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What Determines the Initial Size of New Ventures?

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Abstract

A central notion in entrepreneurship is the initial size of a firm, since it bears upon its future success. Prior work has found that entrepreneurs' background characteristics impact start-up size. Yet, initial size is observed only when entry occurs, and the same individual-level characteristics are likely to determine the entry decision too. Existing research may misreport the determinants of initial size if: (1) it equates the entry decision with size decision, which ignores the possibility that entrepreneurs require different size thresholds to induce entry, and (2) it treats initial size as divorced from the entry process, which may be characterized by different types of entry (e.g. as spinout, de novo, hybrid entry). We show that: (1) selection effects at entry cause endogeneity in the initial size of start-ups, and (2) prospect entrepreneurs have different size thresholds, depending on the type of entry. The ability to implement such comparative tests is enhanced by our access to a very rich data source of matched employees-employers data on nearly the entire Swedish population over a 13 year period.

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Abstract

A central notion in entrepreneurship is the initial size of a firm, since it bears upon its future success. Prior work has found that entrepreneurs' background characteristics impact start-up size. Yet, initial size is observed only when entry occurs, and the same individual-level characteristics are likely to determine the entry decision too. Existing research may misreport the determinants of initial size if: (1) it equates the entry decision with size decision, which ignores the possibility that entrepreneurs require different size thresholds to induce entry, and (2) it treats initial size as divorced from the entry process, which may be characterized by different types of entry (e.g. as spinout, de novo, hybrid entry). We show that: (1) selection effects at entry cause endogeneity in the initial size of start-ups, and (2) prospect entrepreneurs have different size thresholds, depending on the type of entry. The ability to implement such comparative tests is enhanced by our access to a very rich data source of matched employees-employers data on nearly the entire Swedish population over a 13 year period.

Key words: venture initial size, hybrid entrepreneurship, entrepreneurial entry, entrepreneurial selection.

1. Introduction

The initial size of new ventures is a fundamental characteristic of the entrepreneurial process. The size at which entrepreneurs start their business is clearly related to the features of the entered industry (Acs and Audretsch, 1989; Mata and Machado, 1996), but Geroski's (1995) finding that initial size varies considerably within industries suggests that individuals have some discretion in choosing the size suitable for their ambitions. Unfortunately, there is little evidence about the entrepreneur's role in determining initial size. Moreover, the limited evidence that exists assumes that size decision is independent from the decision to enter into entrepreneurship. This assumption seems implausible and may undermine attempts to isolate individuals' true effect on new venture size. In this paper, we consider how individuals influence initial size and assume some dependence between the entry decision and the initial size decision.

The premise of our study is that for two reasons existing work may misattribute the role of the individual in determining initial size. First, individuals may require different sized ventures to induce entry. For example, this might be the case if individuals require larger ventures to offset larger opportunity costs associated with leaving a position with a better wage or a more reputable employer. If individuals self-select into entrepreneurship based on required size, existing work failing to account for dependence might misreport the determinants of initial size. Prior research examining initial size has not corrected for the possibility of self-selection bias. Careful treatment of selection biases will not only clarify the empirical determinants of initial size, but assist in building a more nuanced theoretical understanding of how entry and initial size are interrelated.

A second reason for concern is that existing work also assumes that the size decision is independent from an entrepreneur's entry process. If individuals start as hybrid entrepreneurs (Folta, Delmar, and Wennberg, 2010), initiating ventures while simultaneously working in a wage position, they may rationally prefer to start smaller ventures to test the entrepreneurial waters and learn about a venture's upside potential or an individual's fit in the entrepreneurial context. Size might also be related to the entry process if a venture benefits from financial or organizational spillovers originating with an entrepreneur's prior employer. For example, compared to the unemployed, individuals starting businesses that are spinouts or spinoffs from their employers may be able to harness resources, separate from their own wealth, to start larger ventures.¹ In this paper, we do not assume the initial size decision is divorced from the entry decision or the entry process, hoping to theoretically and empirically clarify how entrepreneurial characteristics influence a venture's initial size.

We have several objectives in this paper. First, we hope to elucidate the size distributions of new ventures. We do so by tracking over an eight-year period, a sample of nearly 19,000 Swedish men who began a new wage job in 1994 with a firm in a knowledge-intensive sector of the economy. Although this focus limits the ability to generalize our results to all industries, Götzfried (2004) noted that these sectors accounted for over half of all jobs in the Swedish economy in 2003 (46.4% of manufacturing and 63.2% of service). Second, we consider the theoretical explanations for (a) why initial size decisions may be inter-related to the entry decision, and (b) why initial size might be determined by the entry process; and we examine the empirical evidence around these issues. Third, we demonstrate the empirical implications of ignoring the dependence between initial size, entry, and the entry process. The empirical

¹ Spinoffs have been defined as new firms partially-owned by a parent company (Ito, 1995: 431-432). Spinouts are new firms started by ex-employees of existing firms in the industry in the year prior spin-outs' formation (Agarwal et al., 2004: 509); De Novo firms have founders with no experience in the entered industry (Helfat & Lieberman, 2002: 730).

evidence supports the notion that entry processes dramatically affect initial size, and ignoring such processes misattributes the true determinants of size. The evidence also suggests that concerns about selection bias may be important when testing for initial size. These findings have strong implications for how we interpret prior research and conduct future research.

