Hiring entrepreneurs for innovation

Louise Lindbjerg and Theodor Vladasel

December 2021

Hiring Entrepreneurs for Innovation[*]

Louise Lindbjerg[†]   Theodor Vladasel[‡]

December 24, 2021

Abstract

Technical human capital improves firms' invention outcomes, but generating innovation revenue may require distinct skills in bringing new ideas to market. We argue that former founders are endowed with *execution skills*, a generalist ability to create and exploit market gaps by acquiring and mobilizing resources, so entrepreneurial human capital enhances innovation in established organizations. Combining register and Community Innovation Survey data from Denmark, we show that entrepreneur hires are associated with higher sales from new products and services. This result is driven by founder hires in middle management, a hierarchical position where broader decision rights and resource access increase execution skills' effectiveness. Founder hires are more tightly linked to innovation new to the firm or market, rather than world, consistent with our prediction that execution skills help bring incremental improvements to market, but do not necessarily generate radical innovation. Together, our findings suggest that entrepreneurial human capital may help firms appropriate a larger share of the value their knowledge generates.

JEL Classification: J24, L23, M12, M21, M51.
Keywords: Innovation, learning by hiring, entrepreneurship, execution skills, human capital, middle management.

[†] Department of Strategy and Innovation, Copenhagen Business School, Kilevej 14A, 2000 Frederiksberg, Denmark, lli.si@cbs.dk.

[‡] Department of Economics and Business, Universitat Pompeu Fabra and Barcelona School of Economics, Ramon Trias Fargas 25-27, 08005 Barcelona, Spain, theodor.vladasel@upf.edu.

1 Introduction

Human capital contributes to innovation and competitive advantage by allowing organizations to exploit knowledge and develop capabilities (Coff, 1997; Campbell et al., 2012a). Human capital is often acquired externally, with the hiring-for-innovation literature highlighting firms' reliance on inflows of knowledge, skills, and experiences from new hires in their efforts to generate and market novel ideas (Almeida and Kogut, 1999; Rosenkopf and Almeida, 2003). Recruiting highly-skilled inventors boosts firms' patenting output and affording them insight into new technical domains (Song et al., 2003; Tzabbar, 2009; Singh and Agrawal, 2011; Kaiser et al., 2018). Yet, for this knowledge to drive profits and performance, established organizations must create and exploit novel business opportunities (Covin and Miles, 1999; Hitt et al., 2001; Teece, 2016). Such functions require a distinct human capital profile centered on new idea execution, combining broad sets of knowledge into novel offerings. We argue that former founders are endowed with execution skills and that hiring individuals with entrepreneurial human capital benefits firms' innovation. Entrepreneur hires, especially when paired with the relevant decision rights, provide an additional path for incumbents to exploit their knowledge internally, appropriating a larger share of the value created through innovation.

Innate preference, skill, and judgment differences relative to employees predispose entrepreneurs to pursuing new ventures; moreover, start-ups expose individuals to a dynamic, uncertain environment and a steep learning curve with regards to both organizational practices and competitive landscape insight. As founders, entrepreneurs deepen their generalist expertise in social and material resource acquisition and mobilization across functional domains and audiences, such as customers, competitors, or suppliers (Alvarez and Busenitz, 2001; Lazear, 2005; Elfenbein et al., 2010; Campbell, 2013; Foss and Klein, 2012; Distel et al., 2019; Faleye et al., 2020). Entrepreneurs thus possess *execution skills* uniquely suited for taking new ideas to market. We propose that execution skills transcend the start-up context and can be deployed by established

firms seeking to bring new products and services to market. This process requires connecting an organization's knowledge with market needs by assembling the requisite internal and external resources, such that entrepreneur hires increase firms' sales from innovation.

The nature of execution skills holds additional implications for how entrepreneur hires affect innovation. Central positions of authority and broader decision rights facilitate the exercise of judgment over what resources to acquire and mobilize in developing new ideas, while product development and market insight help former founders select more profitable projects (Burgelman, 1991; Wooldridge et al., 2008; Foss and Klein, 2012). We thus posit that founder hires in middle management roles have stronger effects on innovation than hires in other ranks. Moreover, radical innovation depends heavily on specialized technical investments and human capital, while incremental innovation benefits from broad search strategies emphasizing customers and competitors (Gatignon et al., 2002; Köhler et al., 2012). Former founders' generalist skill profile favors the pursuit of otherwise difficult to spot marginal improvements, so we propose that entrepreneur hires are more tightly linked to incremental rather than radical innovation.

To test our theory, we combine matched employer-employee administrative and Community Innovation Survey data for Denmark for the years 2007-2016, allowing us to analyze firm-level innovation outcomes, while capturing employees' career history in detail. Empirically, we focus on new entrepreneur hires' effect on firms' share of sales from innovation. To alleviate worker-firm matching concerns, we use firm fixed effects models netting out time-invariant traits and control for multiple lags of sales growth and investment intensity to address time-variant demand for execution skills. As our theory predicts, the positive association between entrepreneur hires and sales from innovation is driven by hires in middle management positions; entrepreneur hires are also more strongly related to incremental, new to the firm or market innovation than to radical, new to the world innovation. Moreover, we rule out alternative explanations based on technical or managerial skills and find that execution skills are subject to depreciation, implying that regular inflows of former founders may be required for sustained innovation.

This paper makes two key contributions to strategic management. We bridge entrepreneurship and hiring-for-innovation research to explain how firms can gain capabilities for boosting innovation through a novel human capital channel (Alvarez and Busenitz, 2001; Teece, 2016). Beyond acquiring technical human capital directly involved in producing inventions (Song et al., 2003; Tzabbar, 2009; Singh and Agrawal, 2011; Kaiser et al., 2018), firms must obtain business development capabilities, so hiring for innovation must account for execution skills. Hiring entrepreneurs for their generalist ability to marshal resources to exploit existing knowledge and bring new offerings to market offers a path for developing these competences, allowing firms to retain more of the value created, rather than cede it to competitors. Moreover, companies hiring former entrepreneurs in middle management roles may be especially well placed for developing sustained competitive advantage, as entrepreneurial human capital reaches its productive potential when accompanied by the relevant decision rights over resource allocation (Teece, 1996; Foss et al., 2015). Execution skills' contribution to firm performance and their interaction with organizational design and other types of human capital can serve as an avenue for further studies of innovation, learning by hiring, and strategic entrepreneurship.

Building on studies of selection (Lazear, 2005; Roach and Sauermann, 2015; Vladasel et al., 2021) and learning (Elfenbein et al., 2010; Eesley and Roberts, 2012; Parker, 2013), we add to the growing literature on returns to entrepreneurial experience (Campbell, 2013; Manso, 2016), proposing that former founders are distinctly endowed with execution skills. These skills cover the entire business development process, centering on forming novel market opportunities for exploiting firm knowledge through resource configuration. Closely related to entrepreneurial top managers and directors' resource reallocation ability (Distel et al., 2019; Faleye et al., 2020) and entrepreneurial judgment (Foss and Klein, 2012), new idea execution skills span all stages of venture creation, are transferable across contexts, and have clear testable implications. Established firms' innovation benefits from such skills, providing an explanation for recent studies finding positive earnings effects for entrepreneurs returning to paid employment, especially in

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knowledge intensive sectors (Campbell, 2013; Luzzi and Sasson, 2016; Manso, 2016). By making precise wherein the portability of entrepreneurial human capital lies, we offer a starting point for investigating how former founders are integrated into established firms and how their skills are deployed and rewarded across domains. Our work highlights that monetary returns to entrepreneurship also accrue to existing organizations: building on a large body of work assessing entrepreneurs' careers, we add to a burgeoning literature on consequences for the firms hiring them (Distel et al., 2019; Faleye et al., 2020; Braunerhjelm and Lappi, 2021), examining the nature of their human capital and finding positive effects on innovation.

2 Theory and Hypotheses

We develop a theoretical reasoning predicting how innovation benefits from hiring entrepreneurs. We outline how founders' human capital is distinct from that of employees, positing that they are endowed with superior execution skills. We then propose that entrepreneur hires help firms gain capabilities in bringing new products and services to market. Finally, we reason that execution skills are most effective when entrepreneurs are hired in middle management ranks and are particularly valuable for incremental innovation.

2.1 Entrepreneurial Human Capital

Entrepreneurs differ from workers in both their pre-entry traits and the skills acquired through their business (Elfenbein et al., 2010; Eesley and Roberts, 2012).[1] On average, individuals who become entrepreneurs have higher non-routine (non)cognitive ability, higher social skills, generalist skills, higher risk and loss tolerance, higher (over)confidence, as well as preferences for autonomy, commercialization, and managerial activities.[2] These traits make entrepreneurs better predisposed to take on new venture development projects, from initially spotting opportunities to finally bringing new ideas to market, relative to other workers. Beyond predisposition,

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[1] Entrepreneurs are theoretically and empirically distinct from the self-employed, given the different organizational forms pursued and tasks performed, partially due to entrepreneurial selection from different parts of the ability distribution (Åstebro et al., 2011; Levine and Rubinstein, 2017; Vladasel et al., 2021).

[2] Among others, Busenitz and Barney (1997), Lazear (2005), Hartog et al. (2010), Åstebro et al. (2011), Roach and Sauermann (2015), Koudstaal et al. (2016), Levine and Rubinstein (2017), Vladasel et al. (2021).

entrepreneurial engagement offers individuals the chance to develop their skills, even through short-term experimentation (Manso, 2016; Mérida and Rocha, 2021).

Founding a firm is an intense learning experience in developing and executing a business idea. Entrepreneurs perform varied functions inside start-ups, allowing them to learn and develop skills regardless of the firm's ultimate success or failure (Minniti and Bygrave, 2001). In highly uncertain environments, founders exercise judgment over how to deploy heterogeneous resources to achieve various outcomes (Foss and Klein, 2012): they plan, experiment with, and execute strategy (Camuffo et al., 2020; Ching et al., 2019); acquire and mobilize the required human, social, and financial capital resources (Davidsson and Honig, 2003; Baker and Nelson, 2005; Hsu, 2007; Zott and Huy, 2007; Zhang, 2011); and lead and manage the start-up (Lounsbury and Glynn, 2001; Hmieleski and Ensley, 2007; Eesley and Roberts, 2012). Entrepreneurs thus gain expertise in many functional areas and strengthen their generalist profile, helping them develop unique venture development skills due to an ability to recombine broad sets of knowledge for the execution of new ideas (Elfenbein et al., 2010; Campbell, 2013). Moreover, beyond *ex ante* higher alertness, practical experience and contact with clients or competitors improve founders' ability to conceive projects that deploy resources to potentially highly profitable new uses (Baron and Ensley, 2006; Ucbasaran et al., 2009; Faleye et al., 2020).

