RESOURCE ORCHESTRATION IN STARTUPS: SYNCHRONIZING HUMAN CAPITAL INVESTMENT, LEVERAGING STRATEGY AND FOUNDER STARTUP EXPERIENCE[1]

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RESOURCE ORCHESTRATION IN STARTUPS: SYNCHRONIZING HUMAN CAPITAL INVESTMENT, LEVERAGING STRATEGY AND FOUNDER STARTUP EXPERIENCE[1]

Research summary: We examine the performance effects of resource orchestration in startups by investigating three key contingencies of resource orchestration: human capital (HC) investment relative to rivals, leveraging strategy and founder startup experience. We find that deviating from rivals' resource investments (either above or below the industry mean) negatively affects performance, while conforming to the norms set by rivals positively affects performance. However, we also find that a higher investment in HC relative to rivals is less detrimental when aligned with a leveraging strategy focused on innovation. In addition, we find evidence that this relationship is conditioned by the entrepreneurial experience of the founders themselves.

Managerial summary: To create value, entrepreneurs need to assemble and manage various resources and capabilities. We explain how entrepreneurs can manage their resources to achieve higher performance. Using a sample of U.S. startups we find that deviations in human capital (HC) investments relative to rivals (either below or above) harm the performance of startups. However, we also find that a higher investment in HC relative to rivals is less detrimental when the startup is focused on innovation. In addition, we find that *experienced* founders benefit from actively orchestrating HC investments relative to rivals with a strategy focused on innovation.

[1] Keywords: Resource orchestration; human capital investment; strategic entrepreneurship; new ventures; dynamic managerial capabilities

INTRODUCTION

Combining various resources and capabilities to achieve superior performance is a key managerial activity (Helfat, Finkelstein, Mitchell, Peteraf, Singh, Teece and Winter, 2007; Sirmon, Hitt and Ireland, 2007; Teece, Pisano and Shuen, 1997). Although the resource-based view (RBV) highlights the value of strategic resources for organizational performance (Barney, 1991; Barney, Ketchen and Wright, 2011; Crook, Ketchen, Combs and Todd, 2008), it has been less able to address how managers use these resources to create value (Priem and Butler, 2001; Sirmon *et al.*, 2007). Recent work on dynamic managerial capabilities (Helfat *et al.*, 2007; Teece *et al.*, 1997) and resource management (Sirmon *et al.*, 2007) highlights the critical role of managers in the conversion of firms' resources into firm capabilities. Managers need to evaluate, integrate, combine, and exploit bundles of resources in order to achieve a resource-based advantage (Augier and Teece, 2009). As Helfat *et al.* (2007) argue, 'the process of assembling and *orchestrating* particular constellations of assets for economic gain is a fundamental function of management' (Helfat *et al.*, 2007:23).

Central to these frameworks is the notion of fit between resources and deployment decisions. As Sirmon *et al.* (2007) note, developing a fit between a firm's resource investments and its leveraging strategy is important for value creation. Leveraging is the process by which firms apply their capabilities to augment the value proposition offered to customers. Despite the theoretical and practical importance of aligning resources with leveraging strategy (Sirmon *et al.*, 2007), testing of this relationship has been limited. Investigation of the contingencies that affect 'resource orchestration' is warranted, as a recent meta-analysis of the resource-performance relationship suggests that contingencies within managers' resource choices are poorly understood (Crook *et al.*, 2008) and that such work may prove valuable to both resource management and dynamic managerial capabilities

perspectives (Baert, Meuleman, Debruyne and Wright, 2016; Helfat *et al.*, 2007; Sirmon, Gove and Hitt, 2008).

In addition, while much work has been undertaken on the entrepreneur's characteristics as drivers of entrepreneurial performance (Shane, 2002; Wright, Hmieleski, Siegel and Ensley, 2007), the linkages with asset orchestration have not yet been explicated. While scholars have recently offered theoretical insights on how resources are orchestrated across a portfolio of startups (Baert *et al.*, 2016), studies have largely overlooked the role of the founder's experience in orchestrating resources and leveraging capabilities. As a result, although the role of the individual founders and their imprints is heightened during those early years (Autio, George and Alexy, 2011), little is known about the micro-foundations of resource orchestration.

In this study, we examine the performance effects (revenue growth) of resource orchestration in start-ups by investigating three key contingencies: human capital (HC) investment relative to rivals, leveraging strategy focused on innovation and founder startup experience. Building on research on imitation (Deephouse, 1999; Lieberman and Asaba, 2006; Sirmon and Hitt, 2009) and industry norms (Spender, 1989), we examine how management of resources in entrepreneurial startups creates value. We find that deviating from rivals' resource investments (either above or below the industry mean) negatively affects revenue growth, while conforming to the norms set by rivals positively affects revenue growth. However, we also find that a higher investment in HC relative to rivals is less detrimental when aligned with a leveraging strategy focused on innovation. In addition, we find evidence that this relationship is conditioned by the entrepreneurial experience of the founders themselves.

This study makes three contributions to theory. First, we contribute to the literature on the *micro-foundations* of resource orchestration by highlighting the critical role of founder

startup experience in the orchestration of the various elements of the business to create value. Although the past few years have witnessed the emergence of efforts to examine the micro-foundations of RBV (Barney *et al.*, 2011; Coff and Kryscynski, 2011; Foss, 2011), there is a dearth of research examining the *'micro-foundations of resource orchestration'* i.e. the individual-level characteristics, actions and interactions that grant firms unique capabilities in structuring, bundling and leveraging resources. While Baert *et al*. (2016) identify the subprocesses by which entrepreneurs obtain and leverage resources across a portfolio of ventures, we still lack an understanding of the micro-level enablers of orchestrating resources.

By proposing a three-way interaction between leveraging strategy, human capital investment and founder startup experience we empirically examine how experience, an important precursor of "managerial cognitive capabilities" (Helfat and Peteraf, 2015:831), critically underpins the process of resource orchestration. Specifically, we find that entrepreneurs who possess more experience in founding ventures are better able to synchronize high investments in human capital with a leveraging strategy focused on innovation, than entrepreneurs with less experience. In doing so, we also complement existing research that investigates the cognitive and affective micro-foundations of dynamic managerial capabilities (Helfat and Peteraf, 2015; Teece, 2007; Zott and Huy, 2007), and identify founder startup experience as an important factor that underpins managerial capabilities for resource orchestration.

