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EFFECTS OF HUMAN CAPITAL ON THE GROWTH AND SURVIVAL OF SWEDISH BUSINESSES

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Abstract: This paper examines the effects of human capital on the growth and survival of a large sample of Swedish businesses. Human capital is represented by conventional measures of the educational attainment and experience of an establishment's workers, and skills-based measures of the types of occupations present in the company. Controlling for an establishment's size and age, as well as its industry and region of location, we find that the human capital embodied in a company's workers significantly affects its performance. The specific effects, however, depend on how human capital is measured and whether the analysis focuses on growth or survival.

Keywords: Firm growth, firm survival, human capital, education, skills

JEL: J21, J24, L25

1. INTRODUCTION

Human capital refers to the education, skills and knowledge that people use in their jobs to produce goods and services, and come up with new ideas and innovations. A vast body of research has studied the effects of human capital on individuals (Becker 1964; Mincer 1974; Card 1999), as well as regions and entire nations (Lucas 1988; Glaeser et al. 1995; Acs and Armington 2004; Abel and Gabe 2011). Studies focusing on individuals often examine the effects of conventional measures of human capital—such as formal education (e.g., years of schooling) and experience (e.g., age)—on earnings; while studies focusing on regions typically analyze the effects of the share of the population with a college degree on indicators of regional productivity (e.g., per capita income) and growth (e.g., population change, new firm formation).

The connection between human capital and individual earnings is reasonably straightforward: education and experience tend to make people more productive, and increased productivity results in higher wages and salaries.¹ Human capital contributes to regional vitality in several ways. A large collection of educated and skilled workers increases the output of regions because these individuals are, as noted above, highly productive. Additionally, the presence of individuals who are highly educated and skilled makes people around them more productive, through human capital externalities (Rauch 1993; Moretti 2004). These knowledge spillovers are cited as a reason for the positive effect of a region's human capital on new firm formation (Acs and Armington 2004). Glaeser (2011) explains that cities with highly-educated people outperform their peers because new technologies favor skilled workers, and globalization allows for the outsourcing of low-skilled—but not high-skilled—labor.

¹ Although the connection between human capital and earnings is straightforward, empirical studies have used a variety of approaches—including an analysis of siblings and twins, and controls for parental education—to obtain unbiased estimates of the returns to schooling (Card 1999).

Operating at levels that are sometimes larger than one individual, but are always smaller than entire regions, are business establishments. These companies serve the purpose of organizing the activities of workers—combining them with physical and financial capital, and entrepreneurial direction—in the production of goods and services. As such, the increased productivity associated with an individual’s education and skills should contribute to stronger performance in business establishments with higher amounts of human capital embodied in their workers. Indeed, focusing on the person who started a company, previous studies have found that the human capital of entrepreneurs has a positive effect on business performance (Colombo et al. 2004; Ganotakis 2012).

This paper examines the effects of the human capital of all employees working in an establishment—not just the entrepreneur—on the performance of Swedish businesses, both in terms of their survival (i.e., remaining in operation) and employment growth over time.² The empirical analysis uses a novel data set made up of 467,000 establishments, with information covering the years 2001, 2006 and 2010. Having employment figures for these three years allows us to analyze the factors affecting establishment survival and growth between 2001 and 2006, a relatively short time period ending prior to the worldwide economic recession, and a longer period of 2001 to 2010.

The data set includes information on the establishments’ employment size, years of operation (i.e., age), industry and location—these variables are commonly used in empirical “firm growth” studies—but also characteristics of their employees such as levels of education, age and occupations. These attributes of workers, aggregated to the establishment level, allow us to investigate the effects on business performance associated with the educational attainment and

² For other studies on the performance of Swedish firms, see—for example—Heshmati (2001), Box (2008) and Andersson and Noseleit (2011).

experience of workers, as well as the relationship between performance and the percentages of workers in several skills-based occupational categories.

Our analysis of the educational attainment, experience and occupations held by workers in an establishment provides a broad view of human capital. Previous studies on the impacts of human capital have used conventional measures of college attainment (or years of education) and experience (Mincer 1974; Glaeser et al. 1995; Card 1999; Moretti 2004), which give an indication of “how much” human capital a person possesses. In recent years, studies have used occupations as an indicator of the skills required on the job (Ingram and Neumann 2006; Florida et al. 2008; Bacolod et al. 2009; Gabe 2009; Florida et al. 2012); this tells us “what types” of human capital workers possess. Studies examining the effects of an entrepreneur’s human capital on business performance make a distinction between general human capital (e.g., education and experience) and knowledge that is specific to the company’s industrial sector (Gimeno et al. 1997; Colombo et al. 2004; Ganotakis 2012). Bacolod et al. (2009) make a similar distinction between a “vertical” orientation of human capital, related to educational attainment, and a “horizontal” orientation, which is based on occupations and skills.