2. The Role of the Individual in Determining Initial Size

The preponderance of research on the determinants of initial size roots in the industrial economics literature and deals with industry-level characteristics (Acs & Audretsch, 1989; Arauzo-Carod & Segarra-Blasco, 2005; Görg, Strobl, & Ruane, 2000; Mata & Machado, 1996). Initial size is determined by industry minimum efficient scale, size, turbulence, and growth.

A handful of studies explore how individual-level characteristics affect firm initial size, and this work addresses two types of determinants: human capital and financial capital. The evidence largely supports the proposition that individuals with more substantive human capital are likely to start larger businesses. For example, after controlling for industry effects, Mata (1996) finds that education (years of schooling) has a positive effect on initial size, suggesting better-trained entrepreneurs start larger firms.² Barkham (1994) finds that entrepreneurs with certain capabilities and knowledge of a specific market positively influence start-up size in that market.³ Colombo et al. (2004) reason that there might be two explanations for the positive relationship between more human capital and initial size: (a) better qualified individuals might have more confidence in their expected entrepreneurial ability, and therefore be concerned about expending the sunk costs necessary for launch; and (b) better qualified individuals might suffer

² He also found that an entrepreneur's age has an inverted U-shaped effect on size, proposing age as a proxy of labor experience, after controlling for education.

³ He used dummy variable to approximate skills in the following areas: technical or scientific, managerial, professional, and sales.

less from financial constraints, because work experience is generally tied to personal wealth. The second explanation should disappear if empiricists can separately measure wealth and human capital. Building on the theory of liquidity constraints developed by Evans and Jovanovic (1982), scholars report systematic empirical evidence of a positive relationship between founder's wealth and start-up size (Colombo & Grilli, 2005; Holtz-Eakin et al., 1993; Cabral and Mata, 2003; Hvide & Moen, 2010). Since these studies did not control for human capital, it is possible these wealth effects actually represent human capital effects. Astebro and Bernhardt (2005) investigate the interplay between human capital and wealth and find that a large fraction of the relation between wealth and initial size is indeed determined by human capital, but there is still a residual effect of wealth on initial size, which support the idea of entrepreneurs as financially constrained individuals. While there is some evidence that individual human and financial capital influence new venture initial size, we emphasize two reasons why further investigation is needed.

First, the size decision may be endogenous to the entry decision. Individuals may have different required size thresholds to induce entry. This might explain why two different entrepreneurs start similar types of businesses at different sizes. This will be the case if individuals have different opportunity costs tied to starting a venture. For example, more capable individuals or those earning higher wages may require a larger-scale operation to compensate for lost opportunities from abandoning a wage job. Prior research has largely ignored that size may be endogenous to entry, even though self-selection biases have been demonstrated to drastically influence entrepreneurial decisions other than size (e.g., Gimeno, Folta, Cooper, and Woo, 1997; Sorensen, 2007; Özcan and Reichstein, 2009). The only attempts to study size determinants while controlling for selection into entrepreneurship are by Mata (1996) and Colombo et al. (2004), but their approach, emulating Bloom and Willingsworth (1985), does not make use of

instances of non-entry and may incorrectly control for selection effects.⁴ The implications are not only curious but fundamental because previous effort may misreport the influence of factors on initial size if our concerns on endogeneity are justified.

Second, the size decision may be endogenous to the entry process. Prior work disregards this issue completely. We present several rationales that each justify why entry processes like hybrid entrepreneurship and type of entry (e.g., spinoff, spinout, denovo) might determine size. Ignoring these processes might lead not only to a selection bias, but an omitted variable bias. We also offer predictions that might enable us to distinguish among the rationales, but that is of secondary importance.

2.1 Theoretical Rationales for How Entry Processes Influence Initial Size

2.1.1 Hybrid Entrepreneurship.

Hybrid entrepreneurs have been defined as individuals initiating ventures while simultaneously engaged in wage work. Folta, Delmar, and Wennberg (2010) demonstrate that the ratio of hybrid entrepreneurs in the Swedish economy between 1995 and 2001 was comparable to the ratio of individuals fully engaged in self-employment; and 58 percent of all entries into self-employment were hybrid entries. They also provide evidence supporting the view that individuals use hybrid entrepreneurship as a means to learn about the entrepreneurial opportunity or their own fit with entrepreneurship, frequently transitioning completely to self-employment if the process reveals

⁴ Mata (1996) and Colombo et al. (2004) control for selection using truncated samples as advocated in Bloom and Willingsworth (1985) and Muthen & Joreskog (1983). In their truncated samples, all information is missing about individuals choosing not to enter self-employment. Therefore, they could not identify instruments (i.e. variables affecting the first stage (entry) but not the second stage (initial size)), crucial for diagnosing whether selection biases are present. Moreover, they could not investigate the source of the selection biases because of omitted variables. The main causes of endogeneity are self-selection and omitted variable.

positive information. We hypothesize that hybrid entrepreneurs may start smaller ventures than those moving immediately into self-employment.

Small-scale entry is consistent with the idea that individuals use their hybrid status to learn about their fit with the entrepreneurial role as well as the ventures upside potential. By maintaining their wage position, they limit the sunk costs incurred in case of failure. Starting with low commitment of human and financial resources represents a rational strategic choice to effectively keep pursuing a career as employee while testing the entrepreneurial waters.

