiges Datum:

\_\_\_\_\_

Vielen Dank für Ihre Unterstützung!

Sie haben uns bei unserer Forschung sehr geholfen. Senden Sie bitte den ausgefüllten Fragebogen mit Hilfe des beigelegten Antwortkuverts an uns zurück.

Bei Interesse an einer Zusendung der Endergebnisse geben Sie bitte Ihre E-mail Adresse an:

E-mail: \_\_\_\_\_

Rücksendeadresse (frankierter Briefumschlag liegt bei):  
Technische Universität Berlin  
Fachgebiet Strategische Führung und Globales Management  
- Patentumfrage - 10449 Berlin

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