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The Effects of General and Specific Human Capital on Long-Term Growth and Failure of Newly Founded Businesses

Andreas Rauch
Serge A. Rijsdijk

The model developed in this paper draws on human capital theory to explain how newly founded business ventures achieve long-term growth and reduce their chances of failure. Using a sample of 201 business start-ups and assessing growth and venture failure over a period of 12 years, we found that general and specific human capital lead to growth and failure in different ways. More specifically, we found that the effect of general human capital on failure was mediated by growth. Unexpectedly, specific human capital was not related to growth and had direct negative effects on business failure.

Introduction

The prediction of venture growth has been a top priority among scientists and practitioners in the domain of entrepreneurship research. Most studies interested in the prediction of growth studied surviving firms (Shepherd & Wiklund, 2006). While these studies delivered useful insights, not taking the venture failure (and successful closure) into account when studying growth creates some potential biases in the results (Coad, 2009). For example, the failure to distinguish between successful closure and failure resulted in an overestimation of the likelihood of business failure (Headd, 2003) and, moreover, may have contributed to the low consensus on the appropriate predictors of venture failure (Shepherd & Wiklund).

One of the most common explanations of business failure discussed in the literature is insufficient experience (Shepherd & Wiklund, 2006). Therefore, human capital theory provides a useful framework to explain growth and failure of business ventures. Most empirical studies examined the relationship between human capital and the decision to continue operating the business venture (e.g., Gimeno, Folta, Cooper, & Woo, 1997).
However, high human capital influences performance thresholds and, therefore, human capital may not be directly related to business continuation (Gimeno et al.). Accordingly, the empirical results of the relationship between human capital and business continuation are inconsistent (e.g., Bates, 1990; Gimeno et al.; Kalleberg & Leicht, 1991). We define business failure as an economic outcome, and therefore, we expect more consistent results between human capital variables and business failure as compared with the relationship between human capital and business continuation. Moreover, little is known about the processes by which business owners’ human capital shape the opportunity set to create long-term outcomes such as avoiding business failure.

In this study, we aim to contribute to the existing literature about the prediction of long-term growth and business failure in several ways. First, the conceptual framework we use to explain the long-term growth and failure of business ventures draws on human capital theory (Becker, 1964). Human capital theory is useful in our context because this theory suggests some propositions regarding the relationship between human capital, growth, and failure of business ventures. Entrepreneurs want to compensate their investments in human capital, and therefore, human capital can be seen as a proxy for intended growth (Cassar, 2006). Growth intention, in turn, affects firm growth (Delmar & Wiklund, 2008). Accordingly, we find consensus in the empirical literature that human capital leads to growth of business ventures (Unger, Rauch, Frese, & Rosenbusch, 2011). However, human capital may not necessarily be correlated with failure because entrepreneurs high in human capital may choose to terminate their enterprise in favor of more attractive opportunities (Cassar). If failure is an economic outcome, then failure depends on economic performance. Human capital is related to economic business outcomes such as size, growth, and profitability (Unger et al.). Moreover, human capital reduces the risk of failure because knowledge and information help successful opportunity recognition and exploitation (Shane & Venkatraman, 2000). Thus, insufficient knowledge and information is one of the reasons for business failure. Finally, business growth reduces the opportunity costs associated with alternative employment opportunities and, therefore, reduces the likelihood of terminating the business venture. Therefore, we propose that high human capital leads to higher growth and, thereby, reduces the long-term failure chances of business ventures. As a consequence, we study growth as a mediator that facilitates the effects of human capital on venture failure.

Moreover, the relationship between growth and failure itself is subject to debate in the entrepreneurship literature. Theoretically, growth can increase the risk of failure at least in the short term. For example, growth reduces the owners’ control of the firm and increases coordination requirements in a changing environment (Coad, 2009). In addition, growing firms tend to face resource deficits and capacity shortages (Garnsey, Stam, & Heffernan, 2006). On the other hand, smallness creates disadvantages, such as high labor intensity and cost disadvantages. Therefore, Coad concluded that the advantages of growth outperform the risks associated with growth. We assume that some of the conflicting results regarding the relationship between growth and failure (cf., e.g., the studies by Almus, 2004, and Wagner, 1999) may be due to the confounding failure with successful closure (Headd, 2003). We speak of business failure when a firm becomes insolvent and is unable to acquire new funding to continue operating under current ownership and management (Shepherd, Wiklund, & Haynie, 2009). Therefore, we carefully assess the reasons why businesses close, making it possible to distinguish between closure as a result of success versus failure.

Additionally, we use a longitudinal design, which allows us to address causal reasons for long-term growth and failure. In the present study, we actually use a 12-year time frame, which is much longer than the time frames used in other comparable studies,
including Cooper, Gimeno-Gascon, and Woo (1994) and Delmar and Shane (2003). We chose this longer period of time in an attempt to cover more aspects of the life cycle of a firm. This is necessary given that lifetime estimates indicate that less than 50% of new businesses have closed after 4 years (Brudeler, Preisendoerfer, & Ziegler, 1992; Headd, 2003; Phillips & Kirchhoff, 1989). Moreover, a substantial proportion of these enterprises did not close “unsuccessfully” (Headd). This means that studies using short time frames may identify only a small proportion of failing firms and, therefore, distort the results.