Built through a dynamic career trajectory, entrepreneurs' human capital is distinct from employees', especially in their higher capacity to create strategic opportunities, assemble and configure heterogeneous resources, as well as craft and execute strategy (Alvarez and Busenitz, 2001; Foss and Klein, 2012). Entrepreneurs thus possess superior execution skills in bringing new ideas to market, enjoying advantages over non-entrepreneurs at all venture development stages, especially in market-facing ones. Distinct from pure technical or routine managerial skills, this knowledge-intensive occupational human capital (Mayer et al., 2012) facilitates successful future entrepreneurial endeavors, as research on serial entrepreneurs' improved performance shows (Gompers et al., 2010; Eesley and Roberts, 2012; Parker, 2013).

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New ventures are not alone in rewarding former entrepreneurs' execution skills. While earlier studies uncover negative returns to entrepreneurship experience in paid employment (Hamilton, 2000; Bruce and Schuetze, 2004; Baptista et al., 2012), recent work paints a positive picture. Entrepreneurs receive a premium upon returning to established firms (Campbell, 2013; Manso, 2016), especially in innovative sectors (Luzzi and Sasson, 2016) or if they have industry experience (Kaiser and Malchow-Møller, 2011), are more likely to reach managerial positions (Baptista et al., 2012; Mérida and Rocha, 2021), and earn higher executive pay (Mérida, 2019).[3] That incumbent firms reward entrepreneurial human capital provides initial evidence that founders' skills are valuable across contexts. We now turn to a theoretical analysis of how entrepreneur hires' execution skills affect firm innovation.

2.2 Entrepreneur Hires and Firm Innovation

Entrepreneurial action inside established organizations has been proposed as a complement to traditional inventive activities, allowing for the economic exploitation of technical and scientific advances (Schumpeter, 1934; Arrow, 1962; Nelson and Winter, 1982; Covin and Miles, 1999; Hitt et al., 2001). But while scholars have paid substantial attention to the effect of knowledge worker hires on firms' development of inventive capabilities, i.e. patenting activities, we know far less about how organizations recruit human capital for transforming inventions into innovations that can be successfully commercialized, i.e. revenue from innovation.

The idea that organizations build, broaden, or deepen capabilities by hiring workers with different knowledge, perspectives, or skills is hardly novel (March, 1991; Rao and Drazin, 2002; Song et al., 2003; Hatch and Dyer, 2004; Lacetera et al., 2004; Jain, 2016; Wang and Zatzick, 2019). New inventor hires affect the quantity, quality, and direction of hiring firms' inventive activities: the knowledge new hires bring from previous contexts such as universities or other innovative firms is reflected in the hiring firm's patents (Almeida and Kogut, 1999; Rosenkopf

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[3] Firms may initially offer former entrepreneurs lower wages due to uncertainty about their ability (Mahieu et al., 2021), but these wages recover and surpass those of workers in the long-run (Mérida and Rocha, 2021).

and Almeida, 2003; Song et al., 2003; Tzabbar, 2009; Palomeras and Melero, 2010; Singh and Agrawal, 2011; Herstad et al., 2015; Kaiser et al., 2015, 2018).[4] Nonetheless, while recruiting inventors spurs patenting, it does not guarantee commercial success.

What human capital do established firms need to hire in order to innovate? Bringing new ideas to market requires firms to undertake entrepreneurial action, characterized by market opportunity creation and resource orchestration in non-standard contexts (Covin and Miles, 1999; Hitt et al., 2001; Kuratko et al., 2001; Sirmon et al., 2011), thus extending further than technical or managerial skills. Entrepreneurial action, as a counterpart to invention, requires employees to tolerate uncertainty and apply their knowledge to commercial ends as they craft and execute strategy with the aim of placing firms on a path to competitive advantage (Stevenson and Jarillo, 1990; Covin and Miles, 1999; Antoncic and Hisrich, 2001; Butler, 2017). These requirements match the execution skills we describe, implying that more generalist former founders have an advantage in marshaling requisite resources for bringing new offerings to market. For instance, multinational companies exhibit larger host country sales when subsidiary managers have entrepreneurial experience, due to their resource allocation skills and enhanced local market knowledge (Distel et al., 2019), while entrepreneurs on the board are positively linked to R&D investments and firm market value (Faleye et al., 2020); more generally, founder hires can help increase firms' long-run productivity (Braunerhjelm and Lappi, 2021).

We thus conceptualize execution skills as a unique multidimensional bundle of traits, abilities, and experiences that allows former founders to successfully pursue new ventures conducive to innovation in established firms. Due to superior competitive landscape insight, entrepreneurs are on average better than other employees at recognizing the commercial potential of existing firm knowledge and devising the appropriate market strategies for realizing opportunities. In addition, introducing new products and services is an uncertain, non-routine endeavor that former founders are better equipped to navigate. Entrepreneurs' higher social skills are useful for

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[4] Firms also hire strategic human capital in advocacy or exports in order to develop stakeholder or foreign market knowledge, respectively (Grimpe et al., 2019; Guri et al., 2019).

assembling the internal and external resources needed for project completion, including financial support and buy-in from employees, leadership, and external stakeholders. Former founders accomplish this broad array of tasks more easily than employees due to their generalist skills and varied functional expertise.[5] Overall, we propose that:

Hypothesis 1 *Entrepreneur hires are positively associated with innovation in established firms.*

2.3 Entrepreneur Hires in Middle Management

Firms' ability to innovate depends not only on human capital, but also on organizational design (Miller, 1983; Teece, 1996; Dess et al., 1999; Foss et al., 2015). By influencing the flow of information and collaboration across the firm through coordination and motivation mechanisms, organizational design may facilitate or hinder workers' ability to exercise their skills. Thus, an important decision firms face is not just whether to hire former founders, but what level of authority and responsibility to entrust them with (Foss and Klein, 2012). Distel et al. (2019) and Faleye et al. (2020) show that entrepreneurs in top management teams or on the board of directors can direct firm strategy and investments, with positive performance effects. While few former founders transition to executive positions quickly, many return to middle management (Baptista et al., 2012), where they enjoy the autonomy often associated with entrepreneurial roles. Moreover, the nature of execution skills and the innovation process suggest that entrepreneur hires are particularly important for bringing new ideas to market when paired with the decision rights afforded to middle managers.

Whereas top managers outline the broad contours of strategy, implementation and execution are usually delegated to middle managers (Kanter, 1982; Burgelman, 1983b; Wooldridge et al., 2008), whose involvement and engagement are positively linked to firm performance (Wooldridge and Floyd, 1990; Huy, 2001; Mollick, 2012). Middle managers constitute a critical organizational design element, performing an information processing function (Garicano, 2000; Colombo and

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[5] Despite concerns that entrepreneurs avoid larger, more bureaucratic organizations (Corbett and Hmieleski, 2007; Sørensen, 2007; Butler, 2017), such firms could remain attractive when higher levels of material and social resources facilitate the deployment of execution skills relative to more constrained environments.

Grilli, 2013; Wooldridge et al., 2008). Put differently, they represent agents of selection inside the firm, picking ideas worth championing and acquiring the requisite resources for their execution (Burgelman, 1983a, 1991; Mollick, 2012). Middle managers' capacity to command upwards and downwards influence is driven by their ability to span boundaries across firm layers, manage emotions and navigate organizational culture, and clearly communicate organizational purpose (Floyd and Wooldridge, 1997; Huy, 2002, 2011; Rouleau and Balogun, 2011; Ahearne et al., 2014; Guo et al., 2017; Gartenberg et al., 2019). Unsurprisingly, middle managers play a key role in firms' entrepreneurial behavior and innovation (Burgelman, 1983a).[6]

Due to their central position in the flow of information, configuration of resources, and exercise of authority, middle managers' involvement in all stages of venture development connects naturally with execution skills. New entrepreneur hires generally link firms' existing technical knowledge with unaddressed market needs, but non-managerial roles rarely confer the authority required to assemble the requisite resources for pursuing innovation; conversely, top managers dispose of stronger decision rights and guide strategy, but may not command full knowledge of firms' technical assets and may be unable to connect them with market gaps (Stevenson and Jarillo, 1990). Middle management roles offer a practical compromise between these extremes, allowing former founders to provide valuable inputs across all stages of new ventures, not just in limited phases of new business development (Burgelman, 1983a).

To begin with, superior market insight and easier access to firms' technical knowledge help new entrepreneur hires in middle management act as effective agents of selection; that is, they discern the value of different ideas, authorize subsequent development, and champion the projects they deem most profitable.[7] Central positions in information and resource flows then facilitate the acquisition of financial support and buy-in for selected ideas by allowing their access to gatekeepers and decision makers at both lower and higher levels of hierarchy, as

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[6] Selective intervention by senior management retains an important role in opportunity formation (i.e. new product and service introduction), amplifying the positive effects of bottom-up initiative (Barney et al., 2018).