Second, we respond to the call by Sirmon and Hitt (2009:1391) to "explore additional contingencies in resource management and asset orchestration". In particular, we are unaware of research examining the performance implications of orchestrating resource investments in the *innovation* process. Investigating the contingencies of resource orchestration in innovation is promising because innovation is a challenging yet critical organizational

endeavor (Carnes, Chirico, Hitt, Huh and Pisano, 2016). Specifically, we examine the interactive effects of a leveraging strategy focused on innovation and resource investments on performance.

In doing so, we contribute to an understanding of the conditions under which the divergence of startups' investment choices from those of rivals becomes favorable. There has been limited research examining how deviations from the norm (Deephouse, 1999) affect the innovation process and performance of startups. Given that innovation is a significant driver of firm performance (Laursen and Salter, 2006), it is crucial to understand how entrepreneurs orchestrate their human capital investments for innovation.

Third, by exploring the tension between conformity to and deviation from the norms of rivals, and integrating it with entrepreneurs' asset orchestration decisions, we add richness to our understanding of the value of *strategic similarity* in the new venture context. Despite the popular belief that entrepreneurial ventures should be novel, distinctive and non-conforming (Navis and Glynn, 2011), we find evidence that conformity to rivals' human capital investments is beneficial. Deviation from rivals' HC investments can only produce optimal results when resource investments and leveraging strategy are effectively synchronized. This suggests that performance depends on the match between investment decisions, leveraging strategy and other contingencies within the resource orchestration framework. Thus, the way entrepreneurs synchronize leveraging strategy and investment plays a critical role in achieving a resource-based advantage and can inform research on the dilemma that entrepreneurs face when choosing between conformity and differentiation.

Our findings are in contrast to existing theories which suggest that high human capital investments produce performance benefits (Crook *et al.*, 2008; Hitt, Uhlenbruck and Shimizu, 2006; Kor and Leblebici, 2005), and have important implications for how nascent entrepreneurs manage human resources in new ventures (Coff and Kryscynski, 2011). We

argue that allocating greater human capital investments relative to rivals may constrain new ventures' insubstantial stock of resources and produce negative performance outcomes. However, we also argue that lower HC investments relative to rivals can also harm the performance of new ventures whereas conformity to rivals' investments can be beneficial. Simply conforming to rivals' investments however does not fully leverage the potential value that entrepreneurs can create by orchestrating firm assets.

THEORETICAL BACKGROUND AND HYPOTHESES

The concept of 'fit' between two or more organizational factors has been central to contingency theory (Donaldson, 2001; Van de Ven and Drazin, 1984; Venkatraman and Camillus, 1984). Specifically, the concept of 'aligning' or 'synchronizing' complex organizational elements (strategy, structure, environment, technology, systems) to achieve organizational success has driven a number of theoretical developments in the strategy and other management literatures (Chandler, 1962; Hofer, 1975; Lawrence and Lorsch, 1967; Meyer, Tsui and Hinings, 1993; Miller, 1981; Thompson, 1967). Overall, research on organizational theory and strategic management suggests that a better 'fit' results in higher performance.

A recent research stream in the strategy literature applies contingency theory to the investigation of the resource-strategy relationship (Chirico, Sirmon, Sciascia and Mazzola, 2011; Gruber, Heinemann, Brettel and Hungeling, 2010; Holcomb, Holmes and Connelly, 2009; Morrow, Sirmon, Hitt and Holcomb, 2007; Sirmon, Hitt, Arregle and Campbell, 2010a; Sirmon, Hitt, Ireland and Gilbert, 2010b). For example, Hitt *et al.* (2006) demonstrate the importance of human and relational capital to internationalization and firm performance (Hitt *et al.*, 2006). Kor and Leblebici (2005) find that, while bundling senior partners with less experienced associates in law firms positively affects performance, combining this type of bundling with higher levels of service or geographical diversification harms performance.

Sirmon and Hitt (2009) demonstrate that when managers' deployment decisions support investment decisions, deviation from rivals' investment choices in physical and human capital enhances performance.

Building on previous work (Helfat *et al.*, 2007; Sirmon *et al.*, 2007), Sirmon *et al.* (2010b) integrate the resource management and asset orchestration perspectives into a unifying framework called the 'resource orchestration framework'. This framework proposes that it is not the *possession* but the *management* of resources (through bundling, accumulation, and coordination of co-specialized assets) that facilitates the creation of a competitive advantage (Sirmon *et al.*, 2010b). This framework is essentially a contingency model whereby firms pursue a 'fit' between resources acquired and strategies deployed in order to influence the performance outcome. The notion of dynamic managerial capabilities (Adner and Helfat, 2003) is central to the framework. Based on the limited work available and its importance to effective management, investigating contingencies in resource orchestration in the context of startups may add richness to the resource orchestration framework and shed light on the value-creating strategies of new firms.

Resource investment decisions relative to rivals

In the early stages of new venture development, a manager's ability to identify, acquire, and allocate resources across business projects/functions is a crucial component in forming dynamic capabilities and creating a sustainable competitive advantage (Bardolet, Lovallo and Teece, 2013; Barney, 1991; Lichtenstein and Brush, 2001). It is well-established in the strategy literature that differences in firms' ability to achieve sustainable competitive advantage are attributable to differences in the way they manage their resource portfolio (Helfat *et al.*, 2007; Penrose, 1959; Sirmon *et al.*, 2007; Teece *et al.*, 1997). In deciding how to leverage their resources and capabilities, new ventures need to choose resource bundles

that will allow them to position themselves successfully in the marketplace (Lichtenstein and Brush, 2001; Penrose, 1959; Sirmon *et al.*, 2007).

Given the wide-ranging implications for their future trajectory, new ventures need to make an early choice between differentiation and strategic similarity (Deephouse, 1999). In the former strategy, the new venture reduces competition by establishing a distinct position in an unexploited niche, allowing it to establish barriers to entry and benefit from local monopolies (Baum and Mezias, 1992; Deephouse, 1999; Porter, 1979). In the latter, the new venture chooses to be 'similar to others ... [in order to] avoid legitimacy challenges that can hinder resource acquisition' (Deephouse, 1999:152). As these two strategies have important implications for the strategic position of the firm, they may differentially influence its subsequent performance. We clarify that in this study we measure performance as revenue growth, which is an appropriate measure of the performance and competitive advantage creation in startups (Kor and Mahoney, 2003; Penrose, 1959).