The Role of Human Capital in Growth and Failure

A theoretical perspective that has been used to explain both growth (Wiklund, Patzelt, & Shepherd, 2009) and failure (Shepherd & Wiklund, 2006) builds on human capital theory. Human capital consists of the skills and knowledge that individuals acquire through their investments in schooling, on-the-job training, and other types of experiences (Becker, 1964). Importantly, the relative magnitude of the relationship between human capital and performance depends on the success criterion used (Unger et al., 2011). Thus, the human capital literature does allow assumptions concerning the relative magnitude of the relationship between human capital and different success indicators. Human capital theory was originally developed to explain variations in financial returns of employees. The theory predicts that people attempt to receive a compensation for their investments in human capital and, thus, try to maximize the economic benefits over their lifetime (Becker). Applied to entrepreneurship, this means that entrepreneurs with high human capital must receive appropriate benefits from their venturing activities. Therefore, entrepreneurs’ human capital should be positively associated with a preference of size and growth (Cassar, 2006; Unger et al.). Moreover, entrepreneurs want to compensate for their human capital investments over their lifetimes (Cassar; Gimeno et al., 1997). Growth reflects success over a period of time more appropriately than, for instance, profit levels at a certain point of time (Delmar, 1997). Finally, human capital may lead to better decisions and more learning and knowledge that, in turn, have long-term consequences (Ackerman & Humphreys, 1990). Thus, the effects of human capital may very well accumulate over time. A large number of empirical studies have addressed the relationship between human capital and business growth (Cooper et al., 1994; Dahlqvist, Davidsson, & Wiklund, 2000). Unger et al. performed a meta-analysis of 70 studies examining the relationship between human capital and performance. The results indicated that the overall size of the relationship between human capital and growth is relatively small (r = .068), and the findings reported in the literature vary considerably (Unger et al.). Thus, despite the large number of studies from different countries included in the meta-analysis, it is difficult to detect strong relationships. However, the meta-analysis did not focus on newly established enterprises, and moreover, most studies included in the meta-analysis did not address the long-term effects of human capital.

Becker (1964) has drawn a distinction between general human capital and specific human capital. General human capital is not directly related to a certain job and includes years of schooling and working experience. General human capital can be applied in different contexts and, thereby, increases the expected returns available in alternative employment opportunities (Gimeno et al., 1997). Since general human capital increases the opportunity costs, it should be positively related to firm growth (Cassar, 2006). In addition, general human capital helps to run the business successfully. It is important because it is a source of knowledge, skills, problem-solving abilities, discipline, motivation, and self-confidence (Cooper et al., 1994). General human capital motivates people to acquire new knowledge that helps individuals adapt to new situations (Davidsson &
Honig, 2003). Moreover, general human capital increases the quality and consistency of delivered work (Becker; Mincer, 1974) and is beneficial to the acquisition of external financing (Bruederl et al., 1992; Parker & Van Praag, 2006).

Specific human capital is directly related to the domain of a small-scale business. Indicators of specific human capital are industry-specific experience, prior self-employment experience, management experience, and having self-employed parents (Bruederl et al., 1992). Importantly, specific human capital cannot be easily transferred to other contexts (Shepherd & Wiklund, 2006). Therefore, specific human capital may not be associated with high expected returns available in alternative employment opportunities. Since opportunity costs are low for specific human capital, specific human capital may not be associated with firm growth. On the other hand, specific human capital helps running the business firm. Industry-specific experience consists of knowledge about profitable niches and ways to increase productivity and should help an entrepreneur organize a business successfully. Prior self-employment experience is important because knowledge generated by prior self-employment provides the individual with the skills and knowledge that are needed to develop the new enterprise. Prior management experience helps to manage and direct employees. Moreover, management experience may serve as a proxy for greater motivation and aptitude to grow the enterprise (Cooper et al., 1994). Finally, owners whose parents are also entrepreneurs often have access to the knowledge and skills needed to run a business. Hence, there are strong theoretical arguments that suggest that both specific and general human capital have a positive impact on business outcomes such as growth and failure. Accordingly, a meta-analysis indicated that there is a positive relationship with success for both general and specific human capital; effect sizes are higher for specific human capital as compared to general human capital (Unger et al., 2011). Therefore, we propose:

**Hypothesis 1:** The general human capital of business founders has a positive effect on firm growth.

**Hypothesis 2:** The specific human capital of business founders has a positive effect on firm growth.

The role of human capital has been discussed with regard to survival chances as well. Theoretically, high human capital increases the perceived opportunity costs associated with maintaining a business venture. Therefore, entrepreneurs high in human capital might choose to terminate their enterprise in favor of more attractive opportunities (Cassar, 2006; Gimeno et al., 1997). As a result, there should be a negative or insignificant relationship between human capital and survival (Cooper et al., 1994). Empirically, the results of studies addressing the relationship between human capital and survival seem to be inconsistent. While some studies suggest that there is a significant positive relationship between human capital variables and survival (e.g., Bruederl et al., 1992; Evans & Leighton, 1989; Gimeno et al.), others have reported insignificant relationships (Bates, 1990; Kalleberg & Leicht, 1991; Stuart & Abetti, 1990). Finally, Dahlqvist et al. (2000) concluded that human capital variables predict growth much better than survival.