Along with using more than one measure of human capital, the analysis looks at the determinants of establishment survival and growth. This will demonstrate how human capital affects the dynamics of employment change (Davis et al. 1996; Andersson and Noseleit 2011), whether it is through reducing job destruction associated with business closures, or affecting the growth of incumbent establishments. For this task, a two-step Heckman (1979) sample selection model was applied. The first-stage model examines whether the firm remained in operation over the period of analysis, while the second stage regression model examines the growth of surviving firms.

Our results provide mixed evidence on the effects of human capital on business performance. The percentage of workers in a business with a college degree increases the likelihood that an establishment remains in operation, but has no effect on its employment growth over time. Results of the analysis show that businesses made up of older (i.e., more experienced) workers are less likely to remain in operation, and the experience of workers has a negative effect on employment growth. Finally, our results indicate that the shares of workers in occupations using management and administration, cognitive, and social skills reduce the likelihood of survival (relative to an omitted category of occupations using motor skills), while these three skills-based occupational groups are associated with higher rates of employment growth.

The rest of the paper is organized as follows. Section 2 provides a conceptual framework for the analysis of establishment growth, along with a discussion of the variables used in the regressions. In section 3, we present the regression models and results. Section 4 provides a summary of the paper, as well as conclusions of the study.

2. CONCEPTUAL FRAMEWORK AND DATA

Many studies have examined the effects of initial size and age on business growth (Simon and Bonini 1958; Hymer and Pashigian 1962; Singh and Whittington 1975; Hall 1987; Petrunia 2008; Teruel-Carrizosa 2010). Evans (1987a; 1987b) analyzed the relationship between employment growth and these business characteristics using the conceptual framework and the regression model shown as equations 1 and 2:

$$(1) \quad S_{t'} = [G(S_t, A_t)]^d (S_t) e_t$$

$$(2) \quad (\ln S_{t'} - \ln S_t) / d = \ln G(S_t, A_t) + u_t$$

where S and A are establishment size and age, $G(\cdot)$ is a firm growth function, t indicates time where $t' > t$ and $d = t' - t$, e is a log-normally distributed error term, and u is normally distributed with mean zero and independent of S and A . The partial derivatives of an establishment's logarithmic growth rate with respect to firm size and age are denoted as $g_S = \partial \ln G / \partial \ln S$ and $g_A = \partial \ln G / \partial \ln A$.

Evans (1987a, 1987b) used this framework to test Gibrat's law (Hart and Prais 1956), which implies that firm growth is independent of size ($g_S = 0$). Most empirical studies have rejected Gibrat's law and instead find that business growth rates are negatively related to initial size (Evans 1987a, 1987b; Dunne et al. 1989; Petrunia 2008; Teruel-Carrizosa 2010). Evans (1987a, 1987b) also used this framework to test Jovanovic's (1982) passive firm learning hypothesis, which implies a negative relationship between firm growth and age ($g_A < 0$).

As is common in empirical studies of business growth, we extend Evans' (1987a, 1987b) framework and—in our case—include a set of human capital variables that are expected to affect an establishment's employment change:

$$\begin{aligned}
 (3) \quad (\ln S_{t'} - \ln S_t) = & \alpha + \beta_1 \ln S_t + \beta_2 \ln A_t + \beta_3 (\ln S_t)^2 + \beta_4 (\ln A_t)^2 + \\
 & \beta_5 (\ln S_t) \times (\ln A_t) + \beta_6 \textit{Education} + \beta_7 \ln \textit{Experience} + \\
 & \beta_8 \textit{Mgmt. \& Admin.} + \beta_9 \textit{Cognitive} + \beta_{10} \textit{Social} + \\
 & \beta_{11} \textit{Motor} + \textit{Industry}_{\text{dummy}} + \textit{Region}_{\text{dummy}} + u
 \end{aligned}$$

where, *Education*, *Experience*, *Mgmt. & Admin.*, *Cognitive*, *Social* and *Motor* are human capital variables, and *Industry_{dummy}* and *Region_{dummy}* are indicators of the establishment's industry and region of location, respectively.