Specifically, by investing resources at higher levels than rivals, firms can establish a niche that is relatively sheltered from competition, which may enhance their performance (Sirmon and Hitt, 2009). This is particularly true for new ventures that lack the necessary economies of scale to compete directly with large firms, and are thus often forced to pursue strategic differentiation. In contrast, startups may choose to imitate the resource investments of other firms in order to gain legitimacy. Research shows that imitation is a common behavior in highly uncertain environments where quick actions are necessary (Lieberman and Asaba, 2006). Firms imitate each other in a range of activities, such as the introduction of new products or services, adoption of organizational forms, market entry, and allocation of resources (Deephouse, 1999; Sirmon and Hitt, 2009). In a new venture environment, most decisions are made under conditions of uncertainty (Knight, 1921), so imitation may be viewed as a very attractive option. Imitation provides legitimacy (Hannan and Freeman,

1987), minimizes risks (Katz and Shapiro, 1985), reduces uncertainty (DiMaggio and Powell, 1983), and economizes on search costs (Cyert and March, 1963). In general, it is suggested that firms with comparable resource endowments imitate each other in order to maintain competitive parity or limit rivalry (Lieberman and Asaba, 2006).

Human capital investment decisions in startups

One of the most critical resource investments that firms make is in human capital (Helfat and Peteraf, 2003; Penrose, 1959; Teece, 1998; Youndt, Snell, Dean and Lepak, 1996). The tacit nature of human resources (knowledge and skills of employees) makes their imitation difficult, which may then provide the basis for a sustained competitive advantage (Teece, 1998; Youndt *et al.*, 1996). However, research on the human capital investment–performance relationship has been mixed: in stark contrast to the results of RBV research (Crook *et al.*, 2008; Newbert, 2007), of 33 studies identified by Newbert (2007), only 11 support the notion that human capital investment is positively and significantly related to firm performance. One explanation for this contradictory evidence is that human capital investment is contingent on other firm characteristics, such as stage of development or strategic choice. Rather than attempting to argue that firms should make human capital investments under all conditions and at all stages, we focus on human capital investments in new ventures.

There are several reasons why high investments in human capital may provide firms with important performance benefits (Geroski, Mata and Portugal, 2010; Gimeno, Folta, Cooper and Woo, 1997; Hitt *et al.*, 2006; Hitt, Bierman, Shimizu and Kochhar, 2001; Kor and Leblebici, 2005; Shane, 2002; Sirmon and Hitt, 2009; Wright *et al.*, 2007). Higher human capital investments than rivals serve as a legitimacy signal to VCs (Baum and Silverman, 2004) and as a signal that the startup has more slack resources, which may in turn positively influence innovation and performance (George, 2005). In addition, low investments in human capital may be detrimental to the motivation and productivity of

employees (Geroski *et al.*, 2010). Lower investment may also facilitate rapid labor turnover, hindering knowledge accumulation and the transfer of tacit knowledge within the firm (Hatch and Dyer, 2004). Having inferior human resource endowments relative to competitors makes new ventures less attractive than rivals, who may develop a reputation for having higher quality personnel (Shane, 2002), thus incentivizing highly skilled people who prefer to work in a company with higher pay and with more qualified and experienced colleagues (Sirmon and Hitt, 2009). For all the above reasons, we hypothesize that:

> ***Hypothesis 1a:*** *A lower human capital investment relative to rivals is negatively associated with startup performance.*

On the other hand, there are several reasons why higher human capital investments relative to rivals might harm startup performance (Crook, Todd, Combs, Woehr and Ketchen Jr, 2011). First, paying higher salaries to attract good candidates may be risky for resource-poor startups, as this may prevent them from allocating these additional resources to other areas. Entrepreneurs face significant liabilities of newness and smallness during early development (Stinchcombe, 1965) that limit their potential to scale up effectively and efficiently. With limited slack, high investment in one resource may restrict cash flows to alternatives, corresponding with expensive opportunity costs.

Second, because resource accumulation in startups may be path dependent, firms are locked into particular directions (David, 1985; Hannan and Freeman, 1984) that may lead to areas of competitive deficiency or disadvantage (Leonard‐Barton, 1992; Sydow, Schreyögg and Koch, 2009). For example, if a startup overfunds one type of resource over another, it might be compelled to adopt cost minimization practices such as buying cheap materials or investing in inferior technologies (e.g. software, databases). Therefore, a choice to overfund one resource over another may have a significant impact on the performance of new ventures and even threaten startup survival. For instance, short-run resource constraints may threaten

startup survival in internationalization (Sapienza, Autio, George and Zahra, 2006) and limit the opportunities they are able to exploit (Kumar, 2009).

Third, paying a higher price for a human resource than a competitor is risky because hiring can be costly if the candidate turns out to be inadequate. Making an employee redundant is costly and disruptive and this cost is greater for higher salaried employees. Investing in higher levels of human capital than rivals may also be inefficient, as the additional investment in human capital would also require greater revenue growth in order to be considered as an acceptable return on investment (Sirmon and Hitt, 2009).

We clarify that our argument is about human capital investments relative to rivals and not about absolute levels of human capital. The argument suggests that investing at levels consistent with rivals (i.e. paying the average human capital investment in the industry) can be an optimal decision. Conformity with rivals can offer managers a safe alternative and can be particularly useful in uncertain and complex situations (Sirmon and Hitt, 2009) that are often the case with startups.

Therefore, we expect that a higher investment in human capital relative to rivals (i.e. paying above the mean investment in the industry) is risky and may lead to inefficiencies and lower performance. In the context of new ventures, which are significantly resource constrained, these risks and inefficiencies may significantly outweigh any advantages of higher capital investments than the industry mean. For all the above reasons, we hypothesize that:

> ***Hypothesis 1b:*** *A higher human capital investment relative to rivals is negatively associated with startup performance.*

Contingencies in resource orchestration: Aligning human capital investments with leveraging strategy and founder startup experience

However, mere possession of resources does not bestow a competitive advantage; rather, it is the management of resources that may facilitate the creation of a competitive advantage (Baert *et al.*, 2016; Helfat *et al.*, 2007; Helfat and Peteraf, 2003; Penrose, 1959; Priem and Butler, 2001). Resource orchestration is the process of structuring the firm's resource portfolio, bundling the resources to build capabilities, and leveraging those capabilities to create value (Sirmon *et al.*, 2008; Sirmon *et al.*, 2010b). Therefore, aligning resource investments with leveraging decisions is likely to affect performance. *Leveraging* is the process by which firms apply their capabilities to create value (Sirmon *et al.*, 2007). For example, a startup with a deep knowledge base can invest in new products or services that enable it to match its capabilities to customers' needs. The tacit knowledge embedded in human capital enables leveraging processes that focus on exploiting market opportunities. In attempting to create value for customers, startups may choose to exploit new opportunities by leveraging their R&D capability for innovations, such as new product offerings or new services in the market. Differences in R&D intensity should lead to significantly different capacities for innovation (Leiponen and Helfat, 2010; Nelson, 1961). However, the innovation process requires active orchestration of both intangible and tangible assets by entrepreneurs (Augier and Teece, 2009). In fact, entrepreneurs should match human capital investment decisions with value-creating leveraging strategies.