We expect consistent effects of human capital on business failure if failure is conceptualized as failure for financial reasons (Shepherd et al., 2009). Most importantly, an opportunity cost perspective cannot be used to explain failure because failure is not associated with a voluntary choice to terminate the business. However, economic theorizing would predict that the same variables predict performance (growth) and business

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1. However, owners may delay venture closure to some extent (Shepherd et al., 2009).
failure (Hudson, 1986). Since human capital predicts growth, it should be negatively related to failure. Some indirect evidence for this argument can be found in two studies that indicated that general human capital predicts both growth and venture survival (Cooper et al., 1994; Dahlqvist et al., 2000). Both studies, however, did not distinguish between venture failure and closure. Additionally, initial resources of business ventures, such as the founders’ human capital, positively influence the development of the venture (Brüderl & Schussler, 1990). Owners with high human capital should be more effective and efficient in running their business than owners with lower human capital (Brüderl et al., 1992). For example, knowledge and information reduce the uncertainty associated with opportunity discovery and exploitation (Shane & Venkatraman, 2000) and allow making better predictions of future developments. Finally, entrepreneurs with more knowledge and information have greater insight into valuable opportunities than entrepreneurs with little knowledge (Shane, 2000). Therefore, we assume that insufficient knowledge and experience is one of the reasons of business failure. While human capital has been related to the decision to continue the business, it has, to our knowledge, not been used as a predictor of failure in previous studies (Shepherd & Wiklund, 2006). We assume that human capital reduces the chances of business failure.

**Hypothesis 3:** The general human capital of business founders has a negative effect on firm failure.

**Hypothesis 4:** The specific human capital of business founders has a negative effect on firm failure.

### Growth as a Mediator Between Human Capital and Failure

A number of studies attempted to unveil the causal effects of human capital on venture growth (e.g., Baum, Locke, & Smith, 2001; Frese et al., 2007; Wiklund et al., 2009). However, only a few studies have addressed the relationship among human capital, growth, and business continuation at the same time (e.g., Cooper et al., 1994; Dahlqvist et al., 2000; Persson, 2004; Westhead, 1995). To our knowledge, no study has assessed the causal relationships among human capital, growth, and failure. We assume that growth is the mediating variable explaining how human capital reduces the probability of business failure. Figure 1 illustrates the proposed mediation effects.

Notably, the relationship between growth and failure itself is an object of debate for theoretical and conceptual reasons. Theoretically, business failure is an economic outcome and, therefore, is related to (negative) performance and growth (Hudson, 1986). However, growth has disadvantages that may increase the failure chances at least in the short term. For example, small firms have limited access to financial capital, which constrains their growth potential. Moreover, growth can put a firm at risk if it only has immature resources to keep up with the challenges of growth (Penrose, 1995).

Figure 1

Conceptual Framework
Furthermore, growth may challenge the capacities of decision makers to deal with the demands of growth (Garnsey et al., 2006). Thus, constraints in financial and human capital may increase the failure chances of growing businesses. Additionally, growth increases coordination requirements associated with a changing business environment, accompanied by a loss of control by the owner and a reduced flexibility of the firm. All these factors may increase the risk of failure (Coad, 2009).

On the other hand, growth has advantages that reduce the likelihood of business failure. For example, growth provides enterprises with resources needed to cope with environmental threats and uncertainty. Moreover, growth reduces liabilities associated with size (Stinchcombe, 1965), such as, for example, cost disadvantages and high labor intensity (Coad, 2009). Since the advantages of growth outperform the disadvantages of growth, there is a negative relationship between growth and business failure (Coad; Kirchhoff, 1994).

Conceptual problems may have also contributed to the difficulties associated with the relationship between growth and failure. Most empirical studies treated survival versus failure as a dummy-coded event (e.g., Audretsch, 1995; Brueckner et al., 1992; Cefis & Marsili, 2005). However, a simple distinction between survival and failure amounts to an oversimplification (Headd, 2003) because both survival and failure are confounded by successful and unsuccessful firms. For example, underperforming firms persist in a market even though they should, over time, be selected out of the market (DeTienne, Shepherd, & De Castro, 2008). Similarly, firm closure includes both failing firms as well as firms closing successfully (Headd). In fact, contrary to what is commonly believed, only a third of new businesses that closed did so under circumstances that the owners considered unsuccessful (Headd, p. 58). Thus, the failure to distinguish between successful and unsuccessful closures as well as between successful and unsuccessful survival may have confounded the results reported in earlier empirical studies. As a consequence, survival versus failure is correlated only weakly with other performance measures such as growth (Combs, Crook, & Shook, 2005). We argue that growth should reduce the likelihood of failure if failure covers financial failure only (cf. above). Accordingly, growth is the mediator through which the effects of human capital are transmitted. Thus, we propose:

**Hypothesis 5:** The relationship between general human capital and failure is mediated by prior growth.

**Hypothesis 6:** The relationship between specific human capital and failure is mediated by prior growth.

**Methods**

**Sample**

The samples were drawn from Jena in East Germany and Giessen in West Germany. Both cities share some structural similarities; they have major universities and a population of about 100,000 citizens. The participants were selected on the basis of four criteria. (1) The enterprise had to have between 1 and 50 employees. This corresponds to the European Union’s definition of small-scale firms. We included this criterion because business size is correlated with growth and failure chances (Audretsch, 1995; Geroski, 1995). Therefore, selecting large- and medium-sized enterprises could have confounded our results. (2) The enterprise had to be founded between 1990 and 1992. This criterion was included because we wanted to study new business ventures (Gartner, 1985) for
which data about business outcomes were available. Moreover, since self-employment was hardly possible in the former communist East Germany, the enterprises had to have been founded after the German reunification in 1989. (3) Participants had to be founders and owners of their enterprise, and (4) the enterprises had to be an independent business. Participants were randomly chosen from lists provided by the local Chamber of Commerce (registration is mandatory in Germany).

