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Entrepreneurial spawning and knowledge-based perspective: a meta-analysis

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Abstract Entrepreneurial spawning is the transitory process by which employees of an existing firm leave their employment to initiate a new business venture. There is a lack of consensus regarding the predictors of entrepreneurial spawning. We used meta-analysis to analyze 28 studies (with 128 effect sizes) to examine the predictors of entrepreneurial spawning. Based on knowledge-based perspective, we hypothesize that employee characteristics (age, education, and job position) and parent firm characteristics (firm age, firm

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Department of Management and Entrepreneurship, Frank G. Zarb School of Business, Hofstra University, Hempstead, NY 11549, USA performance, and firm diversity) are significantly related to entrepreneurial spawning. We identified two inverted U-shaped relationships (age and tenure with entrepreneurial spawning) based on our meta-analytic hierarchical multiple regression analyses. Based on labor market rigidity perspectives, we also examined how country region (North America versus Europe) moderates the relationships between employee characteristics and entrepreneurial spawning and between parent firm characteristics and entrepreneurial spawning. Our paper provides theoretical and practical implications.

Keywords Entrepreneurial spawning \cdot Entrepreneurial career \cdot Entrepreneurial entry \cdot Meta-analysis \cdot Knowledge spillover theory

1 Introduction

Making entrepreneurship one's career is neither the result of incidental decisions nor inherent status but the result of intentional activities at the risk of one's career distinct from paid employment (see Sørensen and Sharkey 2014; Carter et al. 2003). Entrepreneurial careers can come from several different points of departure¹ (Vesper 1980), and the majority of entrepreneurs have experience working for existing firms (Cooper 1985). However, most of the previous research on entrepreneurial entry decisions has ignored the transition

¹ (1) School to venture, (2) job to venture, (3) unemployment to venture, (4) home to venture, and (5) venture to venture

into entrepreneurship from traditional employment (see Carroll and Mosakowski 1980; Folta et al. 2010). Martinez et al. (2011) criticize that it is hard to explain entrepreneurial activities without comprehension of entrepreneurial transitions, especially those from the general working population to nascent entrepreneurs and from nascent entrepreneuris to new firms. Thus, an understanding of entrepreneurial careers requires the "[a]ppreciation of the transitory nature of the entrepreneur's status" (Carroll and Mosakowski 1980, p. 571).

Entrepreneurial spawning is the transitory process by which employees of an existing firm leave their employment to initiate a new business venture (Habib et al. 2013). The phenomenon of entrepreneurial spawning is already prevalent in the practical field. For example, it is well known that former Fairchild Semiconductor employees founded more than 30% of total semiconductor firms in Silicon Valley, which are called "Fairchildren." Former PayPal employees also founded other innovative companies such as YouTube, Linkedln, and Yelp, often called the "PayPal Mafia." In many high-technology industries-including semiconductors (Braun and MacDonald 1978), disk drives (Christensen 1993), and lasers (Klepper and Sleeper 2005)-researchers have found the phenomenon of spawning to be widespread, resulting in the creation of major innovators within those industries (Agarwal et al. 2004). Also referred to as "spinning out" or "spinning off," this process results in newly spawned entrepreneurs taking valuable market and technological know-how from the firms that previously employed them (Agarwal et al. 2004; Agarwal et al. 2007). Because human assets are often represented as a firm's main source of competitive advantage (Coff 1997; Lippman and Rumelt 1982), the exit of these employees to spawn new businesses may leave the parenting firm at a strategic disadvantage. Campbell et al. (2012) empirically demonstrated a negative effect of employee exit to spawn a new business on the source firm's performance. Thus, a holistic understanding of the predictors of entrepreneurial spawning is important to scholars and managers alike as they seek to understand its effects on a firm's ability to create value.

Prior literature has explored the question, Why and when do employees start new ventures to bring their products to market rather than do so within the organizations where they developed the products? The knowledge-based perspective has been dominantly used to explain the above question. Studies from this perspective share implicit assumptions that (1) knowledge is a R. P. Garrett Jr. et al

trigger for new ventures (Gort and Klepper 1982), (2) organizations are knowledge generators (Kogut and Zander 1996), and (3) knowledge in organizations is embedded within individuals (Grant 1996; Nonaka 1994). Accordingly, a considerable number of studies have argued that some organizations are better at producing employee-entrepreneurs than others (Franco 2005; Klepper 2002). For example, younger and smaller parenting firms have better working conditions for employees as future founders to acquire necessary knowledge for starting their own businesses (Gompers et al. 2005). Knowledge-rich firms where some knowledge is commercially unexploited are "hotbeds" for employee entrepreneurship (Acs et al. 2013; Agarwal et al. 2004). Other scholars also believed that some individual employees are more likely to leave their work and pursue entrepreneurship than others (Campbell et al. 2012). High-performing employees who can access private knowledge and benefit from knowledge spilled over from opportunities left dormant by the parent firm are more likely to spawn their own ventures outside the parent firms (Acs et al. 2013; Ghio et al. 2015). Individuals who have developed various skill sets through their employment period may transit to entrepreneurship (Elfenbein et al. 2010; Lazear 2005).

Although these studies are critical for identifying predictors associated with entrepreneurial spawning, individual studies have utilized heterogeneous study designs, measurements, and analyses, which makes it difficult to compare the results from these studies. Consequently, it is still unclear which specific characteristics of both founders as former employees and parent firms impact entrepreneurial spawning. More importantly, despite their potential importance, many predictors have not been properly identified and theorized in detail. For example, employees' age or tenure is often included in primary studies, not as an independent variable but as a control variable. Thus, we still do not know the extent to which these variables determine employee spawning in entrepreneurship. In this vein, it is surprising that there is no systematic review using meta-analysis in this research stream.

We use meta-analysis to investigate predictors of entrepreneurial spawning. The spawning literature has grown rapidly since being called a "new topic for management research" by Agarwal et al. (2004, p. 501) and is now of an appropriate size to be suitable for meta-analytic investigation. Meta-analysis allows researchers to summarize the results of previous empirical findings by serving as a form of evidence-

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based research, generating summary measures of the results across many studies examining the same phenomenon. This methodology reduces biases inherent in individual studies and fills in the gaps between scientific knowledge and practice (Frese et al. 2012; Rauch and Frese 2006). The current study examines the impact of employee and firm characteristics as they relate to entrepreneurial spawning.

We proceed as follows: we review previous research on entrepreneurial spawning, which leads us to the generation of hypotheses regarding its predictors. The theoretical narrative justifying the development of our hypotheses is primarily based on knowledge-based perspective. Next, we describe our meta-analytic procedures and regression analyses for curvilinear relationships. We then present our results, along with an interpretation of our results. Finally, we acknowledge the implications and limitations of our study and outline possible future research directions suggested by the findings of our meta-analysis.

2 Theory and hypothesis development

2.1 Employee characteristics

The knowledge-based perspective views entrepreneurial spawning as "transmitting" the knowledge from incumbent firms to start-ups and also views founders as former employees and "knowledge transmitters" (Agarwal et al. 2011). This approach toward the role of individual employees begins with the question of which among them are able to transmit the knowledge from their current firms to new firms efficiently and effectively via entrepreneurial activities. There are several theoretical perspectives that have implications for this phenomenon, which are the jack-of-all-trades perspective, selfselection theory, the conjecture of firm-specific human capital, and the knowledge spillover theory of entrepreneurship (KSTE).

The jack-of-all-trades perspective (Lazear 2004, 2005) argues that individuals whose skills are various and balanced are more likely to be entrepreneurs. This theory has also received empirical support from many studies (Åstebro and Thompson 2011; Lazear 2004, 2005; Wagner 2003). According to Lazear (2005), individuals that develop balanced skills through jobs and larger numbers of roles from previous jobs enhance their likelihood of becoming entrepreneurs. It implies that different types of human capital investments result in

different occupational choices of self-employed and paid employees. That is, employees who benefit from developing more balanced skills in the course of their employment are able to leave jobs and pursue entrepreneurship than those who do not. This perspective is also consistent with KSTE; in that, employees with a developed set of balanced skills are more capable to appropriate a wide variety of knowledge spillovers and leverage these in the pursuit of a new venture.