Startups that pursue a leveraging strategy focusing on innovation require more qualified and skilled employees who have knowledge of the most recent scientific and technological developments in their field. They also require employees with greater industry experience, as such employees have better knowledge of customer preferences and can find solutions to customers' problems. In order to benefit from a leveraging strategy focused on

innovation, startups also need to motivate employees and reward innovation. This ensures that tacit knowledge accumulates and remains within the firm, which then allows it to assimilate, absorb, and integrate knowledge from external sources (Cohen and Levinthal, 1990).

We argue that the negative relationship between high human capital investment relative to rivals and startup performance would be less pronounced in startups adopting a leveraging strategy focused on innovation. Although conformity with rivals would still pay off, firms adopting a leveraging strategy focused on innovation would suffer less than other firms from paying higher than rivals. In this situation, the benefits of higher human capital investment in startups with a focus on innovation would partly mitigate the negative effects of higher human capital investments. Such investments will allow startups to acquire and retain talented employees with important problem-solving and technical skills, which may enhance product features and facilitate innovation within the firm. But they do not entirely diminish the negative effects as firms may still suffer from (a) higher opportunity costs; (b) being locked into particular directions that may lead to areas of competitive deficiency or disadvantage; and (c) the riskiness of higher salaries if the candidate turns out to be inadequate.

On the other hand, the negative relationship between a lower human capital investment relative to rivals and startup performance would be more pronounced in startups adopting a leveraging strategy focused on innovation. For startups pursuing a leveraging strategy focused on innovation paying less than rivals would hurt the firm even more. The required skills (e.g. scientific) and experience of employees in these startups are higher. Although conformity with rivals would still be the optimum scenario, employees are less interchangeable and possess more tacit knowledge thus making it more important to maintain adequate human capital investments. As a result, when startups are pursuing a leveraging

strategy focused on innovation, lower human capital investments relative to rivals would hurt firm performance. Thus, we posit:

Hypothesis 2a: *The negative relationship between a lower human capital investment relative to rivals and startup performance is more pronounced in startups adopting a leveraging strategy focused on innovation.*

Hypothesis 2b: *The negative relationship between a higher human capital investment relative to rivals and startup performance is less pronounced in startups adopting a leveraging strategy focused on innovation.*

A firm consists of bundles of resources that need to be evaluated, integrated, combined, and exploited in order to create value. One of the most important activities for entrepreneurs is to accumulate and combine different types of resources to achieve superior performance. An entrepreneur's *experience* in assembling and orchestrating constellations of resources can be critical for startup performance (Baert *et al.*, 2016; Ucbasaran, Westhead and Wright, 2009).

We argue that owners with significant entrepreneurial experience are better able to benefit from matching high investments in human capital with a strategy focused on innovation, compared to owners without experience. Entrepreneurial experience provides owners a "familiar corridor for additional knowledge, skills, and abilities regarding firm creation" (Baum et al., 2014:81) which enables them to achieve greater absorptive capacity. Entrepreneurs with higher absorptive capacity can better recognize opportunity and continuously innovate (Alvarez and Busenitz, 2001; Baum, Frese and Baron, 2014). We expect that experienced entrepreneurs that have gained knowledge from managing early stage organizations, recognize the importance of managing human capital effectively and are better positioned to match a firm's investments in human capital with its innovation strategy. Thus, owners with prior entrepreneurial experience that pursue a leveraging strategy focused on

innovation will be better at acquiring and retaining highly skilled employees with important problem-solving and technical skills which are required to enhance product features and facilitate innovation within the firm. This experience will partly, but not entirely, mitigate the negative effects of high human capital investment relative to rivals on performance.

Alternatively, less experienced entrepreneurs may find it more difficult to match the firm's investments in human capital with its innovation strategy. Specifically, we expect inexperienced entrepreneurs to be less effective in matching low human capital investments relative to rivals with a strategy that focuses on innovation. Although, the investments in human resources needed for startups concentrating on innovative activities may be higher, novice entrepreneurs might pay far less than what is needed which is likely to increase risk and even threaten startup survival. Therefore, the negative effects of low human capital investment relative to rivals on performance will be more pronounced when leveraging strategy focused on innovation is high and founder startup experience is low. Thus, we hypothesize that:

> ***Hypothesis 3a:*** *There is a three-way interaction between human capital investment relative to rivals, leveraging strategy focused on innovation and founder startup experience, such that the negative effect of low human capital investment relative to rivals on performance is more pronounced when leveraging strategy focused on innovation is high and founder startup experience is low.*

> ***Hypothesis 3b:*** *There is a three-way interaction between human capital investment relative to rivals, leveraging strategy focused on innovation and founder startup experience, such that the negative effect of high human capital investment relative to rivals on performance is less pronounced when both leveraging strategy focused on innovation and founder startup experience are high.*

METHODOLOGY

Sample

To test our hypotheses, we tracked all startups in the Kauffman Firm Survey (KFS) that were R&D active between 2004 and 2010. Specifically, we used the proprietary KFS dataset of U.S. startups which was formed from a random sample of 32,469 firms from Dun and Bradstreet's database of all startups formed in 2004 in the U.S., excluding non-profit firms, those owned by an existing business, and firms inherited by someone else (DesRoches, Robb and Mulcahy, 2010). The KFS team interviewed the founders of 4,928 startups and surveyed them annually for several years (DesRoches *et al.*, 2010). In total, the analysis included 996 (unbalanced) firm year observations. Our sample consisted of seven years of panel data from 2004 to 2010 (520 startups in total).