2.1.2 Types of Entry.

Consistent with Helfat and Lieberman (2002), we consider entry processes like spinoffs, spinouts, and de novo entry. Spinoffs represent ventures where an individual's employer invests; spinouts represent ventures where an individual worked for an employer in a related industry; denovo firms represent ventures where an individual worked in an unrelated company, or was unemployed prior to founding. We hypothesize that ventures with stronger ties to a parent company enable entrepreneurs to start larger ventures, for three reasons.

First, access to resources beyond the entrepreneur's own resources enables larger initial venture size. Spinoffs, by definition, attain financial capital from the parent firm. Sometimes, parent firms may also encourage transfer of their own capabilities. Both spinoffs and spinouts also enable the entrepreneur to redeploy the skills and know-how learned in a related business to a new venture (Klepper, 2009). The possibility to redeploy resources back to the parent firm or to some other related business reduces the sunk costs associated with the initial investment. Lower sunk costs should encourage larger entry size.

Second, working in a firm exposes individuals to a network of relevant actors for the new venture, such as suppliers and customers (Gompers et al., 2005), colleagues with prior entrepreneurial experience (Nanda & Sørensen, 2010), and potential investors (Burton, Sørensen, & Beckman, 2002; C. Lee, K. Lee, & Pennings, 2001, Chatterji, 2009). The resultant knowledge and credibility lower the cost of capital, and the reluctance to establish relationship-specific investments (Stuart, Hoang, & Hybels, 1999; Brüderl, Preisendörfer, & Ziegler, 1992). The higher the strength of tie to the parent company the more valuable the social capital an individual may receive and use in the entrepreneurial context to attract financial resources and employees, which, result in larger initial size.

Third, employees with high monetary and non-monetary benefits from the parent company have higher opportunity costs for leaving their wage position, suggesting that they require higher size to induce entry. Non-monetary benefits may include the opportunity to pursue a career within the parent company (Carnahan, Agarwal, Campbell, & Franco, 2010; Sørensen & Fassiotto, 2011), as well as the company positive attitude towards “intrapreneurship” (Bhide, 1994; Burton et al. , 2002; Hellmann, 2002). As a result, while fewer spinoffs or spinouts may occur (relative to de novo), those that do, start at larger size.⁵

The ability to discriminate between the rationales behind hybrid entry and type of entry is hindered because they lead to the same size outcomes and are not mutually exclusive. We offered predictions that might enable us to distinguish between them, but this of secondary importance since our main intent is to show that different entry processes lead to systematic differences in observed initial sizes.

⁵ Spinoff represents the baseline category since spinoffs founders also receive financial capital from their parent company. Therefore, their observed initial sizes represent the upper bond limit of the size threshold.

3. Method

3.1 Data and Sample

A proper treatment of dependence between initial size and entry requires a full accounting of instances of non-entry. The data we use are a special (high-technology) extract from a set of three matched longitudinal data sources on the entire Swedish labor market that were gleaned from governmental registers and maintained for research purposes by Statistics Sweden.⁶ The first source is LOUISE—which has demographic and financial information for all legal residents of Sweden over the age of sixteen from 1989 onward. The second source is RAMS—which tracks employment flows in the labor market based on an annual mandatory survey for all firms having at least one employee or earning a profit. The third source is SRU—which tracks financial information for each firm and is submitted annually to the fiscal authorities for taxation purposes. The special abstract we use for analysis is called EPRO (Entrepreneurial Processes Database) and was commissioned for a broader project on entrepreneurship in high-technology manufacturing or knowledge-intensive service sectors, which are thought to be important to the Swedish economy. Individuals were identified as working in these sectors if their employer was in an industry that met Eurostat and OECD classifications, which are based on the ratio of research and development expenditures to gross domestic product. The EPRO extract covers any individual who was active in these sectors at any time from 1989 to 2002.

We constructed a risk set based on individuals, between the ages of 22 and 52, who began working as “employed” (and not involved in self-employment) for a high-technology manufacturer or knowledge-intensive service firm in 1994. A focus on newly employed

⁶ Statistics Sweden is a division in the Ministry of Finance with authority over all national statistics for Sweden, including those related to industry and trade. RAMS is an acronym for Registerbaserad Arbetsmarknadsstatistik, which in English is equivalent to “Register-based Labor Statistics.” SRU is an acronym for Standardiserad Räkenskapsutdrag, which in English is equivalent to “Standardized Accounting Summary.” We believe our data to be comparable to recent studies using matched employee-employer data for Denmark (Sorensen 2007) and Finland (Hyytinen and Ilmakunnas 2007)

eliminates problems with left-censoring, which occurs when a person becomes at risk of switching prior to our ability to observe them; and beginning in 1994 enables measurement of labor market experience since 1989 and avoids the worst of the recession in Sweden in the early 1990's. 133,620 individuals become at risk of transitioning from their current job in 1994 to entrepreneurship, unemployment, or another job. They remain at risk until they enter self-employment or unemployment, or become deceased, or emigrate, or the end of the observation period in 2001.