Self-selection theory partially shares the implications of the jack-of-all-trades perspective. Self-selection theory (Kihlstrom and Laffont 1979; Parker 2009) regards entrepreneurship as the results of individual attitude toward risk, interest, and preference. Accordingly, since aspiring entrepreneurs are less risk-averse individuals than paid employees, their human capital investment paths also will be different from those who stay in paid employment permanently. Extant research has shown that employees who start their own businesses not only benefit from working conditions that allow them to accumulate a variety of skills but also spend their time acquiring entrepreneurial skills during their employment (Elfenbein et al. 2010; Parker 2009; Rider et al. 2013).

Human capital theory provides a more complex story. According to Becker (1964), human capital investments such as formal education, experience, and on-the-job training lead to differential compensation. In general labor market conditions, high human capital hinders entrepreneurship because of relatively lower income for self-employment (Evans and Leighton 1989). In addition, greater human capital from job-specific training may decrease employee mobility because the training and experience gained may not be suitable for other employers (Jovanovic 1979). However, it has been argued that employee mobility to entrepreneurship is more likely to occur among employees whose firm-specific human capital is higher than lower. Skills and knowledge derived from on-the-job training can play major roles in entrepreneurship in terms of exploitation of opportunity (Davidsson and Honig 2003), fund raising (Zacharakis and Meyer 2000), and entrepreneurial success (Rauch et al. 2005). Interestingly, greater firmspecific human capital enhances employee likelihood to exploit the newly discovered opportunities through her own business, rather than corporate entrepreneurship (Parker 2009; Zucker et al. 1998). If this is the case, it is consistent with KSTE because greater human capital facilitates individual ability to recognize and exploit knowledge spillovers.

The KSTE described by Acs et al. (2013) and Hayter (2013) is particularly useful in this regard. KSTE argues that new venture creation results from knowledge that is generated by incumbent firms and academic research institutions but is not commercially exploited (Acs et al. 2013). Incumbent firms may be unable or unwilling to deviate from their core competencies to implement new products or processes, but the knowledge associated with these innovations spills over from the firm to be leveraged by prospective entrepreneurs to initiate a new business (Ghio et al. 2015). Thus, employees within a firm will benefit from knowledge spilled over from opportunities left dormant by the parent firm and may use that knowledge to spawn their own ventures outside the organizational context of the parent. However, transmitting the new and unexploited knowledge to start-ups requires founders as former employees to have two sufficient conditions: (1) benefits from starting their own business outweigh the costs associated with mobility to entrepreneurship (Acs et al. 2013; Carnahan et al. 2010) and (2) new firm founders are willing and able to penetrate knowledge filters and other barriers that prevent efficient knowledge conversion (Acs and Plummer 2005).

To sum, previous theoretical lenses lead us to expect that employees with a developed set of balanced skills, greater firm-specific human capital, the ability to lower the costs of start-ups, and capacity of penetrating the barriers of knowledge spillover are more capable to pursue a new venture. We further develop specific hypotheses consistent with past research and the theories mentioned above in order to find employee characteristics as determinants of entrepreneurial spawning behavior.

Tenure Employee tenure has been an oft-studied variable of interest in prior literature. For example, Agarwal et al. (2011) investigated a positive relationship between tenure and entrepreneurial spawning. The logic for this relationship is that as an employee gains experience and market and technological know-how (human capital) due to knowledge accumulations spilled over from the employing firm, that employee becomes more capable of undertaking his or her own entrepreneurial endeavor.

However, examining exclusively the positive relationship between tenure and spawning may tell only part of the story. Campbell et al. (2012) examined a curvilinear relationship between employee tenure and entrepreneurial spawning. An inverted U-shaped curvilinear relationship may exist between tenure and spawning because, at high levels of employee tenure, R. P. Garrett Jr. et al

an employee may have gained human capital that is so specific to his/her current employment context that it makes it unlikely for that individual to pursue an independent business initiative. Thus, while employee tenure may have a positive relationship with entrepreneurial spawning up to a certain point, beyond that point, the relationship is likely to be negative. We hypothesize that

Hypothesis 1a: Employee tenure in job is positively related to entrepreneurial spawning. Hypothesis 1b: Employee tenure in job has a cur-

vilinear (inverted U-shaped) relation to entrepreneurial spawning.

Job experience In addition to an employee's tenure in a specific job, employee job experience-the amount of time an employee has spent in a career in general, not just specific to the current employment-is expected to have an effect on spawning behavior. According to Shane (2003, p. 75), career experience allows people to "develop information and skills that facilitate the formulation of entrepreneurial strategy, the acquisition of resources, and the process of organizing. Thus, career experience reduces the uncertainty about the value to be gained from exploiting an entrepreneurial opportunity and increases the entrepreneur's expected profit (Shane and Khurana 2001)." In a similar vein, Grichnik et al. (2014) argued that prior experiences (1) get one familiar with the gestation process of an emerging organization, (2) provide one with a set of skills and knowledge (e.g., how to negotiate and convince financiers, how to deploy and acquire resources, and how to keep and attract talented employees) about starting a new venture, and (3) make one know more about the "rules of the game in the industry" for surviving and growing their nascent venture. For instance, prior business contacts acquired from working at a firm reduce market uncertainty in the eyes of stakeholders and thus decrease transaction cost when seeking resources from them. All of these should positively drive entrepreneurial spawning. Thus, we hypothesize that

Hypothesis 2: Employee job experience is positively related to entrepreneurial spawning.

Age Employee age is expected to have a relationship with spawning similar to that of tenure with spawning.

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Many studies in the prior literature have examined age as a predictor of entrepreneurial spawning (e.g., Campbell et al. 2012; Carnahan et al. 2012; Kacperczyk 2013; Özcan and Reichstein 2009). Empirical results from these studies predominantly indicate a positive relationship between an employee's age and entrepreneurial spawning. This is theorized to be a result of the employee gaining experience and expertise that facilitates the individual being able to engage the entrepreneurial process independently from the parenting company. However, as with employee tenure, it is also possible that this relationship is positive only up to a certain point. It is likely that as an employee gets increasingly older, this relationship becomes negative because the employee becomes less comfortable with taking risk independently. Essentially, the employee is wearing the "golden handcuffs" of employment with their firm, and he or she is reluctant to interrupt the relationship with the employer. Thus, employee age only facilitates appropriation of knowledge spillovers up to a certain point. After that point, it becomes increasingly unlikely that an individual will leverage knowledge spillovers. In this regard, the empirical literature has investigated the negative relationship between business owners' age and focus on opportunity (Cate and John 2007; Gielnik et al. 2012; Zacher and Frese 2009). Combining upper echelon theory and life span psychology, Gielnik et al. (2012) explain their findings of a negative effect of business owners' age on their focus on opportunities, suggesting that difficulties in utilization of new ideas and limited time left in the future among older individuals may decrease their willingness to focus on opportunities.

We thus explore the following hypotheses, examining both the linear and the curvilinear relationship between employee age and entrepreneurial spawning:

Hypothesis 3a: Employee age is positively related to entrepreneurial spawning.

Hypothesis 3b: Employee age has a curvilinear (inverted U-shaped) relation to entrepreneurial spawning.

Education The effect of education on entrepreneurship has received scholarly attention for decades. In general, previous research has found that formal education such as year of schooling or postgraduate degree has a positive relationship with entrepreneurial entry (Davidsson and Honig 2003; Delmar and Davidsson 2000; Robinson and Sexton 1994). According to the managerial ability view point (Calvo and Wellisz 1980), as people reach higher levels of education, they are more likely to strengthen their managerial abilities, which potentially leads them to an entrepreneurial career path. In a similar vein, education serves as one of the components of human capital, defined as skills and knowledge from investments in schooling, training, or experience (Becker 1964), which is related to entrepreneurial success (Dyke et al. 1992; Cooper et al. 1994; Mayer-Haug et al. 2013; Unger et al. 2011).

Given the framework of human capital theory, Parker and van Praag (2012) empirically demonstrated that formal education dilutes capital constraints of entrepreneurs and enhances entrepreneurial performance. Analyzing the general population of Swedish adults, Davidsson and Honig (2003) also provide evidence that formal education plays a pivotal role in an individual's engagement in nascent entrepreneurial activities. Although Van der Sluis et al. (2008) recent meta-analysis provides insignificant effects of formal education on entrepreneurship careers in general, the relationship between schooling and entrepreneurial selection among postgraduates is still significantly positive in 52% of observed studies. Similarly, in the context of employee mobility, Campbell et al.'s (2012) analysis of the linked employee-employer data shows that years of education are positively associated both with mobility and transition to entrepreneurship. We thus hypothesize that

Hypothesis 4: Employee education is positively related to entrepreneurial spawning.