The startups in our sample operated in 16 different two-digit North American Industry Classification System (NAICS) codes. Table 1 presents the industries in which the startups competed, the most common being NAICS 31-33 (Manufacturing), accounting for about 39 percent of the sample, and NAICS 54 (Professional, Scientific, and Technical Services), accounting for 25.8 percent of the sample. On average, startups experienced a 32 percent increase in revenues.

[INSERT TABLE 1 ABOUT HERE]

Our unique dataset enabled us to test more accurately the effect of human capital investment on performance. By tracking human capital and R&D investments longitudinally, we were able to overcome a common empirical challenge in studies of innovation. As several scholars have pointed out, human capital is path dependent, which suggests that its value is likely to develop over time (Crook *et al.*, 2011; Penrose, 1959). As such, cross-sectional designs that do not capture this temporal component are unable to clarify the true nature of the relationship between human capital investment and performance. This study addresses

this challenge by observing changes in performance over time while capturing the lagged effects of investments in human capital.

A second common empirical challenge is overcoming sample selection issues which may distort results. Selection biases are common in studies of innovation, as simply observing these startups does not take into account that these firms (innovative startups) are not a random sample. Our dataset is uniquely appropriate to overcoming this challenge as it provides information on startups without R&D activities, making it easier to correct for selection bias using the Heckman two-stage method.

Dependent variable

Performance. We measured the performance of startups in several ways. First, we took the natural logarithm of the percentage *change* in revenues from the previous year (Baum, Locke and Smith, 2001; Delmar and Shane, 2006). The log transformation was used to reduce dispersion in the growth rates of new ventures. Performance was calculated by taking the difference between the revenues in years *t* and *t*-1 and dividing this by the revenues in year *t*-1. This *relative* measure of startup growth is frequently used in the industrial organization and labor economics literature because it reduces the impact of firm size on the growth indicator. Firm growth is an appropriate measure of the performance and competitive advantage creation of startups (Kor and Mahoney, 2003; Penrose, 1959), especially when several growth indicators are tested separately (Davidsson, 2006). Second, we also used an additional indicator for firm performance - revenue growth *relative to rivals*. Third, we used an alternative operationalization of the dependent variable - profits - and our results are consistent.

Independent variables

Human capital investment relative to rivals. We followed Deephouse's (1999) method to measure deviation in human capital investments. Specifically, we created a

variable that measured the annual deviation in human capital investment between startups and the industry (three-digit) mean. In a given year, wages per employee for each startup were compared to the industry mean wage per employee, and expressed as a standard deviation. The following equation measures the deviation in human capital investment of startup *i* in year *t*, where W_{it} is the wage per employee for startup *i* in year *t*, W_t is the mean wage per employee in year *t* for startups in the same industry, and SD(Wt) is its standard deviation:

$$\text{Deviation}_{it} \text{ in Human Capital Investment} = (W_{it} - M(W_t))/SD(W_t)$$

Whereas Deephouse (1999) takes the absolute value of the deviation variable, we purposefully distinguish between negative (below mean) and positive (above mean) deviation levels to test our hypotheses. Investigating deviation levels that are lower or higher than rivals is theoretically more meaningful than taking the absolute deviation which measures only movements from mean industry investment.

Employees' wages are a valid measure of investments in human capital (Abowd, Kramarz and Margolis, 2003). In labor economics, most of the differences in wages can be explained by differences in the attributes of employees. Hitt *et al.* (2001) found starting salaries to be positively correlated with the education of individuals. A smaller proportion of the wage differential can be attributed to firms' employee retention strategies. For example, firms will tend to pay a higher wage than rivals in order to reduce employee turnover and save the costs of hiring and training new employees (Stiglitz, 1985). (In labor economics, the efficiency wage model suggests that the productivity of employees is positively related to the wages they receive.) Although we acknowledge that wages can also reflect firm heterogeneity, we argue that personal heterogeneity is a substantially more important determinant of wages (Abowd *et al.*, 2003). Thus, we draw on the work in strategy and labor economics that argues that differences in wages are explained by differences in the attributes

of employees (Abowd, Kramarz and Margolis, 2003; Hitt et al., 2001; Sirmon and Hitt, 2009).

Leveraging strategy focused on innovation. We measured a 'leveraging strategy focused on innovation' by the deviation from rivals in the proportion of employees responsible for the creation of *new products* and *services*. A high positive deviation means that startups have a strong focus on innovation. Similarly, O'Brien (2003) measured the R&D intensity of a firm relative to its industry rivals to indicate the strategic importance of innovation to the firm (O'Brien, 2003). R&D intensity is used as a proxy for innovation as it has been found to be positively associated with measures of innovative output and new product introductions (Hitt, Hoskisson and Hicheon, 1997). We also created a second variable of R&D employees as a proportion of total employees.

To create our first measure we followed Deephouse's (1999) method. Specifically, we created a variable that measured the annual deviation in R&D intensity between startups and the industry (three-digit) mean. In a given year, the proportion of employees responsible for the creation of *new products* and *services* for each startup was compared with the equivalent industry mean proportion and expressed as a standard deviation. The following equation measures the deviation in R&D intensity of startup *i* in year *t*, where R_{it} is the proportion of employees responsible for the creation of *new products* and *services* for startup *i* in year *t*, R_t is the mean proportion of employees responsible for the creation of *new products* and *services* in year *t* for startups in the same industry, and $SD(R_t)$ is its standard deviation:

$$\text{R\&D Deviation}_{it} = (R_{it} - M(R_t))/SD(R_t)$$

Founder startup experience. We measured prior startup experience of the founders by summing the number of prior businesses created per founder, and taking the log of this number (Eesley and Roberts, 2012). Founders' prior experience can have a positive influence on new venture performance, as it can help endow the new venture with a wider range of

skills (Gimeno *et al.*, 1997) and valuable contacts with customers, suppliers, and investors (Shane, 2002). We also created a binary measure of this variable that equals one if the founders have any prior entrepreneurial experience and zero otherwise, which we used in our robustness checks.

Control Variables

We controlled for founder, firm, and industry characteristics as well as year effects.

Founder education. We controlled for the education of the founder with a binary variable that equals one if the owner had a college degree and zero otherwise (Geroski *et al.*, 2010).

Work experience. Previous work experience has been linked with venture growth (Colombo and Grilli, 2005; Hsu, 2007). We calculated work experience of the founder by taking the log of the years that the founder had worked before founding the business.