3.1.1 Identifying New Firms and their Entrepreneurs.

New entrepreneurial firms are identified using the history of all firms listed in RAMS by identifying whether a firm is listed as new in a year. For all (new) firms we match individuals listed as self-employed in that firm. In cases where there were more than one self-employed individual, we select the individual having the highest salary coming from the venture, or in cases where multiple people earned the highest salary we randomly select among them. So, each new firm had one individual designated as the entrepreneur. We eliminate from the risk set all other self-employed individuals in the new firm.⁷ This resulted in 18,058 new firms created between 1995 and 2001 by the 133,620 individuals, 3,086 of which are corporations. Excluding firms with missing information on initial capital ultimately results in 2694 corporate entries.

3.1.2 Identifying Hybrid Entrepreneurs.

We identify hybrid entrepreneurs by using data on individuals' employment flows over time (RAMS) and following the procedure used in Folta et al. (2010: 257). In particular, an individual

⁷ We left out firms born as selloff, where a parent firm sold off a business in their portfolio, because they are unlikely to be the outcome of an entrepreneurial act.

is classified as hybrid entrepreneur if, in a given year: (1) his primary labor classification is “employed,”; (2) he has a secondary classification as “self-employed” or “self-employed in incorporation” or reports self-employment losses, and (3) he is “employed” in the same firm as in the prior year. This last criterion allows us to consider only individuals who engaged in employment and self-employment simultaneously rather than sequentially.

3.1.3 Identifying Types of Entry.

Ventures are defined as de novo, spinouts, and spinoffs, in a manner consistent with prior literature (Helfat and Lieberman, 2002; Agarwal et al., 2004). Spinoff is coded “1” if, in the year of entry, a founder’s prior employer has a financial stake in the new venture; “0” otherwise. Spinout is coded “1” if, in the year of entry, the founder was an employee in another firm in an industry related to the new venture; “0” otherwise. Relatedness is measured at the two-digit level. De novo is coded “1” if, in the year of entry: (1) the founder was unemployed or “new in the workforce”, (2) the founder was an employee in another firm in an industry unrelated to the new venture; “0” otherwise.

3.2 Measures

3.2.1 Dependent variable.

Two measures of firm initial size are used. The first measure is number of employees in the year of founding (included the founder). This measure has been used repeatedly in the literature (e.g. M. G. Colombo et al., 2004; Cooper et al., 1989; Geroski, 1995; J Mata & Machado, 1996), and is available for all 18,058 new firms in the sample. The second measure is designed to proxy for the initial capital required for start-up and is only available for the 3,086 corporations in the

sample.⁸ This measure is generated by taking in the year of entry the log of the sum of land assets, capital assets, equipment, intangible assets, write downs on short-term assets, capital losses, write offs on long-term assets, pre-paid operating costs (such as rent), investments in inventory, accounts payable, accrued taxes, pre-paid operating costs, other current liabilities and total salaries. According to Colombo et al. (2004: 10), in high-tech industries, employment and amount of total capital are likely to be closely correlated, because in the early years of firms' life costs mainly relate to R&D and new product and service development, and there rarely are sizable investments in physical production assets. So labor and capital can be considered as complements rather than substitutes. We run our analysis on both measures of initial size and results are largely indifferent across them. Independent variables are defined in the Appendix.

4. Results

In this section, we first examine the transitions rate from paid employment to self-employment, and the initial size distribution of the ventures created. Next, we perform bivariate analysis to provide preliminary empirical evidence that different entry processes (types of entry, hybrid entry) lead to systematic differences in the observed initial sizes. Finally, we perform multivariate analysis to empirically test whether initial size is endogenous to the entry decision and whether the entry process influences the initial size.

4.1 Rates of Entrepreneurship and Initial Size

Table 1 displays the distribution of entries over the years 1994 to 2001. In 1994 the sample consisted only of wage-workers. The table also identifies the number of non-entries, i.e.

⁸ Åstebro and Bernhardt (2005) use start-up capital to proxy initial size but they measure it differently, as total amount of equity.

individuals that are at risk of moving to self-employment but stay in wage work. The availability of information on these individuals (non-treated sample) is fundamental for our analysis on selection effects (Hamilton & Nickerson, 2003; Maddala, 1983). Entries are observed in the year an individual leaves employment and switches to the new labor status. There were 18,058 entries between 1995 and 2001. Consistent with prior research, entry is a relatively rare event representing a small portion of the entire sample (e.g. Nanda & Sørensen, 2010).

Table 2 shows the relevant statistics for our two dependent variables representing the initial size of new ventures. Data inspection indicates that the number of employees measure is highly right-skewed in its distribution. Although prior studies report similar distributions, in our sample the skewness is accentuated, with most of the sample consisting of one-employee firms (90%). Indeed, the data we examine are distinct from those used in other studies of initial size, in several ways that systematically impact the size distribution. First, some work explicitly exclude very small ventures, such as those with fewer than five employees (Mata, 1996, 25% of the sample) or those with less than 500\$ sales (Astebro and Bernhardt, 2005). Second, other samples such as the one drawn from the Italian RITA dataset, used by Colombo et al. (2004), oversample some categories of ventures such as those who received VC funding, incubated firms, academic spinoffs, and growth-oriented firms. Third, prior work relies on a non-random selection of industries. For example, Mata (1996) uses only firms operating in the manufacturing sector, which is typically more labor force demanding than service-based firms. Fourth, on average Sweden firms are smaller than their European and US counterparts (OECD report). Finally, it is important to note that prior work largely remains silent about the legal status (corporation, unincorporated ventures, or partnership) of the firms. Given the emphasis on growth-oriented firms we suspect they mostly looked at corporations, which by law requires