Job position Another important factor that impacts employee spawning new businesses is employee hierarchical position in his/her current organization. Although the role of an entrepreneur is different from traditional hierarchical aspects of existing organizations (Bird 1988), employee structural position can play an important role in the decision to start a venture because an individual's level of position within an existing organization can be associated with information/knowledge, reputation, and freedom. First, employees in higher positions can access higher volumes of fine-grained information and knowledge at faster rates than those in lower positions through greater exposure to internal and external contacts (Friedman and Podolny 1992). With a career history survey of MBA alumni of US business school, Dobrev and Barnett (2005) show that an employee in a top management position is more likely than regular employees to become an entrepreneur. Second, high-level positions in an organization can allow employees to attract valuable resources when they leave their current job and start their own companies due to a reputational benefit that reduces the perceived uncertainty of the new venture. For example, it is well known that an entrepreneur's leadership capabilities and relevant track record served as important criteria that venture capitalists evaluate for funding venture proposals (MacMillan et al. 1985). Third, entrepreneurial activity is highly associated with the freedom of experimentation (Kuratko et al. 2001), which is also related to having a higher position in an existing organization. For example, Hornsby et al. (2009) analyzed 458 managers at different structural levels in US firms and found that the number of entrepreneurial ideas is higher for senior and middle-level managers than for lower-level managers. From the reasoning above, we hypothesize that

Hypothesis 5: Employee hierarchical position within an organization is positively related to entrepreneurial spawning.

2.2 Firm characteristics

In addition to individual-level variables, scholars have also argued that entrepreneurial spawning is attributed to the organizational factors of parenting firms. That is, certain firms are more likely to lead their employees to start their own businesses than other firms. Under the knowledge-based perspective, there are several theories in this regard, which are transmission theory, organizational capabilities theory, knowledge spillover theory of entrepreneurship, and the learning perspective.

The transmission theory partially shares the implications of the jack-of-all-trades perspective, which assumes that entrepreneurship is function of diverse skill sets. In this theory, firms are viewed as training fields that prepare individuals through education and exposure to the entrepreneurial process (Gompers et al. 2005; Parker 2009). In this view, spawning is a manifestation of how "entrepreneurial learning and networks may function" (Saxenian 1994, p. 112). By working in a parenting firm that itself displays entrepreneurial behaviors, individuals are exposed to a relevant network of

customers and suppliers for their new business (Saxenian 1994), and they also learn how to found their own companies by participating in the entrepreneurial process with other, more experienced entrepreneurs (Gompers et al. 2005). According to this theory, some firms that provide their employees with more diverse activities, greater scope of ideas, and opportunities to acquire diverse skills are more likely to spawn employee entrepreneurship than other firms that specialize employees' tasks (Gompers et al. 2005; Hyytinen and Maliranta 2008).

Organizational capability theory explains that entrepreneurial spawning is a by-product of incumbent firms' capabilities to exploit the new innovations. A common finding is that employees will leave to start their own firms after they become frustrated with their employers (Garvin 1983). Often, this frustration is borne from having an idea for a new product or market rejected by the firm. On the contrary, companies are less likely to spawn former employees' start-ups if they have enough ability to internalize employees' innovations. In this line of perspective, Andersson et al. (2012) demonstrate that there is negative relationship between superiority of the incumbent firms and entrepreneurial spawning.

KSTE (Acs et al. 2009) argues that the stock of local knowledge generated by incumbent firms or universities drives new businesses. Underexploited knowledge can be transferred to commercial knowledge through several channels (Blien et al. 2006). From this perspective, a key to entrepreneurial spawning is the fact that new knowledge is commercialized not by the incumbent firms but by their employees. Because organizations have different degrees of abilities or strategies to internalize newly generated knowledge, organizational attributes under which knowledge spillovers occur more or less can determine the degrees of entrepreneurial spawning. For example, some firms are more likely to reduce the level of underutilized knowledge by the efforts of internalizing the new knowledge (by, e.g., diversification) than others, which can decrease the willingness of employees' mobility to entrepreneurship (Mawdsley and Somaya 2015).

Together, these theories imply that the existence of abundant entrepreneurial knowledge and lack of commercial opportunities within parenting firms leads to employees becoming entrepreneurs.

Firm age and size Large, established firms may be less likely to spawn entrepreneurial ventures than their

smaller, newer counterparts. First, the rigidity of an established bureaucracy in an old and large company can keep employees from having an entrepreneurial mind set via lowering the expected value of the entrepreneurial opportunity and developing more firm-specific abilities rather than training entrepreneurial skill sets (Sørensen 2007). Small and young firms, on the other hand, allow their employees to access the resources and develop the skill sets related to entrepreneurship (Elfenbein et al. 2010).

Second, established firms may be less capable of a proper response to radical changes in technology that upset established ways of organizing their businesses. For example, Henderson (1993) empirically showed that incumbents were consistently slower than entrants in developing and introducing new technologies. Thus, large, established firms may be less likely than smaller, newer firms to develop the technologies that ultimately would be spun out.

Finally, according to self-selection theory (Elfenbein et al. 2010; Parker 2009), potential entrepreneurs may choose to work in small and young firms rather than in large and old firms, because it is possible that potential entrepreneurs are risk-averse individuals and would like to closely relate pay with their performance. Small and young firms can offer more attractive working conditions for potential entrepreneurs.

Thus, even though entrepreneurial ideas might be germinated at larger and older firms, management chooses not to develop them because it is perceived that those new business opportunities would do more harm than good to the core businesses(es) of the firm. Consistent with the above arguments, we offer the following two hypotheses regarding the relationship of firm age and size with entrepreneurial spawning:

Hypothesis 6: Firm age is negatively related to entrepreneurial spawning.

Hypothesis 7: Firm size is negatively related to entrepreneurial spawning.

Firm location According to knowledge spillover theory, one of the major sources of entrepreneurship is incompletely commercialized knowledge generated by R&D activities in large organizations (Acs and Armington 2006; Acs et al. 2004; Audretsch and Lehmann 2006). Frequently found empirical evidence is that start-up rates are higher in industries with greater investment in R&D than those with less investment (Audretsch and Keilbach 2007; Audretsch and Lehmann 2005). In addition, scholars have tried to explain the variance of start-up ratios with a combination of other factors related to the accessibility of knowledge such as number of highly skilled workers, regional growth, and population density (Audretsch and Fritsch 1994). Recent empirical studies also have consistently found that there is a positive relationship between entrepreneurial activity and regional attractiveness (Audretsch and Keilbach 2007).

Applying similar logic to entrepreneurial spawning, Berchicci et al. (2011) show that firm location is an important predictor of entrepreneurial spawning. Regions of high-density industrial cities are more likely to manifest knowledge spillovers due to rapid development and dissemination of new ideas. Where industry density is low, knowledge spillovers are less likely to occur (Ghio et al. 2015). We can expect the important role of locational attractiveness to affect employees' decision to leave their current jobs and become entrepreneurs. Thus, we hypothesize that

Hypothesis 8: Firms located in regions of highdensity industrial cities are more likely to spawn entrepreneurs than those not located in regions of high-density industrial cities.

Firm performance Firms may also be affected in their disposition toward entrepreneurial spawning by the degree to which they are resource rich. For example, Agarwal et al. (2004) and Kacperczyk (2013) found that firm performance is negatively related to entrepreneurial spawning. Additionally, Agarwal et al. (2002) and Agarwal et al. (2004) found a negative relationship between firm diversity and entrepreneurial spawning. We argue that firm performance and diversity are representative of resource possession and appropriate utilization by a parent firm. When a firm is performing well, it is effectively using the resources it possesses and may view the internal sponsorship of new ventures as an opportunity to leverage the new resource slack that is being generated by the core businesses. Thus, firms that are performing better are more likely to retain their novel technology, rather than spinning it out. Firms performing well are also more likely to possess sufficient slack resources to facilitate investment in new products and processes, thus limiting the degree to

which *spill overs* will occur. Conversely, firms that are performing poorly are likely to "retrench" their resources, hoping to pull the existing business(es) out of the poor prospects in which they are found. In so doing, they may ignore or mismanage product and process innovations, making it more likely that the knowledge spillovers will occur. Poorly performing firms are thus more likely to produce externally spawned entrepreneurial businesses as they keep their focus instead on existing but struggling businesses. We thus hypothesize that

Hypothesis 9: Firm performance is negatively related to entrepreneurial spawning.