[7] This logic applies to both selecting *in* valuable opportunities and selecting *out* poor projects (Lerner and Malmendier, 2013), improving firms' overall innovation portfolio (Klingebiel and Rammer, 2014).

well as external stakeholders; at this stage, execution skills' social dimension likely plays a vital role. Moreover, middle managers' support for entrepreneurial action is strongly associated with firms' implementation of innovative ideas (Kuratko et al., 2005; Hornsby et al., 2009), so hiring former founders in such positions may disseminate and foster a broader entrepreneurial culture throughout the organization. These arguments therefore imply that:

Hypothesis 2 *The positive relationship between entrepreneur hires and innovation is stronger for entrepreneur hires in middle management positions.*

2.4 Entrepreneur Hires and Incremental Innovation

The nature of entrepreneurial human capital holds implications for the type of innovation firms can introduce and appropriate value from. Researchers and practitioners commonly distinguish two broad categories: incremental innovation 'involves refining, improving, and exploiting an existing technical trajectory', whereas radical innovation 'disrupts an existing technological trajectory' (Gatignon et al., 2002). We argue new entrepreneur hires help discover marginal improvements to firms' under-utilized knowledge and have a larger effect on incremental, rather than radical innovation, echoing the notion that 'exploitation includes such things as refinement, choice, production, efficiency, selection, implementation, execution' (March, 1991, p. 71).

Several factors drive heterogeneity in innovative outputs. Radical innovation represents a recombination of relatively distant, often external, knowledge that generates truly novel ideas; this type of innovation is associated with high uncertainty, but promises to generate substantial long-term returns for innovating firms (Dewar and Dutton, 1986). Radical innovation is strongly dependent on highly specialized, technical human capital and R&D investments (Dewar and Dutton, 1986; Subramaniam and Youndt, 2005), science-driven search practices emphasizing university ties, patents, and knowledge acquisition (Köhler et al., 2012; Zhou and Li, 2012) and a deeper, narrower external search (Laursen and Salter, 2006), systematic knowledge management practices (Cantner et al., 2011), and previous breakthroughs or history of engaging with novel technologies (Ahuja and Lampert, 2001; Dunlap-Hinkler et al., 2011). In sum, radi-

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cal innovation is more tightly connected to technical skills and the discovery or invention stage of product development: that is, specialist scientific human capital should matter more than entrepreneurial human capital for this type of innovation.

Conversely, incremental innovation generates commercial success by exploiting firms' existing knowledge assets in new ways (Dewar and Dutton, 1986; Gatignon et al., 2002); technical human capital and R&D investments retain some importance (Laursen and Salter, 2006; Cantner et al., 2011; Leiponen and Helfat, 2011), but this form of innovation exhibits closer ties with insight into firms' competitive landscape and a generalist profile.[8] For example, firms engaging in search strategies with a market orientation, focusing on customers and competitors, are more likely to generate successful incremental innovation (Köhler et al., 2012), as are firms drawing broadly from external sources (Laursen and Salter, 2006; Leiponen and Helfat, 2011). Additionally, the ability to share knowledge internally and externally among employees, customers, suppliers, and partners favors marginal improvements (Subramaniam and Youndt, 2005). As a result, incremental innovation is linked less to the research than to the development stage, where insight into available resources and market needs may prove more valuable.

While execution skills do not exclude a technical component – evaluating knowledge assets may even require a certain technical competence, they emphasize the ability to create market opportunities and resource configurations less visible to workers without such skills (Foss and Klein, 2012); entrepreneurial human capital should thus lend itself more to incremental than to radical innovation. Former founders' stronger previous contact with customers, competitors, suppliers, and other complementors allows for broader insight into the competitive landscape, enhancing firms' market-oriented search. The generalist dimension of execution skills further allows entrepreneur hires to more effectively acquire information and resources across domains, aiding internal knowledge sharing. Former founders' value added thus lies to a larger extent in

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[8] Incremental innovation is sometimes associated with imitation, underscoring the importance of market knowledge. Relative to radical innovation, incremental innovation may also require speed to market rather than intellectual property rights (Lee et al., 2000; Gans and Stern, 2017; Ching et al., 2019), so resource acquisition and mobilization advantages again favor incremental over radical innovation.

bringing to market more marginal improvements in firms' product and service offerings than in developing the technical areas that favor radical innovation, so we posit that:

Hypothesis 3 *The positive relationship between entrepreneur hires and innovation is stronger for incremental relative to radical innovation.*

In sum, our theoretical framework predicts that entrepreneur hires benefit firm innovation through a generalist ability to configure the requisite resources for bringing new ideas to market. We expect stronger effects for middle management hires, where execution skill deployment is facilitated by broader decision rights, and for incremental innovation, where insight into available markets and resources favor marginal improvements.

3   Data

3.1   Empirical Setting

We test our predictions empirically in Denmark, a context that features several key properties. First, the rich data available from the national statistics agency, Statistics Denmark, allows us to analyze a host of innovation outcomes while tracking individual career histories in detail. Second, Denmark has a thriving entrepreneurial ecosystem, ensuring an adequate supply of founders available for firms to hire; the Danish labor market is highly flexible, so career trajectories are dynamic, with substantial moves to and from entrepreneurship. Finally, the presence of (globally) innovative firms affords us with variation in our outcomes of interest.

3.2   Community Innovation Survey Data

To measure firm innovation, we rely on the Danish Community Innovation Survey (CIS). This survey is based on the Oslo Manual designed to collect self-reported data on R&D activities and innovation of European firms and is a major source of information for innovation research (for instance, Cassiman and Veugelers, 2006; Laursen and Salter, 2006; Leiponen and Helfat, 2010; Klingebiel and Rammer, 2014). Statistics Denmark took over the administration of the CIS in 2007, when the data collection approach also changed; we therefore construct our sample starting

in 2007 to ensure consistency in our dependent variables. The data is collected yearly through an online survey at the central webpage for tax reporting by firms registered in Denmark and participation is mandatory for selected firms, so we avoid non-response or attrition issues. The CIS relies on stratified random sampling to ensure coverage across industries facing international competition and excludes state-owned enterprises; sampling intensity is higher for high-R&D industries, as well as larger firms, with around 4,500 firms participating in the survey annually. Our final panel dataset for the years 2007-2016 is unbalanced, although most firms complete the CIS multiple times. We link the CIS data to the general firm register – including *all* firms in Denmark – to obtain additional information on employment and investments; we also link our dataset to patent data to obtain technical output measures.

3.3   Linked Employer-Employee Data

Our main data source for identifying entrepreneurs is the Integrated Database for Labor Market Research (IDA) containing linked employer-employee information on the full Danish workforce from 1980 onward. The IDA database is recognized for its ability to reliably track both firms and workers over time and is often used in entrepreneurship and innovation research (e.g., Dahl and Sorenson, 2012; Kaiser et al., 2018; Rocha and van Praag, 2020). However, due to a change in the key that uniquely identifies firms, we track individual career histories from 1999 onward; the IDA data includes all firms in Denmark associated with at least one individual, excluding holding or shell companies. We match these firms with the general firm register to obtain the year of establishment, which we use to identify new firms. We also match the individual level observations with two other registers containing information on worker occupation (International Standard Classification of Occupations or ISCO codes) and education. We aggregate individual observations to the firm level by computing counts of individuals (e.g., new entrepreneur hires) before merging with the CIS data. Since we are interested in established firms' innovation, we restrict our sample to firms more than five years old and with more than 25 employees, counting only individuals who have their main occupation with the firm.

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3.4 Dependent Variables

Given our theoretical focus on taking innovation to market, our main dependent variable in testing Hypotheses 1 and 2 is the share of *Sales from innovation*. This variable captures the share of revenue derived from new and improved products and services, and ranges from zero to a hundred percent in a given year. To test Hypothesis 3, we disaggregate our dependent variable into shares of *Sales from innovation new to the firm*, *Sales from innovation new to the market* and *Sales from innovation new to the world*, capturing progressively more radical new offerings. Often used as proxies for innovation activities in prior work (Cassiman and Veugelers, 2006; Laursen and Salter, 2006; Leiponen and Helfat, 2010), these measures are especially well-suited to our study as the fraction of revenue obtained from new offerings speaks directly to the function we posit former entrepreneurs perform inside established organizations: unlocking the economic significance of innovation (Grimpe and Kaiser, 2010). Our sales-based variables also allows us to capture innovation more broadly than more technical, traditional measures, as only a small fraction of firms exhibit regular patenting activities. Nonetheless, we use *Any patents*, *Number of patents* and *Citation-weighted patents* as dependent variables to assess whether entrepreneur hires generate new technical knowledge.

3.5 Independent Variables

Correctly identifying entrepreneurs is a key challenge for our study. Since the execution skills we theorize founders bring to the hiring firm come from running a start-up with growth potential, we define entrepreneurs as founders of an incorporated start-up with employees. We use Statistics Denmark's general firm registry to identify new firms, using their date of registration as a legal entity. We define a new firm as one registered in the current or previous year (age zero or one) and with at most 25 employees including the founder at founding, thus excluding spin-offs from existing companies. Identifying incorporated firms' founders is not straightforward. Following Sørensen (2007), we identify founders as individuals working at a new firm with at most three

employees; if the new firm consists of more than three workers, we identify founders as employees in managerial roles; and absent managerial roles, we count the top three earners as founders. We exclude founders who do not hold their main occupation with the firm until year three of its existence, as well as solo ventures within this time frame. This approach, capturing engagement in a meaningful start-up's early life, allows us to measure founding experience in a way that reflects our theoretical interest in entrepreneurial human capital.

For our analysis, we consider year zero or one founding experience within the five years prior to the hiring event, focusing on observations where the focal firm provides the individual's main occupation. To assess labor inputs' relative impact on innovation, we split the workforce into three distinct groups: *Hires with founder experience*, *Hires without founder experience*, and *Stayers*. We also disaggregate founder hires into those occupying *Top management*, *Middle management*, and *Non-management* roles in the hiring firm: we use 1-digit ISCO codes to identify managers and 3-digit codes to identify top managers, then compute the shares of entrepreneur hires at each level. Moreover, we use ISCO codes to assess individuals' managerial experience and compute firms' share of *Hires with managerial experience*: contrasting this group with entrepreneur hires helps us examine the potential for managerial skills to confound our preferred execution skills channel. As current output depends on past inputs, we lag employment shares by one year.[9]

3.6 Control Variables

We control for several variables that may determine firms' innovation outcomes and hiring decisions. We include logged *Firm size* as the total number of workers (based on main occupations), *Firm age* as years since establishment, and the logged book value of *Physical capital*. Following Kaiser et al. (2015), we consider individuals holding a higher education degree in STEM-related areas of technical, natural, health, veterinary, and agricultural sciences and occupying job func-

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[9] In additional checks, we disaggregated stayers into *Stayers with founding experience*, *Stayers without founding experience*, and *Original founding team*, with similar results. Interestingly, entrepreneurial stayers are not significantly related to innovation, which we attribute to human capital depreciation (see Section 5.2).