higher resources at founding. In synthesis, those studies, although highly valuable, draw conclusions based on an elite group whose members may not be responsive to the same considerations as those of the broader population.⁹ Conversely, the Swedish Dataset we use is representative of nearly the entire working population. This unique feature makes it particularly attractive for this study. If on one side, national datasets (e.g. also IDA, Denmark) are likely to overstate the economic impact of sole proprietorships (Elfenbein et al., 2010), on the other side, this turns out precious for our selection concerns. Random samples, where very small firms are predominant produce unbiased results (Dunne & Hughes, 1994).

The second measure of initial size, invested capital, is only measured for corporations. It has a mean of 1.085.182 Kronor (~\$150.000), which is close to those reported in prior studies (e.g., Hvide & Moen, 2011). In contrast to the first measure, the distribution of initial capital is less skewed (1.851.848).

Insert Table 1 & 2 about here

4.2 Entry Processes and Initial Size

4.2.1 Hybrid Entry and Initial Size.

Table 3a reports the main descriptive statistics for initial size across ventures started by hybrid and fully-immersed entrepreneurs (i.e. non-hybrids). In general, the table shows that hybrid entrepreneurship is associated with the creation of smaller ventures, and this evidence is consistent across both our measures of initial size. Moreover, within the corporation sample, this phenomenon is accentuated. Unreported tests show that the differences are all statistically

⁹ To reconcile our data with those of prior work, we distinguish between firms with one employee (16.497), and firms with more than one employee (1561). The latter group averages 3.49 employees, and more closely resembles the average size reported in prior studies (e.g., Colombo et al., 2005).

significant. Table 3b better illustrates the relation between hybrid entrepreneurship and initial size by reporting the distribution of hybrid entry across different levels of initial size (classes of employees), and reveals that the preponderance of hybrid entrepreneurs start with two employees (98%). Overall, this analysis preliminary suggests that it may be reasonable to believe that hybrid entrepreneurship might negatively influence the initial size of a firm.

Insert Table 3a & 3b about here

4.2.2 Types of Entry and Initial Size.

Tables 4a and 4b illustrate the distribution of different types of entry across levels of initial size. The complete sample of entries includes 24 percent de novo firms, 38.5 percent unrelated spinouts, 36.5 percent spinouts, and 1.1 percent spinoffs. When we consider only the corporation sample, the distribution slightly changes but the entry categories exhibit the same ordinal patterns. Both tables show considerable variance in our independent variables across different levels of our dependent variables. Moreover, the tables show some evidence that types of entrants and initial size are correlated. In particular, de novo firms have the smallest size, whereas spinoffs are the largest. This analysis preliminary suggests that it may be reasonable to believe that types of entrants influence the initial size of a firm.

Insert Table 4a & 4b about here

4.2.3 Individual Wage and Entry Processes.

Table 5 reports the distribution of individual wage across types of entry processes. Our intent is to empirically reconcile whether entry processes are to some extent correlated with different levels of employee salaries, since salaries tend to correlate highly with ability. Hybrid

entrepreneurs earn on average higher wages than non-hybrid entrepreneurs, as also found by Folta, Delmar, and Wennberg (2010). Founders of de novo firms earn on average the lowest salary, whereas spinoff founders earn the highest. Overall, we suspect that wage might play a role in explaining initial size, because it will likely capture an individual's opportunity costs.

Insert Tables 5, 6, & 7 about here

4.3 Multivariate Analysis

Our empirical strategy unfolds through three steps: (1) replicate prior models on start-up size; (2) diagnose endogeneity in start-up size by investigating the role of selection effects into entrepreneurship; (3) test our theoretical rationales on how entry processes influence initial size.

Table 6 synthesizes the outcome of this empirical strategy.

4.3.1 Replication of Prior Models Estimating Initial Venture Size.

We estimate a zero-inflated negative binomial model regression on our employee measure of number of employees. Since the distribution of this variable is highly right-skewed, OLS regression is clearly inappropriate.¹⁰ Count models assuming a Poisson distribution are preferred. Similar to Gottschalk et al. (2010), we chose a negative binomial regression model in lieu of Poisson, because our data are over-dispersed (i.e., which violates the assumption of equality between variance and mean of the dependent variable).¹¹ We estimate zero-inflated regressions because our number of employees measure has excessive zeros, since many firms have no

¹⁰ The common procedure of logging the variable didn't solve the skewness of the distribution.

¹¹ The preference of negative binomial over Poisson models is confirmed by an unreported test that shows the alpha coefficient (the over-dispersion parameter) as significantly different from zero (rejecting the null hypothesis that views Poisson as the preferred model).

employee beyond the founder. The Vuong test confirms the appropriateness of zero-inflated negative binomial model over the standard negative binomial.