We collected the data for this study at three points in time. The first wave of the longitudinal sample was drawn in 1993/1994 (t1). In 1997, we contacted the same business owners and asked for participation in the second wave of the longitudinal study (t2). The information about business failure was collected in 2006.

In wave 1, we asked 347 entrepreneurs to participate in our study. We received data from 201 business owners. The response rate was 58%. In the second wave, we tried to contact the 201 business owners of the original sample again. However, 58 enterprises of the original sample could no longer be located (experimental mortality of 29%). Thus, we asked 143 enterprises to participate in our study in the second wave. We received data from 119 enterprises, indicating a response rate of 83% of the businesses we were able to locate. In 2006, we conducted an intensive enquiry about the whereabouts of the 201 enterprises that participated in wave 1. To identify the owners, we analyzed lists provided by the Chambers of Commerce, telephone books, and electronic resources on the Internet. Moreover, we conducted on-site enquiries, asking neighbors about the whereabouts of the companies. Next, we called the original participants to ask them to provide information about the actual state of the enterprise. These strategies allowed us to gather information about the failure status of 189 (94%) enterprises (Table 1). Sixty-two business owners indicated that they had to close down because of financial problems. It is important to note that we considered the business a failure if the former owner indicated that he or she needed to close or to sell the enterprise because it was doing badly; if the owner indicated that he or she sold it for reasons other than financial problems, we did not code this as a failure (14 cases). In 2006, 99 (49%) enterprises were still in operation and run by the same owners. Other studies reported similar survival rates for Germany. For an observation period of 5 years, survival rates range between 49% and 63% (as reported by Brixy & Grotz, 2007, and Brüderl et al., 1992, respectively). Wagner (1994) reported a survival rate of 52% for manufacturing firms over an observation period of 10 years. Four owners closed the original enterprise because they succeeded in starting another more lucrative

Table 1

<table>
<thead>
<tr>
<th>Status of Businesses in 2006</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Failure</td>
<td>62</td>
<td>30.9</td>
</tr>
<tr>
<td>Still in operation</td>
<td>99</td>
<td>49.3</td>
</tr>
<tr>
<td>New enterprise</td>
<td>4</td>
<td>2.0</td>
</tr>
<tr>
<td>Status unknown</td>
<td>12</td>
<td>6.0</td>
</tr>
<tr>
<td>Merger</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>Sold</td>
<td>14</td>
<td>7.0</td>
</tr>
<tr>
<td>Transition to employee</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>Transition to family</td>
<td>8</td>
<td>4.0</td>
</tr>
<tr>
<td>Total N</td>
<td>201</td>
<td></td>
</tr>
</tbody>
</table>

September, 2011
venture. Twenty-four enterprises also continued to exist but had changed owners (merger, sold, and ownership transition). Finally, we were not able to identify 12 businesses of the original sample and, therefore, coded the status of these businesses as unknown (Table 1).

We performed an analysis of variance to assess whether or not there were systematic differences between respondents and nonrespondents of wave 2. Respondents and non-respondents did not differ in start-up capital ($F = .19, \text{ non-significant (ns)}$), number of employees ($F = .02, \text{ ns}$), and type of industry (craft $F = 3.00, \text{ ns}$; service $F = .28, \text{ ns}$; trade $F = 2.62, \text{ ns}$; and manufacturing $F = 3.89, \text{ ns}$). However, there was variation regarding the age of the enterprises ($F = 5.39, \ p < .05$); on average, respondents’ businesses were 2.5 months older than nonrespondents’ firms.

**Measures**

**The Measures Consisted of Interviews and Questionnaires**

**Human Capital.** Human capital was measured at wave 1. We measured education and work experience as proxies of human capital. Using such proxies is common practice in entrepreneurship research (Unger et al., 2011), as education and experience are the observable signals of human capital endowments. There were two measures of general human capital that were adapted to the educational system in Germany: school degree and degree of vocational training. School degree was measured in the questionnaire on a 4-point scale ($1 = \text{no school leaving certificate}, 2 = \text{8th class certificate}, 3 = \text{10th class certificate}, \text{ and } 4 = \text{secondary school diploma}$). Degree of vocational training was measured in the questionnaire and coded in the following way: $1 = \text{no vocational training qualification}, 2 = \text{professional school certificate}, 3 = \text{apprenticeship as skilled worker}, 4 \text{ and } 5 = \text{master craftsman and master engineer certificate, respectively, } 6 = \text{school of engineering certificate, } 7 = \text{university diploma, and } 8 = \text{PhD-specific human capital}$ was measured in the interviews using binary variables. Indicators of specific human capital were prior self-employment experience, prior self-employment in the same type of industry, industry specific experience, and management experience.