Industry experience. Companies founded by individuals with previous experience in the same industry they currently operate in may positively influence performance (Shane, 2002). We controlled for previous experience in the industry with a binary variable that equals one when the founder had experience in the same industry and zero otherwise.

Number of employees. We controlled for the size of the startup by taking the natural logarithm of the total number of employees (Geroski *et al.*, 2010).

VC. We controlled for access to venture capital financing with a binary variable that equals one if the startup had received VC investment and zero otherwise (Stuart, Hoang and Hybels, 1999).

High-tech. Our measure of high-tech industry, adapted from Hecker's (2005) definition of high technology industries, is a dummy variable indicating whether firms compete in high technology areas (Hecker, 2005).[2]

Location. To control for location effects on wages we create a dummy variable indicating whether the startup is located in one of the top U.S. states ranked as high in human capital investments using the Milken Human Capital Investment Composite Index.[3]

Year and industry dummies. Finally, we controlled for year and industry effects.

Model and Econometric Approach

To test our hypotheses we used spline functions in our models. Spline functions are used to test theory that suggests that a continuous relationship can change slopes at theoretical meaningful thresholds called 'knots' (Greene and Zhang, 1997; Newson, 2001). Spline functions can expose differences in behavior above and below a critical threshold. In our study, we examine high and low investments in human capital relative to rivals. Thus, instead of splitting the human capital investment variable and examining different subsamples, we instead create splines based on the mean investment of rivals. The mean deviation is zero (i.e. conforming to rivals' investments), therefore we split this continuous variable into two separate ones that allow us to model the relationship 'above' and 'below' the knot. Spline functions have been used previously in management research. Sirmon and colleagues (2009, 2010a) use splines to model investments in human and physical capital

[2] High technology areas are NAICS 3345 (Navigational, measuring, electromedical and control instruments), NAICS 3254 (Pharmaceutical and medicine manufacturing), NAICS 3341 (Computer and peripheral equipment manufacturing), NAICS 3342 (Communications equipment manufacturing), NAICS 3344 (Semiconductor and other electronic component manufacturing), NAICS 3332 (Industrial machinery manufacturing), NAICS 3335 (Metalworking machinery manufacturing), NAICS 5417 (Scientific research and development services), NAICS 5415 (Computer systems design and related services), NAICS 5112 (Software publishers), NAICS 3346 (Manufacturing and reproducing magnetic and optical media), NAICS 3359 (Other electrical equipment and component manufacturing), NAICS 3364 (Aerospace product and parts manufacturing), NAICS 3329 (Other fabricated metal product manufacturing), NAICS 3251 (Basic chemical manufacturing).

[3] This Human Capital Investment index ranks the U.S. states based on workforce development indicators such as the percentage of population with postgraduate degrees, the percentage of population with science and engineering degrees, the number of doctoral engineers and doctoral scientists per 100,000 people.

below and above the rivals' mean investments (Sirmon and Hitt, 2009) and to measure firms' strengths and weaknesses compared to rivals (Sirmon *et al.*, 2010a).

We estimated fixed-effects panel models, controlling for unobserved heterogeneity by eliminating the effect of venture-level factors, such as the quality of the venture, and thus allowing for an unbiased estimate of the relationship between human capital investments and firm performance (Kor and Leblebici, 2005). Fixed effects help reduce heteroscedasticity and autocorrelation (Greene and Zhang, 1997). The Hausman test showed that a random effects estimator would be inconsistent (the assumption that random effects are orthogonal to the regressors was wrong) and that the fixed-effects model was preferable. The fixed-effects regression model takes the following form:

$$Y_{it} = X_{it}\beta + a_i + \varepsilon_{it}$$

where y_{it} is the percentage revenue increase of startup i at year t; X_{it} is the effect of the measured covariates for startup i at year t; a_i is the unobserved time-invariant effect for startup i; and ε_{it} is the error term. All independent variables were lagged by one year (t-1).

We also corrected for selection bias using the Heckman two-stage method. Because our sample was not random, since it contained startups that were *R&D active,* we employed a two-stage estimation method that allowed us to correct for selection bias (Hamilton and Nickerson, 2003; Heckman, 1979). Firms self-select into R&D activities, which would prevent us from examining the true effect of innovation on the performance of new ventures because R&D firms are not randomly selected. We therefore included a self-selection control in the analysis which we describe in detail next.

In the first stage of this method we estimated the probability of engaging in R&D with a probit regression and two additional variables. To be effective, these additional variables should be exogenous; that is, they should not be related to the variable predicted in the second stage, but they should be related to the variable predicted in the first stage. We

identified two variables meeting this criterion, *average R&D deviation in the industry* and *high-tech* which indicates whether the startup operates in a high-tech sector. The first instrument is an industry level instrument (4 digit) which measures the average R&D deviation of firms in the same 4 digit industry per year. Previous papers have also used as instruments the industry mean of the independent variable (Cheng, Ioannou and Serafeim, 2014; Friedberg, 2003; Hanlon, Rajgopal and Shevlin, 2003; Leiponen and Poczter, 2016; Nevo, 2000). In the second stage of the selection model we corrected for selection bias by including a transformation of the above predicted probabilities as additional explanatory variables. An empirical check on the robustness of our instruments revealed that they are good exogenous variables which are not correlated with performance but which do predict engagement in R&D. The mills ratio was insignificant showing that selection is not a concern in our study.

RESULTS

Table 2 presents descriptive statistics and correlations. We calculated the variance inflation factor (VIF), which showed no multicollinearity problems (VIF was 1.58 which is below the threshold level of 10). The average startup had around 14 employees and its founders had high levels of education. More than a third of startups were high-tech, and the mean performance (measured as the percentage change in revenues from the previous year) was 0.32.

[INSERT TABLE 2 ABOUT HERE]

Table 3 presents the fixed-effects panel regressions. Model 1 includes the control variables and human capital investment below and above the mean. The coefficient of low human capital investment relative to rivals is positive and significant (β= 1.44; $p<0.01$). The interpretation of the coefficient requires careful attention. A positive and significant effect of the HC investment below rivals on performance means that those that pay below the mean

wage will perform better by paying higher wages, thus approaching the mean investment in the industry. Paying above the mean wage also harms performance (β= -1.24; $p<0.001$). This means that those that pay above the mean wage will perform better by paying lower wages, thus approaching the mean investment in the industry. This is in line with our first two hypotheses, thus H1a and H1b are supported. Figure 1 plots the effects of HC investment below and above rivals on performance.