Firm diversity Firms that are widely diversified have varied resources that can be leveraged across many businesses. When a new technology is developed within a diversified firm, it is thus more able to internalize the new technology and support new business development with the resources required. On the other hand, firms that are not diversified do not have a wide-ranging resource set nor are they experienced at diffusing managerial attention among different businesses. KSTE argues that new products or processes that are not aligned with the core competencies of the firm are more likely to spill over to provide opportunities to independent entrepreneurs because the firm is unable or unwilling to recognize the potential of these opportunities (Ghio et al. 2015). Diversified firms have multiple bases for their core competencies and are able to incorporate farranging technological opportunities. On the other hand, non-diversified firms have a limited set of core competencies and will be more restricted in their ability to leverage opportunities inconsistent with the current core competencies. Thus, single business firms are more likely to spawn entrepreneurial ventures, while firm diversity is predicted to be negatively associated with entrepreneurial spawning.

Hypothesis 10: Firm diversity is negatively related to entrepreneurial spawning.

3 Methods

3.1 Literature search

We performed an extensive literature search to identify relevant articles by using the following approaches. First, we searched multiple electronic databases including ABI/ Inform (ProQuest), EBSCOhost Databases (e.g., Academic Search Complete and Business Source Complete), Google (e.g., Google and Google Scholar), JSTOR, ProQuest Dissertations and Theses, ScienceDirect, and Web of Science (e.g., Social Sciences Citation Index). Second, we searched several relevant management, entrepreneurship, and strategy journals, such as Academy of Management Journal, Administrative Science Quarterly, Entrepreneurship Theory and Practice, Journal of Applied Psychology, Journal of Business Venturing, Journal of Management, Journal of Management Studies, Journal of Small Business Management, Management Science, Organization Science, Small Business Economics, Strategic Entrepreneurship Journal, and Strategic Management Journal. Third, we conducted a search of major management and entrepreneurship conference papers, such as Academy of Management Proceedings, Frontiers of Entrepreneurship Research, Southern Management Association, and United States Association for Small Business and Entrepreneurship. Fourth, we performed a snowball² search of key articles on the topic (e.g., Cooper 1985; Gompers et al. 2005) to supplement our first four search techniques. We found that all relevant articles identified by snowball search had already been captured by our primary search methods in the first four steps, thus confirming that our search was exhaustive.

3.2 Selection and exclusion criteria

We specified a set of inclusion criteria to filter the studies we found. A study is considered eligible for inclusion in the current meta-analytic review if it meets the following criteria. First, primary studies had to be empirical and quantitative. All qualitative studies were therefore excluded. Second, because the focus of the present study is to investigate why employees leave their parent firms and become entrepreneurs later³ (Habib et al. 2013), we only targeted studies examining the research questions related to entrepreneurial spawning, entrepreneurial mobility, employee transition to spin-out, and so forth. Third, primary studies had to report at least one correlation coefficient for the relationship between a predictor

² In the snowball approach, we reviewed the reference list of selected critical articles as well as the papers or books that cited selected critical articles in order to identify additional studies.

³ We exclude those who are founders of their ventures and leave their current companies and create the other venture (i.e., subsequent entrepreneurs).

and criterion. The predictors of interest include employees' characteristics (i.e., tenure, job experience, age, education level, and job position in parent firms) and parent firms' characteristics (i.e., firm age, firm size, location, firm performance, and diversity). In addition, we coded a few un-hypothesized predictors and provided them as supplemental information (see Table A1 in supplementary materials). The criterion of interest is entrepreneurial spawning. For the studies that did not report a correlation coefficient, sufficient statistics must have been included to allow us to convert them into effect sizes (Lipsey and Wilson 2001).

We contacted scholars who have published in the entrepreneurial spawning literature to ask for unpublished manuscripts, correlation matrices, and raw data. Our search finally yielded 28 studies and 128 effect sizes. Among 28 studies, 19 studies are unpublished. Table 1 contains the description of each study included in the current meta-analytic review.⁴

3.3 Variable coding procedures

We coded all effect sizes for the relationship between employees' characteristics, parent firms' characteristics, and entrepreneurial spawning. To ensure that each effect size in our meta-analytic review reflected a unique sample, we applied the detection heuristics developed by Wood (2008) to capture duplicate samples used in two or more research papers. During coding, we found two papers that likely used the same sample. When the studies based on the repeat sample reported the same set of relationships, we averaged effect sizes to ensure the sample independence.

3.4 Meta-analytic procedures

Primary analyses We conducted psychometric metaanalysis developed by Hunter and Schmidt (2004). We performed the "bare bones" version of psychometric meta-analysis because the independent variables and dependent variable in the present study were all objectively measured and have reliabilities of 1.00. It is thus unnecessary to use the full version of psychometric meta-analysis to correct for measurement errors (i.e., unreliability). We presented sample-size-weighted mean observed correlation (\overline{r}_o) and computed 95% confidence intervals to gauge the statistical significance of observed correlations. The effect sizes (i.e., observed correlations) are determined to be statistically significant when 95% confidence intervals do not contain zero. We calculated both Varart% and 80% credibility intervals to assess the potential presence of moderators. Varart% represents the percent of the variance in \overline{r}_o explained by statistical artifacts. Hunter and Schmidt (2004) indicated that moderators might be operating if statistical artifacts account for less than 75% of an effect size's variance. We also computed 80% credibility intervals to evaluate the potential existence of moderators because Whitener (1990) advised that moderators might operate in the metaanalytic distribution when 80% credibility intervals are wide. As a supplemental analysis, we performed z test (Hunter and Schmidt 1990) to examine the moderator effect of country region (i.e., statistical significance test of between-group differences in effect sizes).

Regression analyses for curvilinear relationships We examined two curvilinear relationships between age and spawning and between tenure and spawning by performing hierarchical multiple regression analyses. We calculated harmonic mean sample size (Viswesvaran and Ones 1995) and used it as the sample size input because sample sizes differed across the cells in the correlation matrices. Harmonic mean sample size yields more conservative estimates since less weight is provided to large samples (Colquitt et al. 2007).

Publication bias analysis Publication bias is defined as "the possibility that not all completed studies on a topic are published in the literature and that these studies are systematically different from published studies" (McDaniel et al. 2006, p. 927). Publication bias arises when some papers are prevented from being published due to a variety of reasons, such as statistically nonsignificant results, small sample size, and results contradictory to the trends of past research or theory (Kepes et al. 2012). It generally results in overestimating effect sizes, therefore threatening the validity of meta-analytic reviews (Banks et al. 2012; McDaniel et al. 2006).

⁴ Some studies included in our meta-analysis were unpublished, and one may worry whether these studies will influence our meta-analytic results. We argue they should not exert any noticeable effect on our results. First, we only extracted very basic statistic information from the paper (e.g., sample size and correlation coefficients) and they were unlikely to be incorrect regardless of whether they are published or not. Second, these unpublished studies were available on either Social Science Research Network (SSRN) or authors' personal research websites and readers can easily download and go through these papers to replicate our coding and results. We also argue that including these unpublished studies may help our meta-analytic review to minimize the threats of publication bias (Kepes et al. 2012, 2013). We thank an anonymous reviewer who requested us to address this issue.