We computed the indices for general and specific human capital by adding the z standardized items and dividing the values by the number of items. These measures are causal indicators of human capital. As a consequence, indicators of human capital are independent. This means that a change in one indicator of human capital does not necessarily imply changes in the other indicators. Thus, they do not need to be internally consistent (cf., e.g., Becker & Huselid, 1998; Bollen & Lennox, 1991; Schmidt & Kaplan, 1971, for a discussion of the strengths and weaknesses of using an additive index on human resource practices).

**Growth.** We used employment growth as a dependent variable because this variable is used frequently in entrepreneurship research (Davidsson & Wiklund, 2000), and moreover, employment growth is positively related to other growth indicators such as sales growth (Combs et al., 2005; Delmar, 1997). The interviewees provided information about the number of employees in the current and two preceding years. Growth was calculated by the change in the log values of number of employees within the last 3 years in wave 1 and wave 2.

**Failure.** We coded failure by assigning a “1” if the enterprise had closed down for financial reasons (62 enterprises located) and a “0” if owners still ran their business or if
they closed or transferred the business for reasons other than failure (127, 67.2%). Interestingly, 28 owners closed their enterprise for reasons other than financial ones (sold, merger, transition, or new enterprise), underlining the importance of distinguishing between failure and successful closure.

**Control Variables.** Because our design included enterprises from different industries, we controlled for the type of industry. The type of industry was dummy coded and consisted of craft, service, trade, and manufacturing. Other controls that we included were firm age, gender of the business owner, the number of co-owners (log), and a dummy variable indicating whether the firm concerned a family firm or not. Table 2 shows the descriptive statistics and the relationships between the variables.

**Analyses**

To test our hypotheses, we require the data collected at t2 that was, however, not available for the whole sample. As such, selection bias may occur because the variables that have an effect on growth may also impact firm closure that would mean that selection into the sample at t2 is systematic in a fashion that is similar to self-selection (Delmar & Wiklund, 2008; Heckman, 1979). Therefore, we used a Heckman-type (1979) correction model and estimated a probit model using the membership of the final sample as the dependent variable, saving a probability of membership for each case. Following Delmar and Wiklund, and Wiklund and Shepherd (2009), we developed a selection model in which industry, firm age, gender, family firm, growth at t1, and general and specific human capital were used as instrumental variables (see Table 3). We then estimated a strict path model using a weighted least squares mean and variance adjusted (WLSMV) estimator in Mplus 5.1 (Muthén & Muthén, 2007). This estimator produces weighted least squares parameter estimates using a diagonal weight matrix with standard errors and mean- and variance-adjusted chi-square ($\chi^2$) test statistics that use a full weight matrix (Muthén & Muthén). This estimator is the most effective estimator in testing models that contain a continuous mediator (growth at t2) and a categorical dependent variable (failure) with robust standard errors (Beauducel & Herzberg, 2006).

To test the hypothesized model, we first fitted three nested models to the data: the partial mediation model as hypothesized (Table 4, Model A), the full mediation model (Table 4, Model B), and the no mediation model (Table 4, Model C). In all three models, we included the industry dummies, number of co-owners, and Mills ratio as control variables for both growth at t2 and failure. Growth at t1 was also included as a control for growth at t2. Table 4 provides the fit indices and $\chi^2$ difference tests comparing the hypothesized model with the other two models. In the hypothesized partial mediation model, the human capital variables affect failure both directly and indirectly through growth. The fit of this partial mediation model is good (comparative fix index [CFI] = 1.00; root mean square error of approximation [RMSEA] = .000; Tucker–Lewis index [TLI] = 1.00; and weighted root mean square residual [WRMR] = .15). We subsequently assessed whether a full mediation or no mediation model would fit the data even better. In the full mediation model, the human capital variables affect failure only indirectly through growth at t2. As such, we fixed the paths between human capital and business failure. The fit of this model is not good (both the CFI and the TLI are lower than .95). In the no mediation model, specific and general human capital only affect failure directly and not through the mediator of growth at t2. All fit indices indicate the poor fit of this model to the data (CFI = .00, RMSEA = .195, TLI = .00, and WRMR = .95). Comparing the different models by robust $\chi^2$ WLSMV difference tests
Table 2