[INSERT TABLE 3 ABOUT HERE]

[INSERT FIGURE 1 ABOUT HERE]

In order to test the hypotheses regarding the interaction between HC investment levels relative to rivals and leveraging strategy we would expect to see positive and significant coefficients to provide empirical support for H2a and H2b. We find support for Hypothesis 2b (see model 2), as the interaction between leveraging strategy and high HC investment relative to rivals is positive and statistically significant (β= 0.58; $p<0.05$). This shows that the negative effect of high HC investment relative to rivals on performance is less pronounced when startups pursue a leveraging strategy focused on innovation. Hypothesis H2a proposes a negative performance effect resulting from a match between low investment relative to rivals in HC with a leveraging strategy focused on innovation. A positive and statistically significant coefficient would demonstrate empirical support. However, as shown in table 3 (model 2) the coefficient for the interaction of low HC investment relative to rivals and leveraging strategy focused on innovation is negative and not significant. Thus, hypothesis 2a was not supported. Figure 2 plots the interactive effects of low and high HC investment relative to rivals and a focus on innovation on performance.

[INSERT FIGURE 2 ABOUT HERE]

Finally, in examining the triple interaction between HC investment relative to rivals, leveraging strategy and founder startup experience, positive and significant coefficients

would provide empirical support for H3a and H3b. We find support for Hypothesis 3b, as the three-way interaction between leveraging strategy, high HC investment relative to rivals and founder startup experience is positive and statistically significant (β= 0.88; $p<0.05$) (see model 3). However, the coefficient for the interaction of low HC investment relative to rivals, leveraging strategy and founder startup experience is significant but negative (β= -1.37; $p<0.05$). This outcome does not support H3a, instead it suggests the opposite relationship. Figures 3a and 3b plot the 3-way interaction effects.

[INSERT FIGURES 3A AND 3B ABOUT HERE]

Our results were consistent when we used a performance measure relative to rivals—deviation from rivals' performance—as an alternative operationalization of our dependent variable. The results of this test are shown in table 4. These results provide support for hypotheses H1a and H1b as the coefficients of low and high human capital investment relative to rivals are positive and significant (β= 0.39; $p<0.01$) and negative and significant (β= -0.20; $p<0.05$) respectively. In addition, we find support for Hypothesis 2b (see model 2), as the interaction between leveraging strategy and high HC investment relative to rivals is positive and statistically significant (β= 0.25; $p<0.001$). However, H2a is not supported as the coefficient is negative and significant (β= -0.40; $p<0.001$). This outcome does not support H2a, instead it suggests the opposite relationship. Finally, we find support for Hypothesis 3b (see model 3), as the interaction coefficient is positive and statistically significant (β= 0.41; $p<0.001$). However, H3a is not supported as the coefficient is negative and significant (β= -0.72; $p<0.001$) thus suggesting the opposite relationship. This opposite relationship is also consistent with our findings from Table 3.

[INSERT TABLE 4 ABOUT HERE]

To alleviate concerns about endogeneity, we used an instrumental variables (IV) two-stage least squares regression robust to heteroskedasticity, which accounted for the

endogenous character of the leveraging strategy variable. More specifically, we ran a two-stage procedure in STATA using the *average R&D deviation in the industry* and *high-tech* as instruments. The intuition behind the first instrument is that the firm's leveraging strategy is influenced by the average R&D deviation of other firms in the same industry. While firms may imitate the leveraging strategy of other firms in their industry, the R&D deviation of other firms does not directly influence the performance of the focal firm. Similarly, although operating in a high-tech industry is linked to innovation (Stuart, 2000), it does not necessarily affect the firm's ability to increase its revenues. These two exogenous instruments allow us to perform a number of tests in order to assess their validity and relevance. Although we find little theoretical reason to expect our instruments to be invalid, we also examine the validity of our instruments by reporting Hansen's J-test of overidentifying restrictions which essentially tests whether the instruments are correlated with the error term. In order to ensure that our IV estimation is sound, we conduct specification tests such as the Kleibergen-Paap and Cragg-Donald tests for weak instruments and the Stock and Yogo test for the likelihood of bias. Our tests show that both Kleibergen-Paap LM-test and Cragg-Donald Wald F-test reject the null of weak identification, and the critical values of Stock and Yogo tests suggest the lowest expected levels of bias. Hansen's J test clearly approves the null of no correlation between instruments and the error term: the Chi-square p-value is 0.8411. We also run the first-stage estimates to directly evaluate instrument strength. We find that both instruments have t-values in excess of 3.0 so they are very strong predictors of R&D deviation, yet, per Hansen's J test, not correlated with the error term in the main equation. Finally, we use the Durbin and Wu-Hausman test for the exogeneity of the instrumental variable. The results of these tests are not significant, indicating that the null hypothesis of exogeneity cannot be rejected. This implies that our estimates of the non-instrumented regression reported earlier are more appropriate than the instrumented variable regression.

We employ a two-stage Heckman estimation method to correct for selection bias that might occur due to the inclusion of startups that were R&D active (Hamilton and Nickerson, 2003; Heckman, 1979). The inverse Mills ratio is insignificant, indicating that selection is not a concern in our model.

Robustness tests

We conducted several robustness checks to ensure the accuracy of our results and eliminate alternative explanations. First, we ran the same analysis on older startups (older than three years) to control for the possibility that there might be greater variation in human capital in the first years. It might be expected that in earlier years some startups might pay very high wages (e.g. CEO, CTO) compared with others, while in later years this difference might be lower as startups grow older and take on more employees. Therefore, we might observe larger deviations when startups are small, whereas in later years wages would tend to move toward the industry average as startups grow. The results of this test were consistent with the above findings. In addition, by scaling the wage equation by standard deviation we controlled for the possibility that there might be more variation in the earlier years.

Second, we considered a different operationalization of the leveraging strategy variable: R&D employees as a proportion of total employees. The results of these tests are consistent with those reported in Table 3.

Third, we considered a binary operationalization of founder startup experience, with 1 indicating prior entrepreneurial experience of the founder and 0 otherwise. Our results were robust to this alternative operationalization of the independent variable. Our results were also consistent when we compared split-sample estimates to examine the contingency effect of founder startup experience.