The variables labeled as *Education* and *Experience* are conventional measures of human capital that capture the share of employees in the establishment with a BA (Bachelor of Arts)

degree or higher level of formal education, and the average number of years that employees in the establishment could have worked (an individual's age minus the years of education minus six). We also use several human capital variables based on the shares of workers in broad occupational groups within each establishment: management and administration (*Mgmt.&Admin.*) occupations, cognitive occupations (*Cognitive*), social occupations (*Social*), and motor occupations (*Motor*). These groups are based on the classifications of Johansson and Klaesson (2011), which attempt to measure the types of skills that are used by individuals working in these jobs. For example, individuals classified as having a “cognitive occupation” (e.g., engineers and teaching professionals) are involved in knowledge generation and dissemination, while those classified as having a “motor occupation” perform physical and hands-on tasks. The shares of workers in these occupational groups provide an indication of the types of tasks that are performed and, thus, the corresponding skills that are needed.

Although our empirical design and approach to measuring human capital differ from what has been employed previously, we can use results from other studies to inform our expectations about the impacts of the human capital variables on the growth of Swedish business establishments. Previous studies tend to uncover stronger impacts on business performance associated with the specific types of education and skills held by workers (e.g., the company's founder) than more general human capital indicators of experience and the amount of overall education. For instance, Colombo et al. (2004) find that the amount of education in economic, law and management-related fields—similar to our skills-based measure of management and administration—has a positive effect on the start-up size of new businesses, whereas the effects associated with general education are mixed (depending on the control variables used in the regression). Furthermore, they report a larger impact on start-up size related to the owner having

experience specific to the new firm's sector than the effect on size associated with general experience.

The importance of business-related skills was also uncovered by Almus and Nerlinger (1999) and Ganotakis (2012). Ganotakis' (2012) analysis of the performance of technology-based firms in the United Kingdom shows that business-related education and experience have a positive effect on company size, whereas the impact associated with the amount of general education is not statistically significant. Almus and Nerlinger (1999) also find that business skills increase the growth of "non-innovative" firms in Germany.

Based on these previous studies, we expect the types of skills used by Swedish workers to have a larger impact on establishment growth than the effects associated with general education and experience. In our regression analysis, which has the variable measuring physical skills as the omitted category, the occupational-based groups of management and administration, cognitive, and social skills capture the extent to which workers can organize a company's activities, develop strategies and communicate with others. We expect these types of skills to increase the growth of Swedish businesses. On the other hand, past studies—which reported mixed results related to the role of general education and experience on business performance—do not suggest clear expectations about the impacts of the conventional measures of human capital (i.e., education and experience) on establishment growth.

(Table 1 about here)

Table 1 presents definitions and summary statistics of the variables used in the analysis, which are constructed from data provided by Statistics Sweden.³ Establishments that remained in the sample grew by an average of 2.8 percent between 2001 and 2006, and an average growth of 4.5 percent between 2001 and 2010. Focusing on the human capital variables, we see that establishments in the sample have an average of 12.3 percent of their workers with a bachelor's degree and they have workers with an average of 26.8 years of (potential) experience. With an average of close to 60 percent of the workers in Swedish business establishments, the skills-based category of motor occupations has the highest employment share, followed by social occupations (17 percent), management and administration occupations (14 percent) and cognitive occupations (9 percent).

3. REGRESSION RESULTS

Several versions of the regression model shown as equation 3 are estimated to examine the determinants of business growth in Sweden, with an emphasis on the role of human capital. The first specification is the base model, which focuses on the effects of establishment size and age (Evans 1987a, 1987b). The second and third specifications include the education and experience variables, respectively, and the fourth specification includes the skills-based occupational categories (motor occupations are the excluded group). The final version of the model includes all of the human capital variables.

The estimation procedure is a two-stage sample selection model (Heckman 1979) in which the first stage (i.e., survival model) is a probit regression of whether the establishment was in operation at the end of the period and the second stage is the analysis of employment growth (equation 3, with the sample selection variable (λ) that is estimated from the first-stage

³ This dataset has restricted public access.

regression). Marginal effects estimated for the second-stage model incorporate the (direct) effects of the explanatory variables on employment growth, as well as the (indirect) effects of the variables on growth through their influence on survival (which is transmitted through the sample selection variable). Thus, the marginal effects can be interpreted as the impact of a given variable on the employment growth of a (typical) business establishment in operation at the beginning of the period; in our case, 2001. An OLS estimation of employment growth, without the sample selection variable, would produce biased results because an analysis of only those establishments that survived over the period does not account for the influence of weaker performing businesses that disappeared from the sample.

Table 2 presents regression results for all five versions of the model (estimations 1a to 5a) using data from 2001 to 2006, and these models are repeated in Table 3 (estimations 1b to 5b) using data from 2001 to 2010. For each of the specifications, results are presented for the probit survival regression (first column of results), the second-stage employment growth regression, the estimated marginal effect on employment growth accounting for a variable's influence on survival (third column of results), and an OLS regression that examines only those establishments that remained in operation (final column). A comparison of the OLS results to the estimated marginal effects provides an idea of the bias due to the influence of sample selection.