Table 1: **Descriptive statistics for the main variables,** $N = 20,271$

	Mean	St. dev.	Min.	Max.
Innovation outcomes				
Sales from innovation	0.114	0.276	0	1
Sales from innovation new to the firm	0.054	0.181	0	1
Sales from innovation new to the market	0.043	0.162	0	1
Sales from innovation new to the world	0.017	0.101	0	1
Lagged employment shares				
Hires with founder experience	0.00550	0.010	0	0.273
... in *top management*	0.00007	0.001	0	0.053
... in *middle management*	0.00023	0.002	0	0.041
... in *non-management*	0.00520	0.010	0	0.273
Hires without founder experience	0.213	0.146	0	1
Stayers	0.781	0.149	0	1
Control variables				
Firm size	274.903	1,009.146	26	>33,500
Firm age	27.086	18.420	6	>100
Physical capital (thou. DKK)	377.525	2,599.477	0	>9,800,000
R&D workers	24.808	137.963	0	>7,000
University graduates	46.960	181.409	0	>8,800
R&D department	0.225	0.418	0	1
R&D intensity	0.023	0.102	0	1
Collaboration breadth	1.104	2.081	0	8
Applied for patent(s)	0.103	0.305	0	1
Acquired patent(s)	0.082	0.274	0	1
Sales growth	0.120	2.059	-0.996	>200
Investment intensity	0.041	0.095	0	1

tions requiring high levels of knowledge as *R&D workers*. We also control for the logged number of *University graduates* and include dummies for whether the firm has an *R&D department*, has *Applied for patents* or *Acquired patents*, as well as *R&D intensity* as R&D spending over revenue and the number of different formal R&D partner types as *Collaboration breadth*. We lag all IDA-derived measures in the estimation and include two lags of *Sales growth* and *Investment intensity* (net investment over revenue) as flexible time-varying proxies for the demand for execution skills. Finally, our main models include (2-digit NACE level) industry-year fixed effects, as well as firm fixed effects.

3.7 Descriptive statistics

Our estimation sample, summarized in Table 1, comprises 20,271 observations for 3,846 firms. Firms' average share of sales from innovation is 11.4%, with almost half coming from offerings new to the firm (5.4%); those new to the market and world comprise 4.3% and 1.7% of sales,

respectively. New entrepreneur hires are 0.5% of the workforce, reflecting the fact that many organizations do not hire entrepreneurs in a given year. Most hires occur in non-manager roles; instead, non-founder hires and stayers represent 21% and 78% of the workforce, respectively. On average, firms are 27 years old and have 274 employees, of which 25 are R&D workers. Appendix Table A.1 displays the correlations between our main variables.

4 Method

An ideal experiment to test our hypotheses would entail randomly assigning the *quantity* and *quality* of employees with and without entrepreneurial human capital to firms, whose innovative performance we could then track. In practice, the prohibitive cost of such an experiment renders our analysis vulnerable to several sources of endogeneity and bias, whose sign and magnitude are difficult to establish *ex ante*. We explain the identification and interpretation challenges we face and our approach to limiting their impact on our estimates below.

4.1 Identification Challenges

The first order concern for our identification strategy is the positive selection of more innovative firms into hiring entrepreneurs. If firms with a higher share of revenue from new products and services generally hire more entrepreneurs, firm innovativeness confounds our relationship of interest. Firm fixed effects alleviate this concern, but a dynamic effect may arise if firms hire founders when they anticipate additional market opportunities and demand execution skills. In our empirical analysis, we mitigate this potential issue by controlling for a broad set of firm attributes and including lagged sales growth and investment intensity as proxies for time-varying demand for former founders (Bloom et al., 2007; Michaely and Roberts, 2012).

A second order concern with interpreting our results is returning entrepreneurs' ability: if worse performers become employees, can we expect them to impact firms' innovation outcomes? Since moves to and from paid employment are common in entrepreneurial careers, founders becoming wage earners are not necessarily negatively selected (Burton et al., 2016; Dillon and

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Stanton, 2017; Failla et al., 2017), with both successful and unsuccessful exits determined by diverse (non-)business motives (Wennberg et al., 2010; DeTienne et al., 2015). Former founders thus form a general pool of human capital conducive to innovation, regardless of their success: negative selection would run counter to our assertion that they increase innovation, making our estimates lower bounds. Potential assortative matches between more innovative firms and better founders pose a subtler challenge, since our results should be interpreted as upper bounds for entrepreneur hires' effect on average firms' innovation.

4.2 Econometric Model

As Appendix A.1 details, we build on an innovation production function with multi-dimensional human capital inputs, a framework that allows us to calculate the relative impact of entrepreneur hires compared to other labor inputs under a set of weak assumptions (Kaiser et al., 2015, 2018). In practice, we estimate fixed effects ordinary least squares models, regressing innovation outcomes on lagged employment shares (alleviating reverse causality), firm characteristics, firm fixed effects (addressing time-invariant unobservables), lagged sales growth and investment intensity (addressing time-variant demand for former founders), and industry-year fixed effects (addressing common shocks).[10] Although they cannot be interpreted directly, positive employment share coefficients indicate higher innovation returns compared to stayers. More importantly, we test our hypotheses by comparing coefficients for *Hires with founder experience* and *Hires without founder experience*, which also helps us evaluate effect magnitude.[11] We perform similar calculations for comparing entrepreneur hires at different managerial levels and contrast coefficients across models when evaluating different innovation types. We cluster standard errors at the firm level throughout the analysis.

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[10] Pooled ordinary least squares or tobit models produce economically and statistically larger results (Appendix Tables A.2 and A.3). However, potential unobserved firm-level confounders justify using fixed effects. The lack of consecutive CIS observations for some firms prevents us from estimating dynamic panel models.

[11] We calculate effect sizes as $(\beta_{\text{Founder}} + \beta_{\text{Firm size}})/(\beta_{\text{Non-founder}} + \beta_{\text{Firm size}})$ (Appendix A.1). The estimated coefficients do not translate directly into elasticities due to the composite labor index used (Kaiser et al., 2018). The negative *Firm size* coefficient precludes us from calculating meaningful effect sizes relative to the baseline.

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Table 2: **The effect of entrepreneur hires on firms' sales from innovation**

		Model I: Sales from innovation			Model II: Sales from innovation			Model III: Sales from innov. new to firm			Model IV: Sales from innov. new to market			Model V: Sales from innov. new to world		
		β	p	s.e.	β	p	s.e.	β	p	s.e.	β	p	s.e.	β	p	s.e.
	Lagged employment shares															
(1)	Hires with founder experience	0.502	0.005	0.180				0.256	0.036	0.122	0.163	0.125	0.106	0.083	0.249	0.072
(2)	... in *top management*				-2.081	0.126	1.358									
(3)	... in *middle management*				2.625	0.054	1.362									
(4)	... in *non-management*				0.236	0.223	0.194									
(5)	Hires without founder experience	-0.008	0.690	0.020	-0.002	0.921	0.020	0.004	0.755	0.014	-0.017	0.124	0.011	0.005	0.516	0.008
	Control variables															
	Log firm size	-0.012	0.181	0.009	-0.011	0.211	0.009	-0.009	0.170	0.006	0.002	0.747	0.005	-0.005	0.172	0.003
	Log physical capital	-0.003	0.287	0.002	-0.003	0.271	0.002	-0.003	0.063	0.001	-0.000	0.957	0.001	0.000	0.900	0.001
	Firm age	0.002	0.000	0.001	0.002	0.000	0.001	0.002	0.000	0.000	0.001	0.076	0.000	-0.000	0.432	0.000
	Log R&D workers	0.011	0.085	0.006	0.010	0.087	0.006	0.010	0.026	0.004	0.000	0.956	0.004	0.000	0.805	0.002
	Log university graduates	-0.008	0.263	0.007	-0.008	0.288	0.007	0.001	0.824	0.005	-0.009	0.061	0.005	-0.001	0.787	0.002
	R&D department	0.120	0.000	0.014	0.120	0.000	0.014	0.064	0.000	0.010	0.046	0.000	0.009	0.010	0.011	0.004
	R&D intensity	0.067	0.286	0.063	0.066	0.288	0.062	-0.012	0.773	0.043	0.025	0.490	0.036	0.054	0.281	0.050
	Collaboration breadth	0.018	0.000	0.002	0.018	0.000	0.002	0.009	0.000	0.001	0.007	0.000	0.001	0.002	0.015	0.001
	Applied for patent(s)	0.017	0.268	0.016	0.018	0.254	0.016	-0.009	0.429	0.011	0.017	0.077	0.010	0.009	0.097	0.005
	Acquired patent(s)	0.029	0.012	0.012	0.029	0.013	0.012	0.008	0.310	0.008	0.017	0.020	0.007	0.004	0.486	0.005
	Sales growth/investment intensity	Yes			Yes			Yes			Yes			Yes		
	Industry-year fixed effects	Yes			Yes			Yes			Yes			Yes		
	Firm fixed effects	Yes			Yes			Yes			Yes			Yes		
	Number of observations/firms	20,271/3,846			20,271/3,846			20,271/3,846			20,271/3,846			20,271/3,846		
	Adjusted R^2	0.310			0.310			0.198			0.206			0.267		
	F-tests															
	Hypothesis 1: (1)=(5)	7.82	0.005					4.21	0.040		2.79	0.095		1.14	0.286	
	Hypothesis 2: (3)=(2)				5.86	0.016										
	Hypothesis 2: (3)=(4)				3.03	0.082										
	Hypothesis 2: (3)=(2) *and* (4)				2.93	0.053										

Robust standard errors clustered by firm. Sample restricted to firms older than 5 years and with more than 25 employees, for years 2007-2016; stayers represent the baseline category. All models estimated by ordinary least squares with firm fixed effects.