Table 1 List (of studies included in meta-analysis				
Study ID	Authors	Year of publication	Sample size	Country of sample	Predictors (correlation with entrepreneurial spawning)
1	Agarwal, Echambadi, Franco, and Sarkar	2002	1,180	USA	Firm age (-0.110), firm performance (-0.120), diversity (-0.050), number of entries (0.030)
2	Agarwal, Echambadi, Franco, and Sarkar	2004	1,180	NSA	Firm age (-0.110), firm performance (0.010), diversity (-0.060), number of entries (0.030)
æ	Agarwal, Campbell, Franco, and Ganco	2011	11,822	NSA	Tenure (0.030), age (-0.010), gender (0.060), education (0.010), firm age (0.030)
4	Avnimelech and Feldman	2010	280	NSA	Firm age (-0.028), firm performance (-0.004), patents (0.089)
Ś	Bazzazian	2012	444,538	Sweden	Tenure (0), wage (0.010), age (0.030), gender (0.020), firm age (-0.020), firm performance (-0.010), diversity (-0.015)
6	Berchicci, King, and Tucci	2011	45	NSA	Location (-0.120)
٢	Campbell, Ganco, Franco, and Agarwal	2012	767,307	USA	Tenure (-0.010), wage (0), age (-0.010), gender (-0.010), education (0.010), age square (-0.010), tenure square (-0.020)
œ	Carnahan, Agarwal, and Campbell	2012	1,869,633	USA	Tenure (-0.020), wage (0), age (-0.010), gender (-0.010), education (-0.003)
6	Chatterji, de Figueiredo, Jr., and Rawley	2013	12,754	NSA	Tenure (0.028), location (0.003)
10	Dahl and Reichstein	2006	25,506	Danish	Job experience (0.530), job position (0.120), location (0)
11	Frederiksen and Wennberg	2011	233,091	Sweden	Tenure (0), wage (-0.024), job experience (0.030), education (0.007), firm age (0.008), firm size (0.011), tenure square (-0.001)
12	Gacheru	2007	7,187	USA	Tenure (-0.021), age (-0.010), entrepreneurial family background (0.153), education (0.047), marital status (-0.003), family income (0.024)
13	Ganco	2010	10,709	NSA	Gender (0.005), number of entries (-0.003)
14	Hunt	2013	612	NSA	Number of entries (0.158)
15	Hunt and Lerner	2012	612	NSA	Number of entries (0.240)
16	Kacperczyk	2013	7,047	USA	Tenure (-0.010), wage (0), age (-0.010), gender (0.010), education (0), firm age (0), firm performance (0)
11	Lindennann	2011	263	Germany	Tenure (0.080), age (-0.323), job experience (0.050), entrepreneurial family background (0.088), education (-0.025), job position (0.257), firm age (-0.135), firm size (-0.272)
18	Lougui and Broström	2014	12,587	Sweden	Education (0.007), firm size (0.511), number of entries (0.026)
19	Mai and Zheng	2013	615	USA	Age (-0.040), gender (0.060), marital status (-0.020)

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Table 1 (conti	nued)				
Study ID	Authors	Year of publication	Sample size	Country of sample	Predictors (correlation with entrepreneurial spawning)
20	Marx and Kacperczyk	2014	45,158	Mixed	Tenure (-0.025), age (-0.022), gender (0.016), job experience (0.014), firm size (-0.044), patents (-0.031)
21	McKendrick, Wade, and Jaffee	2009	1,281	Mixed	Firm age (0.290), firm size (0.210)
22	Monsen, Mahagaonkar, and Dienes	2012	3,295	India	Age (0.066), education (0.007), unemployment rate (-0.038), self-employment rate (-0.023)
23	Özcan and Reichstein	2009	73,823	USA	Tenure (0.005), wage (0.020), age (0.010), gender (0.040), entrepreneurial family background (0.010), education (0.020), marital status (0.010), family income (0.020), age square (-0.020)
24	Preto, Baptista, and Lima	2009	6,170,011	Portugal	Tenure (-0.036), wage (-0.158), age (0.239), education (0.019), firm size (-0.461)
25	Santella	2013	243	USA	Tenure (0.130), age (-0.030), gender (0.060), job experience (-0.320), entrepreneurial family background (0.090), education (0.120), marital status (0.040), family income (0.110), job position (0.030), firm size (-0.030)
26	Sorgner and Fritsch	2013	36,238	Germany	Age (-0.100), gender (0.093), entrepreneurial family background (0.178), education (0.114), marital status (-0.071), unemployment rate (0.117), self-employment rate (0.161)
27	Tåg, Åstebro, and Thompson	2013	18,275,168	Sweden	Tenure (0.016), wage (-0.006), age (-0.003), gender (0.014), education (0.003), job position (0.004), firm size (-0.003), age square (-0.004), tenure square (-0.014)
28	Werner and Moog	2009	5,178	Germany	Tenure (-0.046), wage (0.028), age (-0.008), gender (0.028), entrepreneurial family background (0.051), education (0.036), marital status (-0.004)

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We used file drawer analysis (Rosenthal 1979) to assess whether publication bias influences our metaanalytic results. File drawer analysis operates under the assumption that some statistically insignificant studies may be missing from an analysis (i.e., placed in a file drawer), and these studies, if included, might nullify observed effect sizes (Borenstein et al. 2009). As such, we computed the number of (missing) studies required to nullify the observed effect (i.e., fail-safe N). If failsafe N is small, then one might be concerned about the influence of publication bias. If fail-safe N is large, one might be more confident that the observed effect, despite possibly inflated by the omission of some missing studies, is not zero. We chose 5 k + 10 guideline to determine the presence of publication bias, meaning that publication bias should not noticeably impact metaanalytic results if fail-safe N is greater than 5 times the number of samples plus 10 (Hedges and Olkin 1985; Rosenthal 1979).

Vote-counting analysis Like many other meta-analytic reviews, our study is influenced by measurement heterogeneity because different studies operationalized entrepreneurial spawning in different ways; thus, research findings may not be comparable across some studies (Combs et al. 2011). As such, we performed a supplemental vote-counting analysis to consider the direction of various effects (positive versus negative versus nonsignificant) under different empirical setups without considering the exact sizes of effects (e.g., Beaudry and Schiffauerova 2009; Newbert 2007).⁵ Vote-counting analysis is to count and tabulate all studies that show significantly positive, significantly negative, nonsignificant, and mixed results (Rosenthal 1991).

4 Results

4.1 Primary analyses

The results for primary analyses, based on 28 studies and 128 effect sizes, are reported in Table 2. The first three columns in Table 2 include the descriptive information for our meta-analytic results, such as names of different distributions, number of samples (k), and the sample size (N) for each distribution analyzed. The fourth and fifth columns contain the sample-sizeweighted mean observed correlation (\bar{r}_o) and its standard deviation (SD_r). We used the information from the sixth column, 95% confidence interval, to determine the statistical significance of \bar{r}_o . For instance, the effect size (\bar{r}_o) for the distribution of tenure equals 0.001 and 95% confidence interval contains zero. We conclude that this effect size is not statistically significant, and hypothesis 1 a is thus not supported.

We used both 80% credibility intervals (in the seventh column) and Var_{art}% (in the eighth column) to assess the degree of heterogeneity of \overline{r}_o . For example, the 80% credibility interval for the distribution of tenure is wide and includes zero, signaling that moderators are likely to exist in this distribution. In addition, the Var_{art}% statistic for the distribution of tenure is 0%, indicating that statistical artifacts cannot explain any of the effect size's variance for the distribution of tenure. This further confirms that moderators are likely to operate in the distribution of tenure because statistical artifacts explain less than 75% of the effect size's variance (Hunter and Schmidt 2004).

Given that the present study has 12 hypotheses, we chose to concisely report the results by tabulating all the hypotheses based on their predicted directions, actual directions, whether effect sizes were statistically significant and whether hypotheses received support in Table 3.

4.2 Supplemental moderator analyses

For more rigorous findings, we should take labor market rigidities into account in the relationship between employees' characteristics and transition to self-employed because occupational mobility is intertwined with labor market rigidities imposed by country factors (Sicherman and Galor 1990). Labor market rigidities have been considered to increase employees' opportunity cost of leaving companies (Nickell 1997), lower venture capital development (Sahlman 1990), and decrease entrepreneurship (van Stel et al. 2007). Accordingly, it is possible that hypothesized relationship between employees' characteristics and entrepreneurial spawning can be moderated by country-level labor market rigidities. Since the labor market is more flexible in North America than in Europe (Nickell 1997; Siebert 1997), we used North America and Europe as a proxy of labor market rigidities, as a moderator.

 $[\]frac{5}{5}$ We thank an anonymous reviewer for requesting us to perform a vote-counting analysis.