(Table 2 about here)

Results of the baseline analysis (estimations 1a and 1b) show that establishment size and age are positively associated with business survival, and—focusing on the marginal effects shown in the third column of results—there is a negative relationship between the employment

growth of Swedish business establishments and these initial conditions. Such results are similar to those reported by Evans (1987a, 1987b) and in numerous other studies of business growth.

The results of estimations 2a and 2b show that the percentage of employees with at least a bachelor's degree has a positive effect on business survival, and—in the second-stage regression that includes the sample selection variable—educational attainment has a positive effect on the growth of establishments that remained in operation over the period. The estimated coefficient corresponding to the sample selection variable (λ) in the second-stage growth regression, however, suggests that the factors shown to increase the likelihood of survival (e.g., initial size and age, and educational attainment) are associated with lower growth rates.⁴ Thus, the marginal effect associated with educational attainment is insignificant (for both time periods) suggesting that the share of employees with a bachelor's degree has no effect on the growth of Swedish business establishments in operation as of 2001. This marginal effect is similar to the OLS coefficient corresponding to the educational attainment variable in estimation 2a, although the OLS result using data from 2001 to 2010 (estimation 2b) suggests that the share of workers with a bachelor's degree enhances establishment growth. This OLS result, estimated over the longer time period, is not confirmed by the marginal effect that accounts for the influence of educational attainment on sample selection.

(Table 3 about here)

Results of estimations 3a and 3b show that the average (potential) experience of workers in a Swedish business establishment has a negative effect on business survival and the growth of

⁴ The sample selection variable is the inverse Mills ratio, which has higher values for establishments with lower estimated probabilities of survival.

businesses that remained in operation (controlling for sample selection); and the marginal effect indicates that the growth of establishments in operation as of 2001 is negatively associated with the average age of their workers. The marginal effects corresponding to the potential experience of an establishment's workers are qualitatively similar to those corresponding to business age (i.e., years of operation), suggesting that older establishments and those with more experienced workers are associated with slower employment growth. On the other hand, establishments with more experienced workers have a lower probability of survival, whereas older businesses are more likely to remain in operation over time. Considering the results of estimations 2 and 3 (over both time periods of analysis), we arrive at the conclusion that the two conventional measures of human capital—education and experience—do not increase the growth of Swedish business establishments (although educational attainment has a positive effect on survival). In other words, the “amount” of human capital possessed by workers in an establishment does not enhance its growth.

Moving to the skills-based occupational categories that account for the “types” of human capital that workers use in their jobs, we see in the regression results for estimations 4a and 4b that—relative to the omitted category of motor occupations—the shares of employees in the skills-based groups of management and administration, cognitive, and social occupations reduce the likelihood of business survival, while they have a positive effect on business growth. The positive effects on employment growth associated with these skills-based occupational categories are found in the OLS results, which do not account for the influence of sample selection, and the marginal effects that are interpreted as the impacts of a variable on the growth of an establishment in operation as of 2001.

The final sets of regression results, which include all of the human capital variables in estimations 5a and 5b, confirm the results found when examining the measures of human capital separately. That is, educational attainment has a positive effect on survival, while the other human capital variables are negatively associated with survival. The marginal effects that account for the influence of sample selection suggest that the average experience of workers in an establishment has a negative effect on the growth of Swedish businesses; the shares of workers in management and administration, cognitive, and social occupations have a positive effect on growth (relative to an omitted category of motor occupations); and there is not a statistically significant relationship between an establishment's employment growth and the educational attainment of its employees.

4. SUMMARY AND CONCLUSIONS

This study examined the effects of human capital on the survival and employment growth of Swedish business establishments. Human capital is represented by the conventional measures related to educational attainment and experience, which indicate the amount of human capital possessed by workers, as well as some occupational-based variables that indicate the types of skills used by employees to perform their jobs. Our empirical approach involved a Heckman two-stage model of business survival and the growth of businesses that remained in operation over time, with an emphasis on the marginal effects that capture the impacts of the explanatory variables on the growth of a “typical” establishment that was open in 2001.

Regression results presented in the paper show that educational attainment, defined as the percentage of workers in an establishment with a bachelor's degree, has a positive effect on survival (i.e., remaining in operation), but that college attainment does not have a statistically

significant marginal effect on the growth of Swedish businesses in operation as of 2001. Our finding of no effect on growth associated with “general” education is similar to the results reported by Ganotakis (2012) for technology-based firms in the United Kingdom. An explanation as for why general education (and experience) may not contribute to business performance is that more educated (and experienced) individuals may be less likely to seek out and follow the advice of others (Ganotakis 2012).