In each of our model specification we control for industry effects (Mata & Machado, 1996), by including dummies for each entered industry at two-digit industry code, and for macroeconomic fluctuations over time, by including year dummies. Column 1 of Table 6 replicates prior models estimating initial venture size, and largely confirms results consistent with prior research. Consistent with prior work (e.g. Mata, 1996; Colombo et al., 2004), we found that generic human capital (wage experience) has a positive effect. The coefficient for financial capital, household income reveals wealthier individuals start larger ventures, consistent with prior research (Hvide & Moen, 2011; Astebro & Bernhardt, 2005).¹²

4.3.2 Considering Selection Effects on Initial Size.

To control for the potential for selection effects into entrepreneurship that may bias our understanding of initial size we run a two-stage model (Heckman, 1989), where the first stage is a probit on entry. The results of the probit model are depicted in Table 7, and correspond closely to results reported in other studies examining entrepreneurial entry (e.g. Sorensen, 2007; Elfeinbein et al., 2010; Folta et al., 2010). The Inverse Mills ratio from the probit model is included in the second stage models to control for selection effects. The effectiveness of this approach hinges partly on whether we can identify instrument variables in the entry equation that do not plausibly influence initial size. We do so by including parent company characteristics (age and size), and employee tenure, measured as consecutive years an individual has worked with the

¹² Controlling for founders wealth is crucial to avoid that plausible correlations between human capital and financial capital that may obfuscate the analysis of start-up size. In fact, in an unreported analysis which includes only the human capital variables (both generic & specific, such as industry experience), these were all significant, suggesting that adding variables related to financial capital partially capture the human capital effect, as advocated by Astebro and Bernhardt (2005).

parent company. Because our interest is in the second stage model, we draw your attention to Table 6.

Column 2 in Table 6 reveals several interesting findings. The significant Inverse Mills ratio suggests that a firm's initial number of employees is tied to the entrepreneurial entry decision - it is inherently part of the calculus entrepreneurs use when deciding to enter. Specifically, it indicates that individuals self-select into entrepreneurship due to unobservable factors and suggests that prior research studying initial size is subject to selection bias. However, a comparison of columns 1 and 2 reveals the extent of this bias is not extreme. There appear only slight downward adjustments in the coefficients related to founders' human capital in column 2. The implication is that human capital effects may be slightly overestimated in prior research. Given that the affected variables tend to influence entry and size in the same direction, it is not surprising that these biases might surface.¹³

4.3.3 Investigating how Processes of Entry Influence Initial Size.

To examine the proposition that processes of entry influence initial size, we add variables around hybrid entrepreneurship and type of entry, respectively, in column 3 and 4 of Tables 6. Likelihood ratio tests reveal that the addition of these variables significantly influences model fit. Hybrid entrepreneurs start smaller ventures. Moreover, initial size is lowest for de novo firms, then unrelated spinouts, then spinouts, then spinoffs, with significant differences across each type of entry. Note also that the addition of these variables has two interesting effects. First, the Inverse Mills ratio dramatically loses statistical power, suggesting that types of entrants absorb

¹³ In fact, the only exception is the measure of entrepreneurial experience, because it has a negative sign on entry (Table 5) and a positive sign on start-up size (Table 6). Theoretical speculations underlying the peculiarity of entrepreneurial experience, support the emerging literature on serial entrepreneurship (Westhead, Ucbasaran, Wright, & Binks, 2005). In synthesis, the positive effect of human capital on start-up size is reduced to the extent that it affects entry too.

much of the endogeneity in start-up size. This offers some support for the idea that individuals require different size thresholds to induce entry depending on the types of entry (selection effect). Second, the Inverse Mills Ratio has lower values, implying that the expectation of entrepreneurial entry is lower, given the observable entry processes. This suggests that type of entry is a fundamental driver of the selection process, and models estimating size are subject to omitted variable bias if they are excluded. Our models reveal some interesting findings, that would not otherwise be evident. Most notably, individuals with high salaries start smaller ventures. Also, the direct influence of human capital is further reduced.

In summary, our empirical inquiry reveals four important findings. First, start-up size is endogenous to the entry decision because individuals self-select in entrepreneurship. Ignoring selection effects causes one to overstate the effect of human capital in terms of previous work experience. Second, the entry process, characterized by different ways of entry, determines initial size. Third, the implications of ignoring types of entry are fundamental since it influences self-selection processes. Fourth, once endogeneity is treated effectively, individuals with higher wages create smaller ventures, overturning the mainstream idea that starting small is not rational if expected earnings, correlated with ability in wage work, are high.

5. Discussion

The preponderance of research on firm initial size casts it as being primarily determined by industry-level factors, which leads to an assumption that all ventures will start at the same size. Our paper abandons that assumption to consider how individual-level determinants influence size. We also make the case that a focus on the individual brings front and center concerns about dependence between entry and initial size, because an individual's decision to enter may be

contingent upon their aspirations for the venture relative to their current state. The purpose of the paper is to explain the sources of dependence between entry and initial size, and demonstrate the implications of failing to account for dependence.

The findings highlight a number of important implications for research in entrepreneurship. First, our results show that ignoring the processes of entry may lead to errors in predicting initial size. Our findings suggest spinoffs start at the largest size, and de novo firms start at the smallest size. While prior work has shown that type of entry may affect a firm's capability and know-how (Helfat and Lieberman, 2002), our work emphasizes its impact on a particular initial decision. It may also imply that capability and know-how advantages linked to type of entry may be endogenous to the entry decision.