5 Results

5.1 Main Results

Table 2 presents our main estimation results. Model I tests Hypothesis 1, which predicts that a higher share of new entrepreneur hires is positively associated with firms' share of sales from innovation. In row (1), hires with founder experience are positively and significantly associated with sales from innovation relative to the baseline stayer category ($\beta = 0.502, p = 0.005$), but hires without founder experience in row (5) return a small and insignificant negative coefficient ($\beta = -0.008, p = 0.690$). Comparing these two estimates provides strong support for Hypothesis 1 ($p = 0.005$) and implies that an additional hire with founding experience contributes 24.7 times more (in absolute terms) to the hiring firm's sales from innovation relative to an additional hire without such experience. Moreover, detecting a short-term effect supports our argument that former entrepreneurs pursue an innovative idea, rather than generate inventions.

Hypothesis 2 proposes that new entrepreneur hires are more tightly linked to innovation when they occur in middle management positions, as opposed to top management or outside of managerial roles. To test this prediction, Model II substitutes employment shares corresponding to the different managerial levels for our main measure of entrepreneurial human capital. Within entrepreneur hires, those in middle management are the most strongly and positively correlated with innovation ($\beta = 2.625, p = 0.054$), followed by non-managers ($\beta = 0.236, p = 0.223$). These estimates are weakly statistically different ($p = 0.082$) and imply that entrepreneur hires in middle management contribute 11.6 times more to firm innovation relative to those in non-managerial roles. Entrepreneur hires in top management are, instead, negatively correlated with firm innovation, although this result is not statistically significant ($\beta = -2.081, p = 0.126$).[12] Comparing estimates for hires with founding experience across managerial layers returns a signif-

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[12] The small fractions of entrepreneur hires in managerial positions (see Table 1) produce large standard errors for these categories, which may inflate p-values for the hypothesis tests in Table 2. Moreover, a concern with this set of estimates lies in the potential selection of better entrepreneurs into higher managerial levels; our finding that entrepreneur hires in top management do not affect the share of sales from innovation speaks against this explanation. However, the negative coefficient for top management founder hires could arise if they occur during periods of especially poor innovative performance (despite our controls for sales growth).

icant difference ($p = 0.016$) and implies that middle management entrepreneur hires contribute 1.2 times more (in absolute terms) to hiring firms' innovation than those in top management. A joint test of hires in middle management relative to those in other positions provides further support for Hypothesis 2 ($p = 0.053$) and highlights the importance of matching entrepreneurial human capital with the relevant decision rights and access to resources.

We test Hypothesis 3 by estimating models separately for innovation that ranges from the most incremental (new to the firm) to the most radical (new to the world). In Model III, hires with founder experience are positively and significantly associated with sales from innovation new to the firm relative to stayers ($\beta = 0.256, p = 0.036$), whereas hires without founder experience return an insignificant coefficient ($\beta = 0.004, p = 0.755$). These estimates are significantly different ($p = 0.040$) and imply that an additional hire with founding experience contributes 55.1 times more (in absolute terms) to the hiring firm's sales from incremental innovation than an additional hire without such experience. The equivalent coefficients for offerings new to the market in Model IV are 0.163 ($p = 0.125$) and -0.017 ($p = 0.124$) for hires with and, respectively, without founding experience. This weakly significant difference ($p = 0.095$) entails a 10.6 times larger contribution (in absolute terms) to firms' offerings new to the market for an additional entrepreneur hire compared to a non-entrepreneur hire. In Model V, we find no significant effect of either hire type on innovation new to the world ($\beta = 0.083, p = 0.249; \beta = 0.005, p = 0.516$) or a difference between them ($p = 0.286$). As we analyze progressively more radical types of innovation, the effect of new founder hires becomes economically and statistically smaller, highlighting the important role entrepreneurial human capital plays for incremental improvements to firms' offerings, as Hypothesis 3 predicts.

In Appendix Table A.2, we estimate models akin to those in Table 2 using OLS without firm fixed effects. The results are broadly similar, although middle management founder hires now produce a more significant coefficient (Model A-II, $\beta = 2.123, p = 0.040$), as do founder hires when analyzing offerings new to the market (Model A-IV, $\beta = 0.163, p = 0.054$). This approach

allows us to compare coefficients across Models A-III-IV, A-III-V, and A-IV-V using seemingly unrelated estimation. Wald tests produce p-values of 0.399, 0.016, and 0.075, respectively, indicating that new entrepreneur hires have a similar impact on innovation new to the firm or market, but not the world, in line with Hypothesis 3.

5.2 Alternative Explanations and Robustness Checks

In this section we test competing explanations of entrepreneur hires' effect on firm innovation based on technical or managerial skills. We also investigate the robustness of our results to alternative dependent variable, independent variable, and sampling choices. Our core argument is that former founders improve innovation through execution skills, but a similar outcome may arise if they help established firms gain access to new technical knowledge. To test this channel, we use firms' possession of *Any patents*, *Number of patents*, and *Citation-weighted patents* as alternative dependent variables that better reflect technical skills and invention outcomes in Table 3, Models A-VI-VIII. We do not find any effects of new entrepreneur hires on either of these patent-based measures (all $p > 0.6$), suggesting that former founders' technical skills (or intellectual property rights) cannot explain our findings.[13]

We obtain similarly insignificant results with *Any sales from innovation* as a dependent variable (Appendix Table A.3, Model A-XII), implying that new entrepreneur hires improve firm innovation along the *intensive*, but not necessarily *extensive* margin. In other words, they are more valuable to firms already engaged in innovation activities and that possess potentially underused technical knowledge or ideas, shoring up our theoretical focus on innovative firms. Accordingly, our findings are stronger when we restrict the analysis to innovation-active firms during the sample period ($\beta = 0.584, p = 0.006$) or innovation-active observations only ($\beta = 1.095, p = 0.002$). These results may also suggest that entrepreneurs do not automatically bring in valuable innovations from their previous firm; in other words, the value they create is due to

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[13] New entrepreneur hires may also occur as a result of 'acquihires', which may bring in both entrepreneurial human capital and innovative projects (as well as intellectual property rights). However, this is a rather new and relatively rare phenomenon in Denmark; moreover, when acquihires occur, they tend to involve older companies than those we consider start-ups in our analysis. Overall, acquihires are unlikely to affect our results.

their human capital, rather than other types of inputs.

As entrepreneurs perform a variety of managerial functions in their start-ups, an alternative explanation for why entrepreneur hires aid firms' innovation outcomes may be that they learn to manage, not necessarily to execute new ideas. In other words, their advantage relative to hires without founding experience may stem not from the ability to create and exploit new business opportunities based on existing knowledge in non-routine settings, but from deploying general skills in routine functions such as goal-setting, operational, monitoring, or personnel practices (Bloom and van Reenen, 2007). We evaluate this potential confounding channel by measuring individuals' previous managerial experience – whether they occupied a management position in the five years prior to hiring – and pitting it against entrepreneurial experience (Busenitz and Barney, 1997; Koudstaal et al., 2016).

Empirically, we regress our main outcome variable, *Sales from innovation*, on three distinct employment shares: *Hires with founding experience*, *Hires with managerial experience*, and *Hires without founding or managerial experience*. Model IX in Table 3 suggests that new entrepreneur hires remain positively and significantly correlated with firm innovation ($\beta = 0.501, p = 0.006$), whereas new managerial hires exhibit a weaker, insignificant association ($\beta = 0.185, p = 0.211$). Although these coefficients are not statistically different from each other ($p = 0.133$, possibly due to the low employment shares in each group), they are economically distinct, as new entrepreneur hires contribute 3.3 times more than new managerial hires to innovation in this model. Moreover, the effect of entrepreneur hires on innovation is virtually unchanged from that in Table 2 when we control for managerial hires, suggesting they might capture different inputs to innovation. We thus conclude that while entrepreneurial human capital may encompass routine managerial skills, an important role remains for execution skills connecting existing knowledge with market insight to generate new business opportunities.

Table 3: **Alternatives to execution skills: technical and managerial skills**

		Model VI: Any patents			Model VII: Number of patents			Model VIII: Citation-weighted patents			Model IX: Sales from innovation		
		β	p	s.e.	β	p	s.e.	β	p	s.e.	β	p	s.e.
	Lagged employment shares												
(1)	Hires with founder experience	0.008	0.939	0.107	0.295	0.626	0.604	-0.116	0.933	1.381	0.501	0.006	0.180
(2)	Hires without founder experience	-0.032	0.032	0.015	0.014	0.942	0.196	-0.102	0.866	0.604			
(3)	Hires with managerial experience										0.160	0.269	0.144
(4)	Hires without either experience										-0.017	0.414	0.021
	Control variables	Yes			Yes			Yes			Yes		
	Sales growth/investment intensity	Yes			Yes			Yes			Yes		
	Industry-year fixed effects	Yes			Yes			Yes			Yes		
	Firm fixed effects	Yes			Yes			Yes			Yes		
	Number of observations/firms	10,753/2,822			10,753/2,822			10,753/2,822			20,271/3,846		
	Adjusted R^2	0.555			0.818			0.593			0.310		
	F-tests												
	Technical skills: (1)=(2)	0.14	0.705		0.21	0.649		0.00	0.993				
	Managerial skills: (1)=(3)										2.26	0.133	

Robust standard errors clustered by firm. Sample restricted to firms older than 5 years and with more than 25 employees, for years 2007-2012, when patent data is available (and years 2007-2016 in Model IX); stayers represent the baseline category. All models estimated by ordinary least squares with firm fixed effects. In Models V-VII, the means of the dependent variables are 5.2% (*Any patents*), 0.402 (*Number of patents*), and 0.464 (*Citation-weighted patents*); in Model VIII, the mean share of hires with managerial experience is 0.9%, with a standard deviation of 0.015.