Means, Standard Deviations, and Intercorrelations of Variables

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Failure</td>
<td>.16</td>
<td>.37</td>
<td></td>
<td></td>
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<tr>
<td>2. Growth t1</td>
<td>.78</td>
<td>.84</td>
<td>.02</td>
<td></td>
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<tr>
<td>3. Growth t2</td>
<td>.07</td>
<td>.68</td>
<td>-.28**</td>
<td>.12</td>
<td></td>
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<tr>
<td>4. General human</td>
<td>.10</td>
<td>.87</td>
<td>-.22*</td>
<td>.20</td>
<td>.27**</td>
<td></td>
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<td>5. Specific human</td>
<td>.05</td>
<td>.55</td>
<td>-.17</td>
<td>.13</td>
<td>.01</td>
<td>-.10</td>
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<td>6. Craft</td>
<td>.14</td>
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<td>-.09</td>
<td>-.08</td>
<td>.01</td>
<td>-.20</td>
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<td>7. Trade</td>
<td>.30</td>
<td>.46</td>
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<tr>
<td>8. Manufacturing</td>
<td>.14</td>
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<td>-.09</td>
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<td>.00</td>
<td>.24*</td>
<td>.00</td>
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<td>-.27*</td>
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<tr>
<td>9. Firm age t1</td>
<td>2.29</td>
<td>.83</td>
<td>.13</td>
<td>-.33**</td>
<td>-.07</td>
<td>-.17</td>
<td>-.20</td>
<td>.04</td>
<td>.17</td>
<td>-.06</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Gender</td>
<td>.20</td>
<td>.41</td>
<td>.14</td>
<td>-.21*</td>
<td>-.23*</td>
<td>-.25*</td>
<td>-.09</td>
<td>-.05</td>
<td>.19</td>
<td>-.13</td>
<td>-.05</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Family firm</td>
<td>.41</td>
<td>.49</td>
<td>-.01</td>
<td>-.14</td>
<td>.25*</td>
<td>-.05</td>
<td>.08</td>
<td>-.08</td>
<td>.03</td>
<td>-.21*</td>
<td>-.03</td>
<td>-.15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Log # co-owners</td>
<td>.53</td>
<td>.55</td>
<td>-.02</td>
<td>.21*</td>
<td>.12</td>
<td>.24*</td>
<td>.09</td>
<td>-.09</td>
<td>-.27**</td>
<td>.12</td>
<td>-.18</td>
<td>-.33**</td>
<td>.04</td>
<td></td>
</tr>
<tr>
<td>13. Mills ratio</td>
<td>.74</td>
<td>.30</td>
<td>.14</td>
<td>-.34**</td>
<td>-.04</td>
<td>-.29**</td>
<td>-.28**</td>
<td>-.23*</td>
<td>.36**</td>
<td>-.66**</td>
<td>-.21*</td>
<td>.12</td>
<td>.42**</td>
<td>-.09</td>
</tr>
</tbody>
</table>

*p < .05, **p < .01

Note: N = 93, listwise exclusion of missing values.
SD, standard deviation.
Table 3

Logistic Regression of Selection into Final Sample

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>Coefficient (standard error) n = 195</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry</td>
<td></td>
</tr>
<tr>
<td>Trade</td>
<td>-.13 (.35)</td>
</tr>
<tr>
<td>Craft</td>
<td>.85 (.54)</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>1.81 (.81)*</td>
</tr>
<tr>
<td>Other controls</td>
<td></td>
</tr>
<tr>
<td>Firm age</td>
<td>.46 (.20)*</td>
</tr>
<tr>
<td>Gender</td>
<td>.34 (.39)</td>
</tr>
<tr>
<td>Family firm</td>
<td>-.27 (.32)</td>
</tr>
<tr>
<td>Research variables</td>
<td></td>
</tr>
<tr>
<td>Growth t1</td>
<td>.37 (.19)*</td>
</tr>
<tr>
<td>General human capital</td>
<td>.26 (.18)</td>
</tr>
<tr>
<td>Specific human capital</td>
<td>.52 (.29)</td>
</tr>
<tr>
<td>Model</td>
<td></td>
</tr>
<tr>
<td>Log likelihood</td>
<td>-241.45</td>
</tr>
<tr>
<td>Chi-square</td>
<td>28.46**</td>
</tr>
<tr>
<td>Pseudo R2</td>
<td>18.1</td>
</tr>
</tbody>
</table>

* p < .05, ** p < .01

Note: Regression coefficients are displayed in the table, and standard errors are displayed in parentheses. Listwise exclusion of missing values.

Table 4

Nested Model Comparison

<table>
<thead>
<tr>
<th>Models</th>
<th>$\chi^2$</th>
<th>df</th>
<th>CFI</th>
<th>RMSEA</th>
<th>TLI</th>
<th>WRMR</th>
<th>$\chi^2$ difference test $\chi^2$ value (df)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model A: Hypothesized model (partial mediation)</td>
<td>.423</td>
<td>1</td>
<td>1.00</td>
<td>.000</td>
<td>1.00</td>
<td>.15</td>
<td>—</td>
</tr>
<tr>
<td>Model B: Full mediation</td>
<td>2.995</td>
<td>2</td>
<td>.88</td>
<td>.073</td>
<td>.42</td>
<td>.46</td>
<td>4.25 (2)</td>
</tr>
<tr>
<td>Model C: No mediation, human capital direct on failure</td>
<td>18.16*</td>
<td>4</td>
<td>.00</td>
<td>.195</td>
<td>.00</td>
<td>.95</td>
<td>17.69* (3)</td>
</tr>
</tbody>
</table>

* p < .05

Notes: All $\chi^2$ difference tests concern comparisons to the partial mediation model (model A); $\chi^2$ difference tests are conducted using the DIFFTEST option for weighted least squares mean and variance estimations (see Muthén & Muthén, 2007).

df, degrees of freedom; CFI, comparative fix index; RMSEA, root mean square error of approximation; TLI, Tucker–Lewis index; WRMR, weighted root mean square residual.
Table 5