Second, we find that hybrid entrepreneurs enter at a smaller scale. Since we suspect that hybrid entrepreneurs are high-ability individuals where their wage signals the extent of opportunity costs, our work overturns the mainstream idea that founding small ventures is non-rational if expected entrepreneurial earnings (correlated with human capital) are high.

Finally, we find little evidence that prior research is errant by ignoring self-selection effects. However, we caution that empirical consideration of entry processes may be important to completely rule out selection biases. Prior work has ignored the potential for selection bias in the study of initial size, so we believe it is important to have drawn conclusions about whether such concerns are justified. Ours is the first study that has treated the entry and initial size decisions as dependent, because it considers individuals who never enter into entrepreneurship.

5.1 Limitation and Future Directions

Although we believe we have used a unique dataset to explore an important but underrepresented phenomenon in entrepreneurship, there are some limitations. We identify two rationales explaining why entrepreneurial processes, hybrid entry and type of entry, may influence initial size. Our effort was not focused on validating the rationales, but merely identifying whether these effects were consequential. Future work may be devoted justifying arguments based on opportunity costs pertinent in our hybrid explanation, and resource contributions pertinent in our types of entry explanation.

The results of our study suggest a couple of directions for future research. For example, it would be interesting to theorize around the causes and mechanisms of selection, that go beyond the study of initial size, and may impact venture performance. Indeed, to the extent that initial size is endogenous to entry processes, it may lead one to question whether initial size actually influences venture performance. Controlling for endogeneity in the performance model may challenge the liability of smallness at the core of organizational theory.

5.2 Conclusion

Prior research ignores that the decision processes determining entrepreneurial entry and start-up initial size are fundamentally related. Since large-scale entry is successful, prior work considers initial size as early outcome of the entry decision. Our work suggests this dichotomy is false, because size is dependent upon entry processes. Our theoretical model and empirical results ultimately caution against neglecting hybrid entrepreneurship and types of entrants.

Appendix. Variable Definitions.

Variable Name	Definition
Wage work	Individual has a primary classification of "employed" and has no secondary classifications in self-employment
Self-Employed	Individual has a primary classification of "self-employed" or "self-employed in incorporation"
Wage	Log of Income from "employed" status
Household Wealth	Log of total household wealth
Married	Dummy variable = 1 if individual is married
Number of Children	# of children under 18 in the household
Education Percentile	Individual's percentile rank in years of education in the sample
Time Unemployed	Log of number of days individual had been in unemployment in the prior year
Self-Employment Experience	Number of years individual has self-employment as primary labor status classification before 1994.
Target Industry Experience	Number of years individual has worked as wage earner in the same industry in which he enters as Self-Employed
Parental Self-Employment Experience	Dummy variable = 1 if at least one parent was previously self-employed
Employer Tenure	Consecutive years individual has worked with current company
Employer Size	Log of the number of employees in the firm in which the individual has worked
Employer Age 0-2	Dummy variable = 1 if employer is between 0 and 2 years old
Employer Age 3-6	Dummy variable = 1 if employer is between 3 and 6 years old
Employer Age > 6	Dummy variable = 1 if employer is > 6 years old
Swedish Citizen	Dummy variable = 1 if individual is a citizen of Sweden
Gender	Dummy variable =1 if individual is male
Age	Founder's age

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Tables

Table 1. Number and Percent of Entries and Non-Entries by Year

Sample	1994	1995	1996	1997	1998	1999	2000	2001	Total
Non-Entries	131,666	131,231	129,982	129,641	129,100	128,527	127,869	127,662	1,035,678
%	98.54%	98.58%	98.03%	98.22%	98.30%	98.22%	98.12%	98.28%	98.29%
Entries	1,954	1,889	2,611	2,346	2,238	2,332	2,451	2,237	18,058
%	1.46%	1.42%	1.97%	1.78%	1.70%	1.78%	1.88%	1.72%	1.71%
Total	133,620	133,120	132,593	131,987	131,338	130,859	130,320	129,899	1,053,736

Table 2. Descriptive Statistics of Initial Size upon Entry

	# of Obs.	Mean	S.D.	Min	Max
Initial # of Employees	18,058	1.209658	2.114283	1	152
Initial # of Employees (>1employee)	1561	3.425368	6.809192	2	152
Initial Capital Invested	2694	1,085,182	3,513,456	0	104,000,000
Log (Initial Capital Invested)	2694	13.2456	1.0531	0	18.46405

Table 3a. Descriptive Statistics of Initial size upon Entry across Hybrid Entry

Variable	Obs.	Mean	Std. Dev.	Min	Max
Initial Size as Number of Employees					
Non-hybrid	13321	1.238871	2.383721	1	152
Hybrid	4737	1.127507	1.026361	1	56
Non-hybrid (only corporations)	2373	2.048462	5.225821	1	152
Hybrid (only corporations)	713	1.638149	2.524777	1	56
Initial Size as Amount of Capital Invested					
Non-Hybrid	2063	13.28154	1.053545	0	18.46405
Hybrid	681	13.17282	1.073183	0	16.96627

Table 3b. Number and Probability of Entry by Hybrid entry across Different Levels of Firm Initial Size (# Employees)