We subject our independent variables to additional checks in Appendix Table A.3. First, whereas our main analysis identifies founders only in years zero and one of their start-up, we consider an alternative definition where we allow founders to be recorded as such for up to three additional years, provided they remain with the firm. This expands the number of individuals for whom we record entrepreneurial experience within the past five years, but implies that start-up experience (i.e. in the venture's first two years) is somewhat more distant from the hiring event. The results are similar to those in Table 2, although their magnitude decreases slightly: in Model A-I, the coefficient is now 0.396 ($p = 0.019$) as opposed to 0.502 ($p = 0.005$). The depreciation of entrepreneurial human capital provides one potential explanation for this pattern, with more recent experience having larger effects on innovation. To probe this explanation further, we re-estimate our models computing the shares of hires with and without founding experience based on the year prior to the hiring event: if entrepreneurial human capital depreciates quickly, more recent founding experience should produce larger effects on innovation. This is indeed what we find, with a Model A-VIII coefficient of 0.637 ($p = 0.025$), implying that hiring firms benefit more from hiring individuals with more recent entrepreneurial experience.

Second, one year of start-up experience (i.e. during a new venture's years zero or one) is enough to identify a founder in our main analysis, reflecting our interest in start-ups' early life, when execution skills are developed. However, this raises the question of whether brief spells in entrepreneurship – potentially reflecting failed projects – lead to enhanced execution skills or whether longer, sustained founding experience is needed. To evaluate this, we re-calculate our measures of entrepreneurial human capital requiring individuals to have been with the venture at least two consecutive years (i.e. years zero and one, or one and two). If short-term engagement does not build execution skills, the estimated *Hires with founding experience* coefficient should increase; otherwise, it should remain essentially unchanged. Using these independent variables produces broadly similar effect sizes to those in Table 2 (Model A-VII, $\beta = 0.387, p = 0.095$), implying that entrepreneurial human capital is developed even through brief engagement during

a new venture's early life; this may suggest that both failure and success are linked with learning and entrepreneurial human capital development and that short-term experimentation provides valuable skill acquisition opportunities (Manso, 2016; Mérida and Rocha, 2021).

Third, we subject the possibility that more entrepreneurial firms hire more former founders to an alternative test, regressing our measures of innovation on *leads* of the employment shares: a positive and significant effect would imply that reverse causality can explain our results. We find that future entrepreneur hires do not affect innovation outcomes: when analyzing *Sales from innovation* in Model A-IX, this variable returns a coefficient of 0.070 ($p = 0.719$). The evidence therefore speaks against reverse causality driving our findings.

Fourth, our theoretical framework guides our analysis of human capital *flows*, but we can also assess the effects of its accumulation as a *stock*. We compute the share of *Workers with founder experience* (mean of 1.2%) and use it as an independent variable. The results point towards a significant positive effect of entrepreneurial human capital stocks on sales from innovation ($\beta = 0.370, p = 0.052$) in Model A-X, albeit statistically weaker than the one for flows. Its positive association with innovation new to the firm is significant ($\beta = 0.250, p = 0.067$), but the one with innovation new to the world is not ($\beta = 0.135, p = 0.159$). So while entrepreneurial human capital accumulation matters, the inflow of execution skills and market insight may be more important for firm innovation, in line with our depreciation argument.

Fifth, our analysis considers all employees who report a firm as provider of their main occupation, although some roles require no specific knowledge or qualifications and are unlikely to affect innovation. When we exclude such positions from our firm size and employment shares calculations, the results are similar to those in Model I ($\beta = 0.495, p = 0.025$), as would be the case if most entrepreneurs are hired in positions above this level and the new variables were simply re-scaled versions of our main independent variables.

Finally, we assess the robustness of our results to sampling decisions. Our focus on *established* firms as recipients of entrepreneurial human capital guided our decision to analyze firms more

than five years old and with more than 25 employees, but these cutoffs are arguably subjective. As a check, we use alternative age cutoffs from more than three to more than 100 years old, estimating our main specification (Model I) in each new sample. We find consistent results in terms of sign, magnitude, and significance for all cutoffs up to 30 years, where the effect begins to weaken, partly due to smaller sample size; the effect is much lower for firms over 40 years old and becomes weakly negative for the oldest firms. We also use size cutoffs ranging from more than 10 to more than 500 employees, estimating our main specification in each sample. We find consistent sign, magnitude, and significance results for all cutoffs from 15 to 200 employees (but not smaller), where the effect weakens both economically and statistically. That larger and older firms benefit less from entrepreneur hires is an important boundary condition for our work, with these firms' more deeply entrenched routines and business models making it more difficult to integrate and act upon entrepreneurial human capital.

6 Discussion

Theoretical implications Finding that entrepreneur hires improve firms' ability to benefit from new products and services, we show how innovation and entrepreneurship interface to generate growth opportunities, linking two distinct strands of literature. Our results highlight the importance of entrepreneurial human capital – former founders' execution skills for bringing ideas to market – as a scarce and valuable resource for firms' innovative performance (Alvarez and Busenitz, 2001; Foss and Klein, 2012). We provide evidence for one possible way organizations can acquire entrepreneurial capabilities (Teece, 2016; Distel et al., 2019; Faleye et al., 2020), a function whose determinants have received limited attention despite recognition that 'entrepreneurial action is required to transform knowledge investments from possessing the potential to create value into a form that enables its appropriation' (Agarwal et al., 2010, p. 271). The capacity to configure resources and bring new ideas to market by hiring entrepreneurs thus allows firms to appropriate a larger share of the value they create (Teece, 1986).

Our work contributes directly to a growing literature on hiring-for-innovation. Building on studies showing that hiring inventors has a strong impact on the earlier, patenting stage of the innovation process (Almeida and Kogut, 1999; Rosenkopf and Almeida, 2003; Song et al., 2003; Tzabbar, 2009; Palomeras and Melero, 2010; Singh and Agrawal, 2011; Kaiser et al., 2018), we emphasize a novel human capital input, entrepreneurial execution skills, into a later stage of the innovation process, namely bringing ideas to market. Our study therefore raises an important question regarding the interaction of these different inputs for increasing the value firms generate and appropriate. When is an entrepreneur hire more valuable than a inventor hire, are they complements or substitutes, and does this vary with the innovation type considered? Answering these questions could be invaluable to firms as they direct their external hiring processes.

In theorizing and showing a stronger effect of entrepreneur hires in middle management on innovation, this paper also highlights the importance of organizational design for human capital deployment (Teece, 1996; Garicano, 2000; Foss et al., 2015). By virtue of greater decision rights and hierarchical position, middle managers perform crucial information processing and resource allocation functions in organizations (Wooldridge et al., 2008; Mollick, 2012). Former founders' advantage in linking market insight with firms' technical assets translate into improved performance as selection agents when they occupy middle management roles; moreover, entrepreneur hires in such roles can better acquire and mobilize resources across dispersed gatekeepers than hires in other hierarchical positions. Matching entrepreneurial human capital and decision rights (Foss and Klein, 2012) is thus vital for execution skills to reach their innovation potential.

Our results suggest that entrepreneur hires in top management are not significantly related to firm innovation, in seeming contrast to Faleye et al. (2020). However, top managers' responsibilities lie mainly in outlining strategy and providing a vision for the firm (including increases in R&D spending across the entire firm, for instance), actions that may take longer to materialize as sales from innovation; the outcomes Faleye et al. (2020) study speak to external audiences' perception of firm value and are far more proximate to the hiring event. Understanding the

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dynamic effects of entrepreneurial human capital on firm innovation and performance presents an important dimension along which our work could be extended.

The core premise of our theoretical framework is that former founders possess a combination of innate and, especially, acquired entrepreneurial human capital (albeit subject to depreciation). The execution skills advantage former entrepreneurs enjoy over non-entrepreneur enhances their effectiveness in seeking, acquiring, and mobilizing heterogeneous social, human, or financial capital resources to pursue novel market opportunities building on under-utilized knowledge. Consequently, we propose and document that entrepreneur hires are more tightly linked to incremental innovation, which finds new uses for existing assets, than to radical innovation, more dependent on technical human capital and investments. That is, execution skills are relatively more helpful in detecting and implementing more marginal, possibly imitative, improvements to firms' product and service offerings. Yet, substantial business R&D is directed towards imitative products and incremental innovation accounts for a fair share of firm revenues (Leiponen and Helfat, 2011), so improvements along this dimension could still be efficiency-enhancing.

We conceptualize entrepreneurial human capital as a unique bundle of execution skills. This notion closely relates to entrepreneurial judgment under uncertainty, or 'decisive action about the deployment of economic resources when outcomes cannot be predicted according to known probabilities' (Foss and Klein, 2012, p. 38). For these authors, entrepreneurial judgment is not contractible or tradable due to the fundamental uncertainty around heterogeneous resource configuration. Our results suggest that entrepreneurial behavior can be traded, albeit imperfectly: previous founding experience is a valuable, though possibly noisy signal that individuals possess entrepreneurial judgment that could be fruitfully deployed inside established firms.[14] This study also links definitions of entrepreneurship as *outcome* (e.g. firm formation) and *function*, namely that entrepreneurs create and exploit strategic opportunities. Defining entrepreneur-

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[14] A *Harvard Business Review* essay (Smith, 2013) takes a more radical view, arguing that hiring entrepreneurs can be problematic for firms: "Too often employers hire entrepreneurs, not entrepreneurial spirit. Big mistake. (...) Far better for you to ferret out the entrepreneurs before they ever join, and spend your energies and resources nurturing true entrepreneurial spirit." Our results offer evidence that entrepreneurs can benefit firm innovation, but the comparative efficacy of entrepreneurial inputs is an interesting question for future research.

ship remains a fundamental, challenging task, but the substantial overlap between alternative interpretations offers a positive upshot for scholars in this area.

In showing how entrepreneurs are valuable for established organizations, we contribute to research on entrepreneurial careers (Burton et al., 2016; Failla et al., 2017; Manso, 2016). While a substantial share of (un)successful founders return to paid employment after entrepreneurial spells, firms may struggle to recognize their distinctive skill set, so former founders experience an initial earnings penalty (Mahieu et al., 2021); however, as execution skills are revealed, former entrepreneurs' wages rebound, displaying a long-run premium (Manso, 2016; Mérida and Rocha, 2021). Our paper helps explain former founders' wage dynamics, but also suggests that firms may capture short run value by capitalizing on entrepreneurs' possibly underrated skills. Future studies may inquire *how* the value former entrepreneurs generate is distributed between employee and firm. Moreover, studies of entrepreneurs' contribution to growth are possibly understated if limited to the value created by their start-ups, but not the firms they subsequently move to, an insight related to the finding that failed start-ups' patents spur substantial follow-on knowledge and value creation (Hoetker and Agarwal, 2007; Serrano and Ziedonis, 2018).