Path Analysis: The Effect of Human Capital on Growth (t2) and Failure

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>Growth t2</th>
<th>Failure</th>
<th>Failure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Models 1 and 2</td>
<td>Model 1</td>
<td>Model 2</td>
</tr>
<tr>
<td>Industry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trade</td>
<td>-.06 (.20)</td>
<td>.53 (.41)</td>
<td>.48 (.42)</td>
</tr>
<tr>
<td>Craft</td>
<td>.24 (.28)</td>
<td>-.54 (.74)</td>
<td>-.54 (.74)</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>.09 (.66)</td>
<td>-.73 (.70)</td>
<td>-.51 (1.00)</td>
</tr>
<tr>
<td>Other controls</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td># co-owners</td>
<td>-.03 (.18)</td>
<td>.26 (.48)</td>
<td>.29 (.51)</td>
</tr>
<tr>
<td>Research variables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Growth t1</td>
<td>.07 (.12)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General human capital</td>
<td>.25 (.15)*</td>
<td>-.59 (.32)*</td>
<td>-.38 (.33)</td>
</tr>
<tr>
<td>Specific human capital</td>
<td>.09 (.22)</td>
<td>-.81 (.41)*</td>
<td>-.73 (.42)*</td>
</tr>
<tr>
<td>Mills ratio</td>
<td>.42 (.52)</td>
<td>-.89 (1.20)</td>
<td>-.54 (1.18)</td>
</tr>
<tr>
<td>Model</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R²</td>
<td>.10</td>
<td>.30</td>
<td>.50</td>
</tr>
</tbody>
</table>

* p < .05, ** p < .01 (one-tailed)

Note: Listwise exclusion of missing values.

(Asparouhov & Muthen, 2006) shows us that the no mediation model fits the data significantly worse than the hypothesized partial mediation model ($\chi^2$ difference test value = 17.69; $p < .05$). Moreover, the $\chi^2$ difference test indicates that the fit of the full mediation model is not significantly better than the fit of the hypothesized partial mediation model ($\chi^2$ difference test value = 4.25; $p = .12$). We, therefore, choose to test our hypotheses using the estimates of the hypothesized partial mediation model. Table 5 shows the results of this analysis.

Results

Table 5 displays the path analyses that were used for hypothesis testing. Hypothesis 1 assumed that general human capital is positively related to growth. The first column of Table 5 displays the relationships between human capital and growth at t2, controlling for growth at t1. The longitudinal effect on growth was significant for general human capital ($B = .25; p < .05$), indicating support for hypothesis 1. Specific human capital was not related to growth ($B = .09$, ns). Therefore, hypothesis 2 had to be rejected. The second column (model 1) of Table 5 displays the relationship between human capital and failure (hypotheses 3 and 4). Both general and specific human capital were negatively associated with failure. The effect of general human capital was significant ($B = -.59; p < .05$) as well as the effect of specific human capital ($B = -.81; p < .05$). Thus, hypothesis 3 and
hypothesis 4 were supported. Hypothesis 5 predicted that the relationship between general human capital and failure is mediated by prior growth. To test this hypothesis, we estimated the path from human capital to failure through growth at t2 (model 2, Table 5). The path from general human capital to failure became insignificant in model 2 (B = -.38, ns), indicating that the effect of general human capital on failure is mediated by growth. Thus, we found support for hypothesis 5. Since the coefficient of specific human capital remained significant in model 2 (B = -.73, p < .05) and there was also no significant effect of specific human capital on growth at t2, we conclude that hypothesis 6 must be rejected. Figure 2 provides a graphic overview of the results.

Discussion

We have found that economic theorizing can predict long-term outcomes of new business ventures fairly accurately. Specifically, the general human capital of business founders was positively related to growth after the first 5 years. Moreover, both general and specific human capital were negatively related to failure after 12 years. Finally, owners with high general human capital compensate for their human capital investment by growing their enterprises more than owners with low human capital and, thereby, reduce the risk of failure. Our variables explained 10% of the variance in venture growth and 50% of the variance in venture failure. These are strong effects (cf. Unger et al., 2011), given that we used a longitudinal design that allowed us to hold prior growth constant.

Interestingly, and similar to the results reported by Cooper et al. (1994) and by Dahlqvist et al. (2000), we found that general human capital affects both growth and failure. However, specific human capital was not related to growth and had a direct effect on business failure. This would seem to contradict the notion that specific knowledge is more important than general knowledge (Bosma, van Praag, Thurik, & de Wit, 2004; Unger et al., 2011). We did not expect such differential effects of specific and general human capital because the literature contains a number of arguments suggesting that both are important. However, the underlying mechanisms for how they affect growth and failure might be different. For example, general school and professional education sometimes require huge investments, which can exceed investments in specific human capital considerably. Therefore, owners with high general human capital strive for growth (Cassar, 2006). Moreover, cognitive ability could be a variable that accounts for the effects of general human capital because cognitive ability is related to performance (Frese et al.,
and could thereby help throughout the whole process of opportunity exploitation. Additionally, growing the enterprise over a long period of time may require broad and new knowledge related to growth management; general human capital helps to learn and acquire such new knowledge. Specific human capital may be important for certain tasks at a specific point in time, and thus, specific human capital has few applications outside this context (Shepherd & Wiklund, 2006). For example, industry-specific experience may help an entrepreneur to recognize an opportunity in a domain that is related to this industry (Kirzner, 1997; Shane, 2000). However, industry-specific experience may not increase opportunity costs in the same way as general human capital does because alternative employment opportunities are restricted to the industry-specific experience. Moreover, specific human capital is not easily transferred to other contexts. Hence, business failure is particularly risky for owners with high specific human capital. Therefore, specific human capital may not be associated with growth aspiration and growth, but at the same time, specific human capital helps to maintain the enterprise in a profitable niche.