A second key finding uncovered in our analysis is that the average age of workers in an establishment has a negative effect on its survival and employment growth over time. An explanation for these results, based on a study of German firms by Meyer (2011), is that companies comprised of older workers might be less likely to adopt new technologies. Similarly, Ganotakis (2012) explains that more experienced workers may be less likely to seek out the advice of others, as noted above, and have a lower proclivity to introduce “innovative products and practices.”

Occupational-based indicators of human capital that capture the skills used by workers suggest that—compared to people who use motor skills while performing their jobs—those with management and administration, cognitive, and social occupations help stimulate the employment growth of establishments. These types of skills can be used to develop strategies for growth and identify market opportunities (i.e., cognitive skills), organize an establishment’s activities (i.e., management and administration skills), and communicate and interact with an establishment’s customers and other businesses (i.e., social skills). Similarly, Ganotakis (2012, p. 499) explains that management and marketing skills are important to business performance “as they can contribute to the formulation of strategies that are necessary for a firm to be able to successfully exploit a technological innovation in a marketplace.”

Interestingly, our findings also suggest that, relative to those who use motor skills, the percentages of workers in Swedish establishments who use management and administration, cognitive, and social skills reduce the likelihood of business survival. An explanation for these results, suggested by Gimeno et al. (1997), is that these workers have higher thresholds for business success and—if the establishment's performance does not meet the target—these workers will move on to other opportunities. Thus, the skills-based groups of management and administration, cognitive, and social occupations appear to reduce the likelihood of establishment survival (compared to the skills-based category of motor occupations) due to the high threshold for business performance, yet they enhance the employment growth of establishments that do survive because of their abilities to develop new strategies, organize activities and communicate with others.

These results are generally consistent with our expectations, suggested by previous studies, about the impacts of specific skills (e.g., management and administration) and more general measures of human capital (e.g., education and experience) on business performance. Our findings related to the primary importance of business-related skills to establishment growth are similar to the results reported by Almus and Nerlinger (1999), Colombo et al. (2004) and Ganotakis (2012). The fact that the skills-based measures of human capital influence the growth of Swedish businesses, whereas educational attainment and overall experience do not, is also consistent with other studies (Almus and Nerlinger 1999; Ganotakis 2012) that did not uncover significant impacts on business performance associated with these conventional measures of human capital.

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Table 1. Variable Definitions and Summary Statistics (n=467,034)

Variable	Definition	Mean	St. Dev.
Dependent Variables			
<i>Survival</i>	=1 if establishment was in operation in 2006 (2010), =0 otherwise	0.579 (0.446)	NA NA
<i>Growth</i>	(Logarithmic) growth rate of employment between 2001 and 2006 (2010)	0.028 (0.045)	0.519 (0.617)
Explanatory Variables (all measured as of 2001)			
<i>Size</i>	Establishment employment size	8.365	55.16
<i>Age</i>	Establishment age (i.e., years in operation)	8.071	5.719
<i>Education</i>	Share of employees with at least 3 years of higher education, equivalent to a bachelor's degree in Sweden	0.123	0.284
<i>Experience</i>	Average experience of employees, where experience is measured as an individual's age minus 6, minus years of education	26.82	10.72
<i>Cognitive</i>	Share of employees with an occupation categorized as "cognitive"	0.094	0.253
<i>Mgmt. & Admin.</i>	Share of employees with an occupation categorized as "management and administration"	0.139	0.279
<i>Social</i>	Share of employees with an occupation categorized as "social"	0.173	0.324
<i>Motor</i>	Share of employees with an occupation categorized as "motor"	0.593	0.449
<i>Industry Dummies</i>	Dummy variables based on establishment's 2-digit SIC code, 60 categories in total	NA	NA
<i>Regional Dummies</i>	Dummy variables based on establishment's location, 4 regions in total	NA	NA

Notes. Regional dummies are defined by the Swedish Board of Agriculture: i) metropolitan municipalities (*municipalities in the functional regions of Stockholm, Gothenburg and Malmö*), ii) urban municipalities (*regional center's outside the metropolitan areas and their "suburb municipalities"*), iii) rural municipalities (municipalities not part of (i) or (ii) with a *population density above 5 people per km²*), and iv) sparsely populated rural municipalities (*population density below 5 people per km²*) (Westlund 2011).