If hiring former entrepreneurs is associated with higher innovation sales, then why do some firms hire only a small share of such individuals? If in equilibrium firms balance the marginal costs and benefits of hiring entrepreneurs, our results imply some firms operate sub-optimally. A demand-side explanation for this potential inefficiency stems from the failure stigma facing unsuccessful entrepreneurs (Landier, 2006; Zunino et al., 2021), such that the expected benefits of founder hires are underestimated. This stigma not only hinders firm entry, but may limit entrepreneurship in established companies and impose larger costs on society as a whole than previously thought. Firms may also worry about integrating former founders into established structures. Entrepreneurs exhibit preferences for autonomy in contrast with existing bureaucracies (Corbett and Hmieleski, 2007; Sørensen, 2007; Butler, 2017), so a rigid environment would limit the ability to extract execution skills' full value. While one could bypass this problem

by hiring former founders in middle management, affording them increased decision rights and autonomy, firms may be constrained in the availability of such positions. On the supply side, entrepreneurial human capital may indeed be scarce. A small fraction of the population enjoys recent founding experience and some may become serial entrepreneurs. A systematic inquiry into the drivers of entrepreneur hires could help unpack these explanations, providing valuable insight into where and how post-entrepreneurship careers unfold, as well as the availability of entrepreneurial human capital as a strategic input.

Our emphasis on entrepreneurial action inside established firms appears at odds with studies of employee entrepreneurship, where the 'abundance of under-exploited knowledge' is used outside the organization that generated it when employees deploy their human capital through spin-offs (Agarwal et al., 2004; Campbell et al., 2012b; Ganco, 2013; Gambardella et al., 2015). Yet, our argument is simply that firms *can* exploit the scientific and technical knowledge they produce by hiring the appropriate human capital. Former entrepreneurs' execution skills allow firms to appropriate a larger share of the value they create, thereby improving firms' incentives to generate knowledge in the first place and leaving them less liable to competition from ventures spawned otherwise. Disentangling entrepreneur hires' contribution to preventing spin-offs by exploiting technical knowledge in-house from their contribution to encouraging spin-offs by acting as role models for peers may represent a fruitful area for future research.

Finally, we speak to work on corporate (Covin and Miles, 1999; Kuratko et al., 2001; Burgers and Covin, 2016) and strategic (Hitt et al., 2001; Kuratko and Audretsch, 2009; Teece, 2016) entrepreneurship. We link a specific input to an innovation output through execution skills, but cannot test precisely *how* those skills are used (Teece, 2016). Future research could inquire how entrepreneurs differ from other employees in their ability to act as selection agents (Burgelman, 1991; Mollick, 2012), orchestrate resources inside the firm and assemble new venture teams (Burgelman, 1983a; Sirmon et al., 2011), or instill entrepreneurial spirit (Kuratko et al., 2001). Moreover, do organizations organically become more entrepreneurial by (inadvertently) hiring

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former founders or must they pursue a deliberate strategy to create innovation capabilities? Does hiring entrepreneurs signal an appealing environment to other former founders, helping develop an enterprising culture? Closely linking entrepreneurial inputs, processes, and outputs holds much promise for both researchers and practitioners.

Managerial implications   A natural implication of our study is that companies hiring entrepreneurs may enjoy larger sales from new products and services. Our findings lend credence to the following quote from Dell's Entrepreneur-in-Residence, Ingrid Vanderveldt: "If a large corporation is going to stay relevant, they have to be innovative. Those corporations that reach out to embrace entrepreneurs can be the innovators. They are leading the way" (Smith, 2018). However, it is not enough to hire former founders; firms must also assign them to positions where execution skills can be better exploited. Middle management roles are particularly important, since they provide a compromise between market knowledge and access to firms' technical assets, as well as the decision rights necessary for acquiring and mobilizing resources (Foss and Klein, 2012). Although such positions may be scarce, moves towards firm decentralization may aid the creation of middle manager positions; in turn, this organizational design choice can favor the deployment of execution skills (Foss et al., 2011, 2013).

Firms should also consider the type of innovation entrepreneur hires bring about: execution skills primarily build on firms' existing knowledge base and favor incremental relative to radical innovation, though they retain a positive effect on the latter. One may be concerned that such improvements are marginal or imitative, but this need not deter firms from hiring entrepreneurs. Companies allocate substantial resources to R&D activities directed at incremental innovation and extract significant value from it; moreover, incremental product improvements may pave the way for strategic renewal and generate long-run competitive advantage (Covin and Miles, 1999). That said, entrepreneurial human capital is subject to depreciation, so regular inflows of founder hires may be required for sustained innovation.

Companies are often concerned with the possible negative performance implications of losing employees to competing spin-offs (Sørensen, 2007; Campbell et al., 2012b; Gambardella et al., 2015; Tåg et al., 2016). Our findings suggest that established firms could counteract this loss by hiring former entrepreneurs: rather than allow underused knowledge to leave the firm, they can exploit it through new offerings. Since their execution skills are honed in practice, fewer founder hires may be needed to replace the lost entrepreneurial human capital from employees exiting the firm and starting a competing venture. Organizations may thus be able to achieve savings even when entrepreneurs command a labor market premium, while new entrepreneur hires allow them to appropriate a larger share of the rents they generate. If so, firms could perhaps worry less about competing spin-offs and focus more on attracting and retaining relevant human capital. To enhance their ability to recruit entrepreneurial human capital, firms may also consider setting up human resource practices with a view towards avoiding the biases and blind spots that often preclude entrepreneurs from returning to the most relevant jobs possible (Butler, 2017).

Limitations Our study provides an initial foray into the effect of entrepreneurial human capital on firm innovation and is not without limitations. As noted, our observational data renders our analysis liable to endogeneity concerns. While we have done our best to tackle such concerns, our results could still be driven by unobserved confounders, such as changes in firms' innovation strategy. We nonetheless view our efforts as a first step in a systematic analysis of entrepreneurial human capital and firm performance. We are also limited in our ability to address specific mechanisms linking entrepreneur hires and innovation sales. Although we rule out alternative channels based on technical or managerial skills, we cannot pin down exactly how execution skills affect resource allocation. Moreover, former entrepreneurs may affect firms' inventive capabilities in more subtle ways than we pick up. By disaggregating turnover from innovation into its radical and incremental components we obtain results consistent with the idea that entrepreneur hires add relatively more value in identifying market gaps suitable for

existing products with smaller improvements, although they still positively influence the more technical radical innovation. Future research using detailed patent data could more directly assess entrepreneurs' contribution to inventive activities, perhaps comparing the relative effects of execution, technical, and managerial skills, as well as their complementarity. Finally, subsequent work could explore worker and firm heterogeneity in founder/joiner experience, successful/unsuccessful venturing, organizational bureaucracy, or industry volatility.

Conclusion We propose that former entrepreneurs possess execution skills, a generalist ability to create opportunities by acquiring and mobilizing resources around new ideas, beneficial for employers' innovation. This effect is stronger when entrepreneur hires are coupled with middle management decision rights, while execution skills' generalist profile and accompanying market insight favor incremental over radical innovation. Our work opens a set of research avenues at the interface of innovation, entrepreneurship, and strategy.

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Appendix A   Supplementary Material

A.1   Innovation production function

Our sales from innovation production function assumes a Cobb-Douglas specification regularly used in the innovation literature, including studies of hiring multi-dimensional human capital (Hausman et al., 1984; Blundell et al., 1995; Kim and Marschke, 2005; Kaiser et al., 2015, 2018). Our dependent variable is a firm's share of sales from innovation in a given year, I. This variable takes values in the $[0, 1]$ interval and is a function of (entrepreneurial) labor and capital inputs. In turn, labor is a differentiated input: a firm's labor force, L, is split into newly hired entrepreneurs, L_E, newly hired non-entrepreneurs, L_N, and stayers, L_S, with $L = L_S + L_N + L_E$. To accommodate the fact that many firms will not hire former founders in any given year (an important feature of our data), we construct a composite measure of labor, QL, that combines the different human capital inputs in a linear, additive way (Griliches, 1967; Hellerstein et al., 1999; Galindo-Rueda and Haskel, 2005). Expressed as a function of this quality-adjusted labor input and suppressing firm and time indices, the Cobb-Douglas production function is:

$$I = AK^{\delta}QL^{\rho}, \tag{A.1}$$

where K denotes capital input and A includes additional control variables (other than capital or labor) such as industry, geographical, or time effects that we include in our empirical model. Each type of human capital x adds to the QL composite with a separate coefficient θ_x which measures its impact or marginal productivity relative to stayers (for whom the coefficient θ_S is normalized to 1), or the exchange rate at which one can be converted into the other (Griliches, 1967).[15] Our specification for quality-adjusted labor is then:

$$QL = L_S + \theta_N L_N + \theta_E L_E. \tag{A.2}$$

Expressing the count of stayers as a function of total labor force (i.e. firm size), newly hired non-entrepreneurs and newly hired entrepreneurs, and then factoring out the total labor force, the expression of quality-adjusted labor becomes:

$$QL = L(1 + ((\theta_N - 1)s_N + (\theta_E - 1)s_E), \tag{A.3}$$

where $s_N = L_N/L$ and $s_E = L_E/L$ are the shares of newly hired non-entrepreneurs and newly hired entrepreneurs in the total labor force, respectively. Since employment shares add up to one, excluding stayers from the estimation prevents the model from becoming perfectly collinear. Plugging in the expression for quality-adjusted labor, taking logs in equation A.1, and exploiting the fact that $\ln(1 + z) \approx z$ for small z (which our employment shares satisfy), we obtain the following linear approximation for the (log) of innovation output:

$$\ln I = \ln A + \delta \ln K + \rho \ln L + \beta_N s_N + \beta_E s_E, \tag{A.4}$$

where $\beta_N = \rho(\theta_N - 1)$ and $\beta_E = \rho(\theta_E - 1)$. Using the resulting $\hat{\beta_N}$, $\hat{\beta_E}$, and $\hat{\rho}$ estimates we can then back out the relative impacts $\hat{\theta_x}$ of labor input x and test our theoretical hypotheses. Note that the many zero values introduced by our differentiated human capital inputs (especially new entrepreneur hires) preclude a standard log-linear specification, such that β_N and β_E do not translate directly into elasticities; however, a positive β_x coefficient suggests that hiring an additional unit of labor type x provides higher returns in terms of sales from innovation than would an additional stayer (the excluded category). More importantly, we can compare β_N

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[15] Note that this approach assumes the different types of labor are perfect substitutes, though this assumption can be relaxed with similar results (Hellerstein et al., 1999). This assumption also conveniently implies that the relative marginal productivity of labor type x (to the excluded category) is constant, such that it does not depend on the employment levels in each category (Galindo-Rueda and Haskel, 2005).

and β_E in order to examine the innovation effects of hiring an entrepreneur relative to a non-entrepreneur as a direct test of our hypotheses. To understand the magnitude of our results, the relative effect of hires with founding experience relative to hires without founding experience can then be calculated as $\theta_E/\theta_N = (\rho + \beta_E)/(\rho + \beta_N)$.