**Theoretical and Practical Implications**

Our finding that growth plays an intermediate role between general human capital and long-term failure may resolve some of the controversies surrounding the role of human capital in the literature. We found relatively strong effect sizes indicating the importance of an economic model of business failure. Previous research has reported relatively small effects of human capital on growth (Unger et al., 2011) and that effects on survival are even smaller than effects on growth (Dahlqvist et al., 2000). Our results indicate that human capital approaches need to specify theory about the timing of effects. Strong effects seem to unfold over time, and therefore, assuming simple relationships between human capital and growth may underestimate the value of human capital. Moreover, analyzing the long-term consequences of human capital requires the selection of an appropriate outcome variable. Most previous studies have analyzed the effect of human capital on the decision to continue operating a business venture (e.g., Gimeno et al., 1997). We define failure as an economic outcome and, therefore, relied on an opportunity cost perspective for explaining failure. Survival, in contrast, may not always be an economic outcome because there are noneconomic reasons to maintain a business venture such as, for example, individual performance thresholds (DeTienne et al., 2008; Gimeno et al.). Thus, to select the correct predictors of long-term outcomes, entrepreneurship theory needs to distinguish between successful and unsuccessful closure and survival. Finally, there are intervening processes explaining the long-term consequences of human capital. This means that human capital approaches need to look at mediating processes through which human capital reduces the likelihood of failure. Practitioners, investors, and entrepreneurs should know that growth reduces the risk of failing for financial reasons. Therefore, they should evaluate a venture’s growth potential carefully. General human capital is one of the predictors of venture growth, and our results confirm the investors’ interest in human capital. Governments as well as entrepreneurs should invest in developing knowledge because knowledge and information have long-term effects on business outcomes.

**Limitations and Future Research**

We studied the human capital of the owner and founder of the business venture. Thus, we did not study firm-level human capital in our study, which is a distinct source
of human resource advantages (Wright, Dunford, & Snell, 2001). Similarly, if there were several owners and founders in the enterprise, we relied on the information provided by the key founder of the firm. Therefore, we used the number of co-owners as a control variable in our analysis. Nevertheless, it is important to generalize our results to individual business founders and not to the level of start-up business firms.

Moreover, we used employment growth as an indicator of business growth because employment growth is highly related to other indicators of growth, such as sales growth. For example, the correlations between sales growth and employment growth range between .57 and .90 (Delmar, 1997; Weinzimmer, Nystrom, & Freeman, 1998). On a conceptual level, however, employment growth and sales growth capture different aspects of growth. For example, improvements in process efficiency may increase sales volume without affecting employment growth. On the other hand, it is unlikely to increase the number of employees without increasing sales at the same time (or even before). Additionally, changes in employment are more stable than changes in sales (Delmar). Thus, employment growth is a conservative measure of business growth.

Our study did not include an assessment about the year of venture failure. However, failure is not time invariant; for example, ventures have a higher probability of failure during the early years (Phillips & Kirchhoff, 1989). Including an assessment of time of failure would have resulted in a more dynamic model of business failure.

Because we studied businesses that existed at wave 1 of our study, surviving and successful enterprises were overrepresented in our sample. However, in some cases, such a bias works against our hypotheses because we have reduced variance in both predictors and criteria. Moreover, our longitudinal design, the analysis of response and survival bias, and the analysis of selection bias indicated that our data are robust, and our conclusions are based on a sound analysis. A strength of our study using repeated measurements of growth is that common-method variance is reduced.

The reliance on a longitudinal design allowed us to draw causal conclusions. Since human capital is operationalized as previous education and experiences, it is a relatively stable characteristic, and therefore, we can exclude reverse causality in our study. However, some alternative explanations as to why the predictors in our study had such long-term consequences may stimulate future research. Recent entrepreneurship theorizing calls for a process view of entrepreneurship because entrepreneurial firms have to manage different tasks and challenges at different points in time (Baron, 2007). Baron’s position contradicts the assumption of lagging effects over a long period of time. We assume that the lagged effects could also occur because effects accumulate over time. For example, human capital leads to greater learning and knowledge, which helps to grow a business more successfully. This would be in line with a process view of entrepreneurship, and additionally, it would explain why human capital could have such long-term effects. Thus, future research should investigate how entrepreneurs develop new knowledge and how the effects of human capital accumulate over time. However, reverse causality is a likely explanation for other, less-stable predictors of venture growth (Delmar & Wiklund, 2008). Testing reverse causality would require that entrepreneurship research addresses the role of current skills and knowledge rather than past experiences. Thereby, we do not reject the notion that specific knowledge provides a source of competitive advantages but expect that current knowledge is more directly related to effective behavior by the entrepreneur and, therefore, produces higher effect sizes than specific human capital that consists of past experiences (Davidsson, 2004; Unger et al., 2011).
REFERENCES


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