Table 2. Effects of Human Capital on the Growth and Survival of Swedish Establishments, 2001 to 2006 (n=467,034)

Variable	First-Stage <i>Survival</i>	Second-Stage <i>Growth (ln)</i>	Marginal Effect	OLS Regression
Estimation 1a				
<i>Size (ln)</i>	0.423** (0.006)	0.191** (0.021)	-0.108** (0.021)	-0.135** (0.003)
<i>Size</i> ² (ln)	-0.052** (0.001)	-0.025** (0.002)	0.012** (0.003)	0.012** (0.001)
<i>Age (ln)</i>	0.376** (0.008)	0.198** (0.022)	-0.067** (0.023)	-0.138** (0.005)
<i>Age</i> ² (ln)	-0.042** (0.003)	-0.021** (0.004)	0.008 (0.004)	0.023** (0.002)
<i>Size*Age (ln)</i>	0.037** (0.002)	0.004 (0.002)	-0.023* (0.003)	0.009** (0.001)
Sample Selection Lambda	NA	1.214** (0.073)	NA	NA
Wald Chi-Squared	1,527**	NA	NA	NA
R-squared	NA	0.053	NA	0.050
Estimation 2a				
<i>Size (ln)</i>	0.426** (0.006)	0.200** (0.021)	-0.107** (0.021)	-0.135** (0.003)
<i>Size</i> ² (ln)	-0.053** (0.001)	-0.026** (0.003)	0.012** (0.003)	0.012** (0.001)
<i>Age (ln)</i>	0.376** (0.008)	0.206** (0.022)	-0.066** (0.023)	-0.138** (0.005)
<i>Age</i> ² (ln)	-0.041** (0.003)	-0.022** (0.004)	0.008 (0.004)	0.023** (0.002)
<i>Size*Age (ln)</i>	0.037** (0.002)	0.003 (0.002)	-0.023** (0.003)	0.009** (0.001)
<i>Education</i>	0.055** (0.007)	0.037** (0.009)	-0.005 (0.010)	-0.004 (0.004)
Sample Selection Lambda	NA	1.241** (0.074)	NA	NA
Wald Chi-Squared	1,470**	NA	NA	NA
R-squared	NA	0.053	NA	0.050

Table is continued on the following page.

Table 2. Effects of Human Capital on the Growth and Survival of Swedish Establishments, 2001 to 2006, continued

Variable	First-Stage <i>Survival</i>	Second-Stage <i>Growth (ln)</i>	Marginal Effect	OLS Regression
Estimation 3a				
<i>Size (ln)</i>	0.406** (0.006)	0.162** (0.019)	-0.123** (0.020)	-0.150** (0.004)
<i>Size</i> ² (ln)	-0.049** (0.001)	-0.019** (0.002)	0.015** (0.002)	0.014** (0.001)
<i>Age (ln)</i>	0.386** (0.008)	0.206** (0.022)	-0.064** (0.023)	-0.134** (0.005)
<i>Age</i> ² (ln)	-0.037** (0.003)	-0.013** (0.004)	0.013** (0.004)	0.027** (0.002)
<i>Size*Age (ln)</i>	0.033** (0.002)	-0.002 (0.002)	-0.025** (0.003)	0.007** (0.001)
<i>Experience (ln)</i>	-0.108** (0.004)	-0.178** (0.007)	-0.102** (0.008)	-0.100** (0.003)
Sample Selection Lambda	NA	1.202** (0.071)	NA	NA
Wald Chi-Squared	2,102**	NA	NA	NA
R-squared	NA	0.058	NA	0.055
Estimation 4a				
<i>Size (ln)</i>	0.437** (0.006)	0.228** (0.024)	-0.125** (0.024)	-0.153** (0.004)
<i>Size</i> ² (ln)	-0.055** (0.001)	-0.028** (0.003)	0.017** (0.003)	0.015** (0.001)
<i>Age (ln)</i>	0.369** (0.008)	0.252** (0.025)	-0.045 (0.025)	-0.129** (0.005)
<i>Age</i> ² (ln)	-0.040** (0.003)	-0.028** (0.004)	0.004 (0.005)	0.021** (0.002)
<i>Size*Age (ln)</i>	0.039** (0.002)	0.002 (0.003)	-0.029** (0.003)	0.008** (0.001)
<i>Cognitive</i>	-0.024** (0.009)	0.036** (0.011)	0.056** (0.013)	0.045** (0.005)
<i>Mgmt. & Admin.</i>	-0.031** (0.008)	0.068** (0.010)	0.094** (0.012)	0.080** (0.005)
<i>Social</i>	-0.080** (0.008)	0.028** (0.010)	0.093** (0.012)	0.078** (0.004)
Sample Selection Lambda	NA	1.387** (0.082)	NA	NA
Wald Chi-Squared	1,314**	NA	NA	NA
R-squared	NA	0.056	NA	0.052

Table is continued on the following page.