	ĸ	N	r, 0	SD,	95% CI	80% CR	Var _{ært} %	Fail-safe N	Fail-safe <i>N</i> > 5 <i>k</i> + 10?	z test
Employee characteristics										
H1a tenure	15	27,923,223	0.001	0.022	-0.010 to 0.011	-0.027 to 0.029	0	1	I	
North America	9	25,128,249	0.003	0.022	-0.003 to 0.008	-0.026 to 0.031	0	l	1	<i>p</i> < 0.1
Europe	œ	2,749,816	-0.016	0.007	-0.018 to -0.014	-0.025 to -0.007	9	211	Yes	
Published	S	8,887,821	-0.030	0.009	-0.032 to -0.028	-0.042 to -0.018	1	4,006	Yes	
Unpublished	10	19,035,402	0.015	0.004	0.014 to 0.016	0.011 to 0.020	4	1,177	Yes	
H2 job experience	6	304,504	0.070	0.140	-0.017 to 0.156	-0.110 to 0.249	0	I	I	
H3a age	16	27,717,526	0.051	0.101	0.003 to 0.099	-0.079 to 0.180	0	82,280	Yes	
North America	×	2,737,677	-0.010	0.003	-0.010 to -0.009	-0.013 to -0.006	27	142	Yes	n.s.
Europe	9	24,931,396	0.057	0.104	0.032 to 0.083	-0.076 to 0.191	0	89,727	Yes	
Published	9	8,888,436	0.163	0.114	0.135 to 0.191	0.016 to 0.309	0	88,526	Yes	
Unpublished	10	18,829,090	-0.002	0.007	-0.004 to -0.001	-0.011 to 0.006	1	104	Yes	
H4 education	15	27,472,893	0.007	0.008	0.003 to 0.011	-0.004 to 0.017	1	2,954	Yes	
North America	7	2,737,062	0.002	0.007	0.000 to 0.004	-0.007 to 0.010	s	76	Yes	n.s.
Europe	7	24,732,536	0.007	0.008	0.005 to 0.009	-0.003 to 0.018	0	2,038	Yes	
Published	S	8,887,821	0.014	0.009	0.012 to 0.016	0.003 to 0.025	1	903	Yes	
Unpublished	10	18,585,072	0.003	0.005	0.002 to 0.004	-0.003 to 0.010	2	584	Yes	
H5 job position ^a	4	18,301,180	0.005	0.004	0.002 to 0.008	-0.001 to 0.010	1	476	Yes	
Firm characteristics										
H6 firm age	80	699,502	-00.00	0.020	-0.019 to -0.000	-0.034 to 0.015	3	0	No	
North America	4	20,329	0.011	0.034	0.003 to 0.019	-0.028 to 0.050	18	0	No	n.s.
Europe	ŝ	677,892	-0.011	0.013	-0.014 to -0.007	-0.027 to 0.006	e.	34	Yes	
Published	e.	9,508	0.025	0.110	-0.001 to 0.052	-0.114 to 0.165	3	I	I	
Unpublished	S	689,994	-0.010	0.014	-0.013 to -0.007	-0.028 to 0.008	4	17	No	
H7 firm size	×	24,737,802	-0.117	0.199	-0.246 to 0.013	-0.371 to 0.137	0	I	1	
Published	2	6,171,292	-0.460	0.010	0.463 to0.458	-0.473 to -0.448	0	I	I	
Unpublished	9	18,566,510	-0.003	0.014	-0.006 to 0.001	-0.020 to 0.015	0	1	I	
H8 firm location ^b	ŝ	38,305	0.001	0.004	0.002 to 0.004	0.001 to 0.001	100	I	I	
Published	1									
Unpublished	2	38,260	0.001	0.002	0.001 to 0.001	0.001 to 0.001	100	I	I	
H9 firm performance	4	453,045	-0.010	0.002	0.011 to0.009	0.010 to0.010	100	13	No	
Published	2	8,227	-0.005	0.012	0.008 to0.002	-0.005 to -0.005	100	I	I	
Unpublished	7	444,818	-0.010	0.000	0.010 to0.010	-0.010 to -0.010	100	I	1	

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	\bar{r}_o	SD,	95% CI	80% CR	Var _{art} %	Fail-safe N	Fail-safe <i>N</i> > 5 <i>k</i> + 10?	z test
H10 firm diversity 2 445,718	-0.015	0.002	-0.016 to -0.014	-0.015 to -0.015	100			
All of the correlations in the Table 2 refer to the correl	ation between	i each predic	ctor and entrepreneuria	l spawning. Some met	a-analytic dis	tributions cannot b	e broken down into	published
versus unpublished subgroups either because they have	studies with	only one typ	e of publication status	or because they have in	sufficient nur	nber of samples (e	g., $k = 2$). File draw	ct i

drawer analysis is employed to address the concern that observed significant effect sizes may be spurious. If an effect has already been non-significant, then fail-safe N calculated based on k number of independent samples, N sample size, \bar{r}_o sample-size-weighted mean observed correlation, SD, sample-size-weighted observed standard deviation of correlations, Var_{ar}% percent of variance in Fo explained by statistical artifacts, 95% CI 95% confidence interval, 80% CR 80% credibility interval, z test for the statistical significance of moderator effect of country region (i.e., statistical significance test for between-group difference), H hypothesis, n.s. non-statistically significant file drawer analysis is not relevant (Borenstein et al. 2009)

High job position (e.g., top management position) = 1, low job position = 0

^b Located in high-density metropolitan cities = 1, otherwise = 0

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We performed a series of z tests to assess the moderating effect of country region (North America versus Europe). We analyzed the meta-analytic distributions with total number of samples around or greater than 10 because moderator testing in meta-analysis has low power (Steel and Kammeyer-Mueller 2002). We also excluded the meta-analytic distribution overrepresented by North America (e.g., firm size metaanalytic distribution) from our moderator analyses. We found that tenure and entrepreneurial spawning has a marginally stronger, yet negative, relation in Europe $(\bar{r}_o = -0.016)$ than that in North America $(\bar{r}_o = 0.003)$. We did not detect any significant moderator effect of country region on the meta-analytic distributions of (employees') age, education, and firm age.

4.3 Curvilinear relationships

In addition to hypothesizing the linear relationship between predictors and entrepreneurial spawning, we also had two hypotheses predicting non-linear (inverted Ushaped) relationships between tenure and spawning and between age and spawning. As shown in Table 4, it is noted that the squared terms for both tenure ($\beta = -0.166$, p < 0.001) and age ($\beta = -2.738$, p < 0.001) are negative and statistically significant, which is in support of both hypotheses 1b and 3b, meaning that one standard deviation change in tenure squared and age squared will result in -0.166 and -2.738 standard deviation changes in entrepreneurial spawning.

4.4 Publication bias analysis

We conducted a file drawer analysis of our collected samples, and the results were shown in the ninth (fail-safe N) and tenth (whether fail-safe N is greater than 5k + 10) columns in Table 2. One should note that file drawer analysis is only applicable to the meta-analytic distributions with $k \ge 3$. In addition, file drawer analysis does not apply to the metaanalytic distributions having statistically insignificant results because file drawer analysis is used to address the concern that an observed significant effect may be spurious. If an effect has already been insignificant, then fail-safe Ncalculated based on file drawer analysis is not relevant (Borenstein et al. 2009). We found that 4 out of 19 metaanalytic distributions fail to satisfy the 5 k + 10 guideline (i.e., the meta-analytic distributions marked with "no" in the tenth column in Table 2), denoting the possible presence of publication bias in these 4 meta-analytic distributions.

Hypotheses	Predicted direction	Actual direction	Statistical significance of effect sizes	Results
Employee characteristics				
H1a tenure	+	+	n.s.	Not Supported
H1b inverted U-shaped relationship for tenure			Sig.	Supported
H2 job experience	+	+	n.s.	Not supported
H3a age	+	+	Sig	Supported
H3b inverted U-shaped relationship for age			Sig.	Supported
H4 education	+	+	Sig.	Supported
H5 job position	+	+	Sig.	Supported
Firm characteristics				
H6 firm age	-	-	Sig.	Supported
H7 firm size	-	_	n.s.	Not supported
H8 firm location	+	+	n.s.	Not supported
H9 firm performance	-	_	Sig.	Supported
H10 firm diversity	-	-	Sig.	Supported

Table 3 Summary of results for all hypotheses based on psychometric meta-analysis

H hypothesis, n.s. not statistically significant, sig. statistically significant

Therefore, one should exercise caution when interpreting the effect sizes from these four meta-analytic distributions.