	Initial Size (Initial # of Employees) Upon Entry								Total
	1	2	3	4	5	6-10	10-20	> 20	
Non Hybrid	12,100	857	128	88	37	61	32	18	13,321
	90.83%	6.43%	0.96%	0.66%	0.28%	0.46%	0.24%	0.14%	
Hybrid	4,397	253	42	19	13	8	3	2	4,737
	92.82%	5.34%	0.89%	0.40%	0.27%	0.17%	0.06%	0.04%	
Total	16,497	1,110	170	107	50	69	35	20	18,058

Table 4a. Descriptive Statistics of Initial size upon Entry across Types of Entry

Variable	Obs.	Mean	Std. Dev.	Min	Max
Initial Size as Number of Employees					
De Novo	11264	1.111.782	.7207424	1	35
Spinout	6599	1.286.559	2.783.845	1	152
Spinoff	195	4.261.538	1.059.363	1	82
Initial Size as Amount of Capital Invested					
De Novo	1360	130.752	1.025.655	0	1.769.447
Spinout	1150	1.332.321	.9541098	0	1.846.405
Spinoff	184	140.198	1.391.523	7.325.149	1.700.604

Table 4b. Number and Probability of Entry by Types of Entrants across Different Levels of Firm Initial Size (# Employees)

Types of Entrants	Initial Size (Initial # of Employees) Upon Entry								Total
	1	2	3	4	5	6-10	10-20	> 20	
De Novo	10,563	514	87	31	26	28	14	1	11,264
Spinouts	5,841	548	64	68	22	31	13	12	6,599
Spinoffs	93	48	19	8	2	10	8	7	195
Total	16,496	1,11	170	107	50	69	35	20	18,058

Table 5. Descriptive Statistics for Wage (log) Upon Entry, by hybrid entry & types of entry

Variable	Obs.	Mean	SD	Min	Max
Non-hybrids	13321	10.45623	3.992036	0	15.49578
Hybrids	4737	11.79113	1.053084	4.61512	15.31131
De Novo	11264	10.08907	4.073.422	0	15.32971
Spinouts	6599	11.99568	1.740.151	0	15.49578
Spinoffs	195	11.98858	2.782.405	0	14.59494

Table 6. Zero – Inflated Negative Binomial Models on Initial Size (# of employees)

Variables	1	2	3	4
Spinouts^a				1.014*** (0.104)
Spinoffs^a				2.445*** (0.185)
Hybrid Entrepreneur			-0.604*** (0.106)	-0.424*** (0.102)
Days on Unemployment	-0.182*** (0.021)	-0.173*** (0.022)	-0.182*** (0.022)	-0.133*** (0.029)
Household Wealth	0.026** (0.009)	0.026** (0.009)	0.024** (0.009)	0.033*** (0.009)
Individual Wage	-0.007 (0.012)	-0.011 (0.013)	-0.013 (0.013)	-0.035** (0.012)
Age	-0.084 (0.063)	-0.077 (0.063)	-0.064 (0.062)	-0.123* (0.059)
Age, Squared	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.001 (0.001)
Education Percentile	-0.646*** (0.161)	-0.605*** (0.164)	-0.557*** (0.163)	-0.673*** (0.156)
Wage Experience	0.108*** (0.029)	0.108*** (0.029)	0.149*** (0.030)	0.126*** (0.028)
Entrepreneurial Experience	0.016 (0.024)	0.015 (0.024)	0.051* (0.025)	0.032 (0.023)
Target Industry Experience	0.016 (0.012)	0.014 (0.012)	0.008 (0.012)	-0.058*** (0.014)
Inverse Mills Ratio		0.080 (0.064)	0.157* (0.064)	0.102 (0.063)
Industry Dummies	yes	yes	yes	yes
Year Dummies	yes	yes	yes	yes
No. of Observations	18,058	18,058	18,058	18,058
Log Likelihood	-7142.226	-7141.431	-7088.671	-6879.121

Robust standard errors are in parentheses.

^a Compared against omitted category de novo.

*p<0.05; **p<0.01; ***p<0.001.

Table 7. Probit Model (Self-Employment Entry (1) and No Entry (0))

Variables	Self-Employment Entry	
	<i>Coefficients</i>	<i>Standard Errors</i>
Age	0.084***	0.007
Age squared	-0.001***	0.000
Education Percentile	0.691***	(0.019)
Entrepreneurial Experience	-0.034***	(0.004)
Married	-0.008	(0.011)
Children	0.003	(0.005)
Sex	-0.261***	(0.010)
Sweden Citizen	0.011	(0.018)
Days in Unemployment	0.108***	(0.003)
Household Wealth	0.051**	(0.019)
Individual Wage	-0.063***	(0.002)
Wage Experience	0.054***	(0.005)
Industry Experience	-0.087***	(0.004)
Industry Experience squared	0.002***	(0.000)
Employer Tenure	0.356***	(0.020)
Employer Tenure squared	-0.009***	(0.001)
Employer Size	-0.133***	(0.002)
Employer Age 0_2 ^a	-0.066***	(0.018)
Employer Age 3_6 ^a	-0.160***	(0.017)
Parental Self-Employment Experience	0.622***	(0.020)
N. of Observations	139,928	
Pseudo R-Squared	0.224	
Log Likelihood	-41780.483	

^a Compared against omitted category Age >6

*p<0.05; **p<0.01; ***p<0.001.