Table 2. Effects of Human Capital on the Growth and Survival of Swedish Establishments, 2001 to 2006, continued

Variable	First-Stage <i>Survival</i>	Second-Stage <i>Growth (ln)</i>	Marginal Effect	OLS Regression
	Estimation 5a			
<i>Size (ln)</i>	0.422** (0.006)	0.204** (0.023)	-0.141** (0.024)	-0.168** (0.004)
<i>Size</i> ² (ln)	-0.052** (0.001)	-0.022** (0.003)	0.020 (0.003)	0.018** (0.001)
<i>Age (ln)</i>	0.379** (0.008)	0.270** (0.025)	-0.040 (0.026)	-0.124** (0.005)
<i>Age</i> ² (ln)	-0.036** (0.003)	-0.021** (0.004)	0.009 (0.005)	0.025** (0.002)
<i>Size*Age (ln)</i>	0.034** (0.002)	-0.004 (0.003)	-0.032** (0.003)	0.005** (0.001)
<i>Education</i>	0.055** (0.008)	0.027* (0.010)	-0.019 (0.012)	-0.016** (0.004)
<i>Experience (ln)</i>	-0.108** (0.004)	-0.194** (0.008)	-0.106** (0.009)	-0.102** (0.003)
<i>Cognitive</i>	-0.033** (0.009)	0.033** (0.012)	0.060** (0.014)	0.051** (0.005)
<i>Mgmt. & Admin.</i>	-0.020** (0.008)	0.089** (0.010)	0.106** (0.012)	0.092** (0.005)
<i>Social</i>	-0.083** (0.008)	0.018** (0.010)	0.086** (0.012)	0.071** (0.004)
Sample Selection Lambda	NA	1.405** (0.082)	NA	NA
Wald Chi-Squared	1,703**	NA	NA	NA
R-squared	NA	0.062	NA	0.058

Notes. Standard errors are shown in parentheses. ** and * denote statistical significance at the 1-percent and 5-percent levels. The regression models also include intercepts and two sets of dummy variables, not shown in the table, that control for an establishment's industry and region of location. Of the original sample of 467,034 establishments in 2001, 270,455 of the businesses were in operation as of 2006.

Table 3. Effects of Human Capital on the Growth and Survival of Swedish Establishments, 2001 to 2010 (n=467,034)

Variable	First-Stage <i>Survival</i>	Second-Stage <i>Growth (ln)</i>	Marginal Effect	OLS Regression
Estimation 1b				
<i>Size (ln)</i>	0.431** (0.006)	0.154** (0.021)	-0.124** (0.021)	-0.145** (0.004)
<i>Size</i> ² (ln)	-0.051** (0.001)	-0.026** (0.002)	0.007** (0.002)	0.008** (0.001)
<i>Age (ln)</i>	0.320** (0.008)	0.082** (0.018)	-0.124** (0.019)	-0.163** (0.007)
<i>Age</i> ² (ln)	-0.041** (0.003)	-0.012** (0.003)	0.015** (0.004)	0.022** (0.002)
<i>Size*Age (ln)</i>	0.049** (0.002)	0.018** (0.002)	-0.013** (0.002)	0.010** (0.002)
Sample Selection Lambda	NA	0.965** (0.064)	NA	NA
Wald Chi-Squared	2,680**	NA	NA	NA
R-squared	NA	0.064	NA	0.063
Estimation 2b				
<i>Size (ln)</i>	0.433** (0.006)	0.166** (0.021)	-0.123** (0.022)	-0.145** (0.004)
<i>Size</i> ² (ln)	-0.051** (0.001)	-0.027** (0.003)	0.007* (0.003)	0.008** (0.001)
<i>Age (ln)</i>	0.320** (0.008)	0.090** (0.019)	-0.123** (0.019)	-0.163** (0.007)
<i>Age</i> ² (ln)	-0.040** (0.003)	-0.012** (0.003)	0.014** (0.004)	0.022** (0.002)
<i>Size*Age (ln)</i>	0.048** (0.002)	0.018** (0.002)	-0.014** (0.002)	0.009** (0.002)
<i>Education</i>	0.044* (0.008)	0.042** (0.008)	0.012 (0.009)	0.014** (0.006)
Sample Selection Lambda	NA	0.997** (0.066)	NA	NA
Wald Chi-Squared	2,526**	NA	NA	NA
R-squared	NA	0.064	NA	0.063

Table is continued on the following page.