Overall, this approach based on an innovation production function with differentiated labor inputs and a composite labor index provides a useful way of measuring the relative contributions of different employment shares to firm innovation. The empirical model we adopt easily extends to alternative dependent variables and additional employment shares, especially when comparing different types of innovation or entrepreneurial hires across managerial positions.

A.2   Additional tables

Appendix Table A.1 displays the pairwise correlations between our main variables, whose summary statistics we report in Table 1. Appendix Table A.2 provides the counterpart to our main estimates in Table 2 using ordinary least squares models without firm fixed effects. The results are similar across the two types of models, suggesting that time-invariant firm characteristics may not strongly affect the relationship between entrepreneurial hires and firm innovation; without firm fixed effects, the effect of entrepreneurial hires on sales from innovation becomes slightly more significant (Model A-II) and the coefficient on new entrepreneurial hires becomes a significant predictor of sales from innovation new to the market (Model A-IV). Appendix Table A.3 then summarizes some of the robustness checks we discuss in the paper with regards to how we compute our independent variable: extending or restricting the time period we consider relevant for founding experience, focusing on direct moves from entrepreneurship to paid employment, and using stocks of former entrepreneurs as opposed to shares of new entrepreneurial hires (Models A-VI-X). We also show tobit estimates for our analysis of sales from innovation (Model A-XI), dealing with censoring in our dependent variable (although not with confounding time-invariant firm characteristics). Finally, we use *Any sales from innovation* as an alternative dependent variable (Model A-XII).

Table A.1: **Correlation table**

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
(1)	Sales from innovation	1.00																					
(2)	... new to firm	0.70	1.00																				
(3)	... new to market	0.66	0.07	1.00																			
(4)	... new to world	0.42	0.01	0.08	1.00																		
(5)	Hires w/ founder experience	-0.03	-0.01	-0.03	-0.02	1.00																	
(6)	... in *top management*	-0.01	-0.01	-0.01	-0.01	0.15	1.00																
(7)	... in *middle management*	0.03	0.02	0.01	0.01	0.21	0.01	1.00															
(8)	... in *non-management*	-0.03	-0.01	-0.03	-0.02	0.98	0.03	0.03	1.00														
(9)	Hires w/o founder experience	-0.09	-0.06	-0.06	-0.04	0.26	0.01	0.04	0.25	1.00													
(10)	Stayers	0.09	0.06	0.07	0.04	-0.32	-0.02	-0.05	-0.32	-1.00	1.00												
(11)	Firm size	0.04	0.04	0.01	0.01	-0.03	-0.01	-0.01	-0.03	0.04	-0.04	1.00											
(12)	Physical capital	0.05	0.04	0.02	0.03	-0.03	-0.01	-0.00	-0.03	-0.03	0.04	0.35	1.00										
(13)	Firm age	0.04	0.04	0.04	0.01	-0.10	-0.01	-0.02	-0.09	-0.19	0.20	0.06	0.04	1.00									
(14)	R&D workers	0.08	0.05	0.04	0.07	-0.04	-0.01	-0.04	-0.04	-0.06	0.06	0.39	0.40	0.10	1.00								
(15)	University graduates	0.09	0.06	0.05	0.06	-0.04	-0.01	-0.01	-0.04	-0.04	0.04	0.56	0.46	0.10	0.93	1.00							
(16)	R&D department	0.38	0.25	0.23	0.22	-0.08	-0.01	0.01	-0.08	-0.17	0.17	0.06	0.10	0.07	0.15	0.16	1.00						
(17)	R&D intensity	0.13	0.05	0.06	0.18	-0.03	-0.01	0.02	-0.03	-0.05	0.05	-0.00	0.03	-0.05	0.09	0.08	0.36	1.00					
(18)	Collaboration breadth	0.32	0.21	0.21	0.17	-0.06	-0.01	0.00	-0.06	-0.12	0.12	0.12	0.16	0.08	0.19	0.21	0.48	0.20	1.00				
(19)	Applied for patent(s)	0.26	0.13	0.15	0.24	-0.07	-0.00	-0.01	-0.07	-0.12	0.12	0.09	0.13	0.06	0.21	0.19	0.50	0.27	0.40	1.00			
(20)	Acquired patent(s)	0.19	0.11	0.12	0.13	-0.02	-0.00	0.01	-0.02	-0.05	0.05	0.11	0.15	0.04	0.17	0.18	0.29	0.12	0.27	0.34	1.00		
(21)	Sales growth	0.01	-0.01	-0.01	0.06	0.03	-0.00	-0.00	0.03	0.06	-0.06	-0.01	-0.00	-0.02	0.00	-0.00	0.01	0.05	0.01	0.03	0.00	1.00	
(22)	Investment intensity	0.06	0.03	0.03	0.06	-0.00	-0.01	0.02	-0.00	0.03	-0.03	0.00	0.12	-0.03	0.03	0.03	0.09	0.20	0.11	0.10	0.05	0.02	1.00

All pairwise correlations larger than 0.014 (in absolute terms) are significant at the 5% level; the data covers years 2007-2016.

Table A.2: **Ordinary least squares models**

		Model A-I: Sales from innovation			Model A-II: Sales from innovation			Model A-III: Sales from innov. new to firm			Model A-IV: Sales from innov. new to market			Model A-V: Sales from innov. new to world		
		β	p	s.e.	β	p	s.e.	β	p	s.e.	β	p	s.e.	β	p	s.e.
	Lagged employment shares															
(1)	Hires with founder experience	0.422	0.004	0.146				0.275	0.010	0.107	0.163	0.054	0.085	-0.017	0.766	0.056
(2)	... in *top management*				-1.083	0.158	0.767									
(3)	... in *middle management*				2.123	0.040	1.034									
(4)	... in *non-management*				0.131	0.372	0.147									
(5)	Hires without founder experience	-0.007	0.604	0.014	-0.002	0.867	0.014	-0.005	0.613	0.009	-0.015	0.076	0.008	0.012	0.067	0.007
	Control variables	Yes			Yes			Yes			Yes			Yes		
	Sales growth/investment intensity	Yes			Yes			Yes			Yes			Yes		
	Industry-year fixed effects	Yes			Yes			Yes			Yes			Yes		
	Firm fixed effects	No			No			No			No			No		
	Number of observations/firms	21,844/5,419			21,844/5,419			21,844/5,419			21,844/5,419			21,844/5,419		
	Adjusted R^2	0.185			0.185			0.086			0.072			0.085		
	F-tests															
	Hypothesis 1: (1)=(5)	8.30	0.004					6.67	0.010		4.19	0.041		0.25	0.620	
	Hypothesis 2: (3)=(2)				6.15	0.013										
	Hypothesis 2: (3)=(4)				3.63	0.056										
	Hypothesis 2: (3)=(2) *and* (4)				3.09	0.046										
	Hypothesis 3: (III)=(IV)							0.71	0.399							
	Hypothesis 3: (III)=(V)							5.82	0.016							
	Hypothesis 3: (IV)=(V)							3.18	0.075							

Robust standard errors clustered by firm. Sample restricted to firms older than 5 years and with more than 25 employees, for years 2007-2016; stayers represent the baseline category. All models estimated by ordinary least squares (without firm fixed effects).

Table A.3: **Robustness checks**

	Sales from innovation																		Any innov. sales		
	Model A-VI: Founder + 3y			Model A-VII: Founder − 2y			Model A-VIII: Direct hires			Model A-IX: Leads			Model A-X: Stocks			Model A-XI: Tobit			Model A-XII: Founder		
	β	p	s.e.	β	p	s.e.	β	p	s.e.	β	p	s.e.	β	p	s.e.	β	p	s.e.	β	p	s.e.
Lagged employment shares																					
Hires w/ founder exp.	0.396	0.019	0.169	0.387	0.095	0.232	0.637	0.025	0.284	0.070	0.719	0.196	0.370	0.052	0.190	1.845	0.008	0.698	0.032	0.902	0.261
Hires w/o founder exp.	-0.007	0.708	0.020	-0.003	0.898	0.020	-0.001	0.963	0.020	-0.005	0.828	0.024				-0.113	0.115	0.072	-0.053	0.070	0.029
Control variables	Yes			Yes			Yes			Yes			Yes			Yes			Yes		
Sales growth/investment	Yes			Yes			Yes			Yes			Yes			Yes			Yes		
Industry-year FEs	Yes			Yes			Yes			Yes			Yes			Yes			Yes		
Firm fixed FEs	Yes			Yes			Yes			Yes			Yes			No			Yes		
Number of obs./firms	20,271/3,846			20,271/3,846			20,271/3,846			17,649/3,599			20,271/3,846			21,844/5,419			20,271/3,846		
Adjusted R^2	0.310			0.310			0.310			0.308			0.310						0.490		

Robust standard errors clustered by firm, OLS FE models (except in Model A-XI). Sample restricted to firms older than 5 years and with more than 25 employees, for years 2007-2016; stayers represent the baseline category, except in Model A-X, where we include the stock of workers with founder experience.