4.5 Supplemental vote-counting analysis

In line with the suggestions in prior research (e.g., Beaudry and Schiffauerova 2009; Bushman and Wang 2009; Newbert 2007), we performed a supplemental votecounting analysis to consider just the direction of effects of studies (see Table 5). For hypothesis 1a, we predicted that employee tenure in job is positively related to entrepreneurial spawning. There were 14 relevant studies for this hypothesis, with 29% of them showing significantly positive results, 29% of them showing significantly negative results, 36% of them demonstrating non-significant results, and 7% of them displaying mixed results. In conclusion, 29% of studies yielded support to the hypothesized positive relationship between employee tenure in job and entrepreneurial spawning. We repeated the same type of analysis to all the other hypotheses and reported percent of studies that show support to hypotheses in the last column of Table 5.

5 Discussion

The results of this meta-analysis indicate that employee and firm characteristics operate as predictors of entrepreneurial spawning. Interestingly, we were able to discern inverted U-shaped relationships between employee age and spawning as well as employee tenure and spawning. The inverted U-shaped hypothesis between employee age and entrepreneurial spawning is consistent with Levesque and Minniti (2006) empirical finding that people of intermediate age are more likely to engage in entrepreneurial activities than people that are either too young or too old.

We did not find a significant result for hypothesis 2, the relationship between job experience and spawning. In arguing for this hypothesis, we had included logic consistent with traditional entrepreneurs seeking to initiate new ventures, not necessarily those that are spawning new ventures by exiting corporate employment. It may be that that logic is not compatible with entrepreneurial decision making in the context of spawning. Individuals employed by a firm are gaining career experience specifically applicable to their current position and may not be actively seeking new venture opportunities. Thus, the experience gained by these employees may have a countervailing effect; namely, that the experience they have gained over time in their employment will make it more likely that they will remain with their employer, where the knowledge and experience gained will be most appropriately applicable.

		-			
	Spawning			Spawning	
	Step 1 β	Step 2 β		Step 1 β	Step 2 β
Tenure	0.001***	-0.160***	Age	0.051***	-2.762***
Tenure squared		-0.166***	Age squared		-2.738***
<i>R</i> ²	0.000***	0.002***		0.003***	0.152***
ΔR^2		0.002***			0.149***
Nharmonic	21,494,469	21,494,469		21,321,807	21,321,807

Table 4 Hierarchical multiple regression analyses for curvilinear relationships

 N_{harmonic} harmonic mean sample size, β standardized regression weights, R^2 multiple correlations, ΔR^2 incremental change in R^2 ***p < 0.001

Entrepreneurs that initiate new ventures while not currently employed, on the other hand, are leveraging whatever knowledge and experience they have gained in order to give themselves an advantage. Thus, in the context most frequently explored in the entrepreneurship literature, it is expected and empirically confirmed that individuals with more experience are more likely to recognize, discover, and exploit opportunities. Further research on entrepreneurial spawning may investigate the complexities of this relationship in the context of spawning.

Table 5 Vote-counting analysis

	Predicted direction	Significantly positive	Significantly negative	Non-significant	Mixed results ^c	Total number of samples ^d	Supported (%) ^e
Employee characteristic	s						
H1a tenure	+	4 (29%)	4 (29%)	5 (36%)	1 (7%)	14	29%
H1b tenure squared	-	1 (33%)	1 (33%)	1 (33%)	0 (0%)	3	33%
H2 job experience	+	4 (67%)	1 (17%)	1 (17%)	0 (0%)	6	67%
H3a age	+	6 (40%)	3 (20%)	5 (33%)	1 (7%)	15	40%
H3b age squared	-	0 (0%)	2 (67%)	1 (33%)	0 (0%)	3	67%
H4 education	+	9 (64%)	0 (0%)	3 (21%)	2 (14%)	14	64%
H5 job position ^a	+	3 (75%)	0 (0%)	1 (25%)	0 (0%)	4	75%
Firm characteristics							
H6 firm age	-	1 (14%)	2 (29%)	3 (43%)	1 (14%)	7	29%
H7 firm size	-	3 (38%)	3 (38%)	1 (13%)	1 (13%)	8	38%
H8 firm location ^b	+	0 (0%)	0 (0%)	2 (100%)	0 (0%)	2	0%
H9 firm performance	-	2 (50%)	1 (25%)	1 (25%)	0 (0%)	4	20%
H10 firm diversity	-	0 (0%)	0 (0%)	1 (50%)	1 (50%)	2	0%

The percentage in the parentheses is computed by dividing the number of samples that showed significantly positive, significantly negative, non-significant, or mixed results by the total number of samples and multiplying by 100%

^a High job position (e.g., top management position) = 1, low job position = 0

^b Located in high-density metropolitan cities = 1, otherwise = 0

^c Some studies showed mixed results that were positive, negative, significant, and/or non-significant

^d Some studies had to be excluded from vote-counting analysis because they did not report the significance level of correlation coefficients and/or regression coefficients

^e This column refers to the percent of samples that showed support for hypotheses

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5.1 Implications for theory and research

Our meta-analysis contributes to the extant literature on entrepreneurial spawning in several ways. First, this study advances the literature on employee mobility to entrepreneurship by comprehensively testing a number of hypotheses developed from individual and organizational antecedents. Although the work of employee mobility to entrepreneurship has so far been studied extensively (Agarwal and Braguinsky 2014), there has been minimal research that integrates micro- with macro-domains. The integrated framework that we produced allows researchers to understand the extent to which employee mobility to entrepreneurship is influenced by the demographic characteristics of employees and incumbent firm characteristics simultaneously.

Second, scholars have also faced a lack of comprehensive and systematic reviews for employee entrepreneurship. In fact, there remain theoretical and empirical disagreements. Different and sometimes opposite directions of predictions have been explained in the primary studies according to different theoretical backgrounds. Hence, we provided underlying theories regarding characteristics of employees and parenting firms before we developed the relevant hypotheses in this study. By doing so, we do not only aggregate theories and empirical findings but also attenuate the different effects of individual primary studies.

Third, this meta-analysis provides new evidence to the debate about "the small firm effects" for entrepreneurial spawning. To date, it is widely recognized that there is a negative relationship between the size of incumbent firms and employee mobility to entrepreneurship. Specifically, employee entrepreneurship is more likely to be spawned from small firms (Sørensen 2007; Elfenbein et al. 2010; Parker 2009). However, our meta-analysis demonstrated that the parent firms' size does not play a role in entrepreneurial spawning. This result is particularly important for three reasons. First, it is possible that the consistently reported small firm effect can be the result of selective publication. Our analysis was based on the inclusion of both published and unpublished studies. Second, the insignificant finding of small firm effect provides us with the possibility that the effects of small firm for entrepreneurial spawning are contingent upon other moderators. For example, the degree of relatedness to parent firms could be a moderating factor between the parent firms' size and entrepreneurial spawning. Chen (2013) found that the effect size of the correlation between incumbent firm size and entrepreneurial spawning is largely reduced if the new firms are created in a different area from that of the parent firms. Third, it is possible that firm size is not a significant factor, likewise for firm age. According to Klepper and Thompson (2006), spin-offs are associated with an incumbent firm's age.

Lastly, beyond entrepreneurship literature, our metaanalysis also makes a contribution to the studies of a boundaryless career, defined as "...a sequence of job opportunities that go beyond the boundaries of a single employment setting (DeFillippi and Arthur 1996, p. 116)." A boundaryless career emerges as a consequence of the organizational restructuring and the changes or breaks in traditional psychological employment contract (Sullivan 1999). As Sullivan (1999) recognized that incorporating the entrepreneurship literature advances career theory, we believe that this meta-analysis systematically provides important evidence to occupational boundary transitions. Specifically, we answer the questions of the condition under which an adult will (or can) change her/his occupation from a wage-employee to an entrepreneur. Our meta-analysis shows that the individuals' decisions to leave the parent firms to start their own companies were motivated by tenure (inverted Ushape), age (inverted U shape), level of education, and job position. In addition, it is also indicated that occupational boundary transitions from wage-employee to entrepreneurship is significantly influenced by firm characteristics such as parent firm's age, performance, and diversification.

5.2 Implications for practice

Our meta-analysis offers several implications for practitioners. First, corporate managers can use our results not only to identify potential entrepreneurs but also to get tips regarding how to avoid the threats of employee entrepreneurship. For example, our results show that middle-aged employees with moderate amounts of job tenure, higher education, and higher positions within the organization are more likely to quit their jobs and start their own firms. In addition, our results show that the relationship between employee entrepreneurship and firm performance and the relationship between employee entrepreneurship and diversification are consistent with Klepper and Thompson (2006) findings. As such, if the parent firms want to retain those potential employee entrepreneurs, it can be implied that better performing firms and diversified firms are less likely to spawn new ventures.