Table 3. Effects of Human Capital on the Growth and Survival of Swedish Establishments, 2001 to 2010, continued

Variable	First-Stage <i>Survival</i>	Second-Stage <i>Growth (ln)</i>	Marginal Effect	OLS Regression
Estimation 3b				
<i>Size (ln)</i>	0.398** (0.006)	0.091** (0.018)	-0.142** (0.018)	-0.162** (0.004)
<i>Size</i> ² (ln)	-0.043** (0.001)	-0.015** (0.002)	0.010** (0.002)	0.012** (0.001)
<i>Age (ln)</i>	0.341** (0.008)	0.076** (0.017)	-0.124** (0.018)	-0.159** (0.007)
<i>Age</i> ² (ln)	-0.032** (0.003)	0.003 (0.003)	0.022** (0.003)	0.029** (0.002)
<i>Size*Age (ln)</i>	0.040** (0.002)	0.008** (0.002)	-0.015** (0.002)	0.006** (0.002)
<i>Experience (ln)</i>	-0.230** (0.004)	-0.275** (0.010)	-0.140** (0.010)	-0.143** (0.004)
Sample Selection Lambda	NA	0.878** (0.058)	NA	NA
Wald Chi-Squared	5,061**	NA	NA	NA
R-squared	NA	0.071	NA	0.070
Estimation 4b				
<i>Size (ln)</i>	0.444** (0.006)	0.209** (0.026)	-0.141** (0.026)	-0.164** (0.005)
<i>Size</i> ² (ln)	-0.054** (0.001)	-0.031** (0.003)	0.011** (0.003)	0.012** (0.001)
<i>Age (ln)</i>	0.313** (0.008)	0.144** (0.022)	-0.103** (0.023)	-0.153** (0.007)
<i>Age</i> ² (ln)	-0.039** (0.003)	-0.020** (0.004)	0.010* (0.005)	0.019** (0.002)
<i>Size*Age (ln)</i>	0.050** (0.002)	0.019** (0.002)	-0.020** (0.003)	0.008** (0.002)
<i>Cognitive</i>	-0.036** (0.009)	0.053** (0.011)	0.081** (0.013)	0.071** (0.007)
<i>Mgmt. & Admin.</i>	-0.044** (0.008)	0.089** (0.009)	0.124** (0.011)	0.110** (0.007)
<i>Social</i>	-0.069** (0.008)	0.031** (0.009)	0.085** (0.011)	0.072** (0.006)
Sample Selection Lambda	NA	1.181** (0.078)	NA	NA
Wald Chi-Squared	1,982**	NA	NA	NA
R-squared	NA	0.067	NA	0.065

Table is continued on the following page.

Table 3. Effects of Human Capital on the Growth and Survival of Swedish Establishments, 2001 to 2010, continued

Variable	First-Stage <i>Survival</i>	Second-Stage <i>Growth (ln)</i>	Marginal Effect	OLS Regression
	Estimation 5b			
<i>Size (ln)</i>	0.412** (0.006)	0.149** (0.022)	-0.160** (0.022)	-0.182** (0.005)
<i>Size</i> ² (ln)	-0.046** (0.001)	-0.020** (0.003)	0.015** (0.003)	0.015** (0.001)
<i>Age (ln)</i>	0.335** (0.008)	0.150** (0.021)	-0.102** (0.022)	-0.149** (0.007)
<i>Age</i> ² (ln)	-0.030** (0.003)	-0.005 (.004)	0.018** (0.004)	0.026** (0.002)
<i>Size*Age (ln)</i>	0.041** (0.002)	0.008** (0.002)	-0.022** (0.003)	0.004* (0.002)
<i>Education</i>	0.038** (0.008)	0.017* (0.009)	-0.012 (0.011)	-0.009 (0.006)
<i>Experience (ln)</i>	-0.231** (0.004)	-0.317** (0.012)	-0.144** (0.013)	-0.148** (0.004)
<i>Cognitive</i>	-0.036** (0.009)	0.057** (0.010)	0.084** (0.013)	0.074** (0.007)
<i>Mgmt. & Admin.</i>	-0.015 (0.008)	0.127** (0.009)	0.139** (0.011)	0.126** (0.007)
<i>Social</i>	-0.078** (0.008)	0.016 (0.009)	0.075** (0.011)	0.064** (0.006)
Sample Selection Lambda	NA	1.122** (0.071)	NA	NA
Wald Chi-Squared	3,605**	NA	NA	NA
R-squared	NA	0.074	NA	0.072

Notes. Standard errors are shown in parentheses. ** and * denote statistical significance at the 1-percent and 5-percent levels. The regression models also include intercepts and two sets of dummy variables, not shown in the table, that control for an establishment's industry and region of location. Of the original sample of 467,034 establishments in 2001, 208,437 of the businesses were in operation as of 2010.