Second, educators or policy makers who are interested in mid-career entrepreneurship development can use our meta-analysis to sort out the effective audiences for entrepreneurial learning among aging populations. Scholars have recognized that entrepreneurial education largely ignored the older age groups. Rather, it has mainly focused on non-experienced learners such as college students (Rae 2005). Since continued employment is not guaranteed for older individuals, educators and policy makers should prepare a relevant educational program for people in their mid-career to achieve a potentially successful transition to entrepreneurship.

5.3 Limitations

The first limitation of this study is the insufficient number of samples in some meta-analytic distributions analyzed, such as firm diversity and firm location. The meta-analytic distributions having small number of samples are likely susceptible to second-order sampling error (Hunter and Schmidt 2004). Thus, some of our results are preliminary and readers should interpret them with caution. Meanwhile, we call for more primary studies to investigate these research areas receiving little attention so that more accurate cumulative knowledge of entrepreneurial spawning can be built.

Second, our results are likely from distributions with substantial variations and are possibly influenced by moderators due to small Varart% values (see Table 2) across many meta-analytic distributions analyzed (see the meta-analytic distributions with Varart% values less than 75%). We wish we could untangle the heterogeneity in effect sizes by exploring and examining more moderators in addition to country region. Nevertheless, we have few samples in our meta-analytic distributions, particularly at the firm level, and many included primary studies did not provide sufficient statistics that would allow us to do moderator analysis. Moderator testing in meta-analysis is a low-power test (Steel and Kammeyer-Mueller 2002), and the results of moderation can be hardly significant with small number of samples. We encourage future research to investigate more potential moderators (e.g., interaction between individual-level and firm-level [and possibly some environment-level] variables) beyond the one identified in the present study. Our results provide a road map and open up avenues for researchers to conduct further research to search for the moderators in the distributions with small $Var_{art}\%$ values in Table 2.

Third, our meta-analysis is limited in its ability to assess curvilinear relationships for only some of our independent variables. For example, individual job experience and education could also have curvilinear relationships with spawning. As job experience gets very large, an individual might be reluctant to try new things as their knowledge becomes increasingly narrow, and overly high levels of education might preclude someone from spawning if their knowledge is very specific, rather than the general knowledge that is more often associated with entrepreneurship (Lazear 2004). Indeed, an ideal analysis would explore all possible curvilinear relationships. However, after searching primary studies in the spawning literature, we could not find any other studies exploring curvilinear relationships other than the ones examined in our research. Therefore, we were unable to address the potential of these other potential curvilinear relationships, though we do recognize it as an interesting avenue for future researchers to explore.

Fourth, our study was also limited within the assumption of an immediate transition to entrepreneurship from paid employment. However, the modes of employee entrepreneurship can be more complex. For example, individuals can take self-employment as their second job while they simultaneously are working at the organizations (Folta et al. 2010). In addition, individuals who left current jobs for pursuit of entrepreneurship may spend time in unemployment (Preto et al. 2009). Future research could be directed at taking various modes of employee entrepreneurship into account.

Fifth, our results derive from the private sector only; however, labor market is not restricted to the private sector. Although it has been noticed that there are differences in risk across sectors (Parker 2007; Parker 2009) and in perceptions toward entrepreneurship between private sector and public sector employees (Özcan and Reichstein 2009; Parker 2009), data that we used in this study prevent us from controlling for these differences. This limitation constrains the applications of our study. Future work can consider including sector variation in order to maximize the generalizability of the current results.

Sixth, we were unable to investigate possible moderating relationships in this meta-analysis. Moderation testing in meta-analysis (e.g., subgroup analyses) is a low-power test that requires a large number of samples and big effect size difference to yield meaningful and significant results (Kepes et al. 2013). Given the number of samples and small effect sizes in our meta-analysis, it prevents us from performing further moderator analyses.

Finally, like many other meta-analytic reviews, measurement heterogeneity plagues our meta-analysis because different studies operationalized entrepreneurial spawning in different ways; as such, research findings may not be comparable across some studies (Combs et al. 2011).⁶ We wish we could stratify our dataset according to the measures of entrepreneurial spawning to mitigate the aforementioned problem. Unfortunately, we were unable to do so in light of the small number of usable samples we have. A series of studies on the topic of entrepreneurial spawning was published in the economic literature, where editorial norms do not mandate authors to report correlation matrices (Combs et al. 2011); hence, many studies of relevance to our metaanalysis had to be excluded from analysis (e.g., Hyytinen and Maliranta 2008; Parker 2009). We encourage future studies to report correlation matrices so that more robust and precise cumulative knowledge can be built. We also recommend future studies to develop an agreed-upon measure of entrepreneurial spawning because the field has become quite divisive in terms of measurement of entrepreneurial spawning. In light of these points, our meta-analysis just offers an interim assessment of entrepreneurial spawning literature and we encourage readers to exercise caution when interpreting our results.

5.4 Future research directions

The results of our meta-analysis suggest several important directions for future research. First, while our development of hypotheses led us to explore only individual- and firm-level antecedents of spawning, we were able to classify predictors of entrepreneurial spawning into three categories—individual, firm, and environmental—and future research may benefit from the use of this categorization to propose new models of spawning. While our meta-analysis detected only a few variables in each category that were statistically significant as predictors of entrepreneurial spawning, researchers may dig deeper into each category to discern other possible predictors of spawning. Additionally, the selection of variables from these categories may assist researchers looking to develop more complex models of spawning, perhaps including moderation and/or mediation in their models. For example, although there was no significant direct effect of employees' tenure on spawning in our main analyses, we actually revealed that under rigid labor market in Europe, tenure may be negatively associated with spawning.

Second, our results indicate that there may exist more complicated relationships between spawning and its predictors than were previously investigated in the literature. In our examination of the literature, we did find that Campbell et al. (2012) examined the curvilinear relationship between employee tenure and spawning. However, it appears to us that our own analysis of the curvilinear relationships between employee tenure and spawning and between employee age and spawning (hypotheses 1b and 3b) is a novel contribution to the literature on spawning. Also, to our knowledge, there have not been other studies on spawning that investigate curvilinear relationships. Scholars studying the phenomenon of entrepreneurial spawning may consider in their future research projects to model other curvilinear relationships.

For the individual category, although we used knowledge-based perspective to predict the factors for entrepreneurial spawning, it might be interesting to explore relevant psychological or motivational factors associated with employees' decisions to leave their current employers. For example, meta-analysis revealed that organizational commitment and job satisfaction are major predictors for employee turnover (Griffeth et al. 2000). The type of termination might have different impacts on entrepreneurial spawning. Some employees who start ventures might involuntarily leave their employers (Carnahan et al. 2012; Mawdsley and Somaya 2015). Future research can add type of turnover, voluntary or involuntary, as antecedents or moderators.

For the organization-level category, scholars called for the effects of incentive structures or preventative policies of incumbent firms on entrepreneurial spawning (Folta et al. 2010; Mawdsley and Somaya 2015). For example, employment contracts with aggressive non-compete covenants will be negatively associated with employee mobility to entrepreneurship (Stuart and Sorenson 2003).

Finally, our review of the literature indicated that a category of antecedents to entrepreneurial spawning——namely environmental characteristics—

 $[\]frac{6}{6}$ We appreciate an anonymous reviewer to recommend us to discuss the issue of measurement heterogeneity.

appears to be under-explored. While not directly developed as hypotheses in our theoretical narrative, metaanalysis revealed three predictors of entrepreneurial spawning from the firm's external environment (see Table A1). Future research may also focus on environmental barriers or enhancers to entrepreneurial spawning. For example, while localized competition will reduce entrepreneurship (Plummer and Acs 2014), government support can promote entrepreneurship (Acs and Szerb 2007).

In conclusion, our meta-analysis reveals several important predictors of entrepreneurial spawning, including two—employee tenure and age—that have a curvilinear effect on spawning. Our results may be important to managers and practitioners as they plan environments that will either best capture the technologies they develop to be internalized within the firm or to minimize the loss from spinning-out technologies. Additionally, our results have important implications for scholars seeking to further our understanding of entrepreneurial spawning.

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Studies included in the meta-analysis are marked with an asterisk (*).

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