Fourth, we also ran our models using profit instead of revenue as an alternative operationalization of the dependent variable. The results were consistent. Finally, to control

for regional differences that could impact wages we created the residual of a regression that has wages as a function of region, industry, year and other firm characteristics. Our results were consistent when we used this predicted residual to control for regional differences in labor markets.

DISCUSSION

Penrose highlighted some time ago the critical role of managers in the conversion of firm resources into firm capabilities, new product applications and value creation (Penrose, 1959). However, previous work on the resource-based view has failed to address how managers use resources to create value (Priem and Butler, 2001; Sirmon *et al.*, 2007) and how these are connected with the strategies pursued by firms (Sirmon *et al.*, 2010b). Recent developments in asset orchestration (Helfat *et al.*, 2007) and resource management (Sirmon *et al.*, 2007) have attempted to draw attention to the role of managerial activity in value creation. Our study advances knowledge on the role of entrepreneurs in orchestrating resources by focusing on three key contingencies: human capital investments relative to rivals, leveraging strategy and founder startup experience.

The findings indicate that deviations in human capital investments relative to rivals (either below or above) harm the performance of startups. However, they also show that it is insufficient to look solely at the investment decisions of new ventures when investigating performance differences. While HC investment above rivals impairs a firm's ability to create value, the magnitude of loss is greater for new ventures focusing on less innovative strategies. We do not find evidence that new ventures with a leveraging strategy focused on innovation should *invest more* in human capital than rivals. New ventures with high HC investment relative to rivals are *less disadvantaged* when they pursue a leveraging strategy focused on innovation compared to adopting a less innovation-focused strategy. Perhaps it takes time for new ventures with significant R&D investments to reap the benefits from their

innovation. It might be expected that in later years, new ventures with significant R&D investments might benefit more from high HC investments than rivals due to the importance of retaining tacit knowledge in the firm. Therefore, although we did not observe that innovative startups should invest more in human capital than rivals when they are young, in later years we might observe greater performance gains.

We also find that an entrepreneur's experience in assembling and orchestrating resources is critical for startup performance. Whereas *novice* entrepreneurs are at an advantage when they invest HC at levels consistent with rivals, *experienced* founders benefit from actively orchestrating HC investments relative to rivals with a leveraging strategy focused on innovation. Specifically, experienced founders who pursue a leveraging strategy focused on innovation can produce *optimal* performance outcomes by paying *below* rivals' HC investments. This is an unexpected relationship and future research needs to explore this outcome more fully. Perhaps employees are attracted to startups with experienced founding teams and are willing to accept lower wages in the short term to work in startups where they can learn from experienced teams (Coff and Kryscynski, 2011). Founder quality and reputation might also be an important factor influencing employee job satisfaction. In addition, experienced founders may be better at providing nonpecuniary job benefits to up-and-coming stars by providing learning opportunities, promoting employee participation, providing recognition and promoting fairness in decisions. As a result, working for experienced, or even celebrity entrepreneurs, may be an important attraction for start-up employees.

Overall, these findings have important implications for both theory and practice. First, we contribute to the literature on the *micro-foundations* of resource orchestration by drawing attention to the role of founder startup experience as a catalyst in asset orchestration. Our study advances knowledge on resource orchestration by examining how the co-alignment of

resource investment, leveraging strategy and founder startup experience produces performance gains. These findings, combined with the recent work of Sirmon *et al.* (2008, 2009), Hitt *et al.* (2001, 2006), Kor and Leblebici (2005), Baert *et al.* (2016), Gruber *et al.* (2010) and Holcomb *et al.* (2009), suggest that contingencies that affect resource orchestration lie at the heart of resource-based advantage. Therefore, the *selection* of resources (structuring the resource portfolio and bundling), the *deployment* of resources to create value (leveraging innovation capabilities), and *micro-level enablers* (experience of founders) are fundamental factors that affect performance.

To explore the role of micro-level enablers, we empirically examine how founder experience, a precursor of "managerial cognitive capabilities" (Helfat and Peteraf, 2015: 831), critically influences the process of resource orchestration. An increasing number of scholars have been calling for "micro-foundations" for strategic management, typically understood as foundations that are rooted in individual action and interaction (Abell, Felin and Foss, 2008; Felin, Foss, Heimeriks and Madsen, 2012; Foss, 2011; Gavetti, 2005; Teece, 2007). However, existing work on resource orchestration and RBV does not go sufficiently far with respect to accounting for relevant micro-foundations (Barney *et al.*, 2011). Micro-foundations of resource orchestration relate to the critical role of individuals in structuring, bundling and leveraging firm resources. By taking into account individual-level heterogeneity and linking it to the various strategic, organizational and human resource decisions, our study complements existing research that investigates the cognitive and affective micro-foundations of dynamic managerial capabilities (Helfat and Peteraf, 2015; Teece, 2007; Zott and Huy, 2007) and helps us uncover how firms create and sustain competitive advantage, thus furthering strategic entrepreneurship.

Second, we contribute to theory on resource orchestration by examining the performance implications of synchronizing resource investments in the *innovation* process.

By building theory on how firms orchestrate HC investments relative to rivals with an innovation-focused leveraging strategy we show that mere possession of resources is a necessary but insufficient condition for value creation. Superior performance can be produced when human capital investment and innovation strategy are purposefully *synchronized* by the entrepreneur.

By examining the contingent effects of innovation on resource orchestration we also provide a more nuanced insight into the debate between strategic similarity and differentiation in new ventures (Deephouse, 1999). Perhaps neither of these perspectives (strategic similarity and differentiation) are fully correct, instead, it may be that entrepreneurs need to master the process of orchestration which requires the effective co-alignment of multiple factors.

Third, we respond to the call by Sirmon *et al.* (2010b) for additional research on resource orchestration in startups. We still lack insights into how entrepreneurs orchestrate and leverage resources and capabilities in the different stages of the firm's lifecycle (Sirmon *et al.*, 2010b). Specifically, by integrating work on imitation (Lieberman and Asaba, 2006) with the literature on human capital (Coff and Kryscynski, 2011; Sirmon and Hitt, 2009) this study has important implications for how nascent entrepreneurs manage human resources in new ventures (Coff and Kryscynski, 2011).

Entrepreneurs face an important hiring dilemma about how much to compensate their employees (Wasserman, 2012). Although existing theories suggest that high human capital resources produce performance benefits (Eisenhardt and Schoonhoven, 1990; Hitt *et al.*, 2006; Kor and Leblebici, 2005), our findings imply a more nuanced relationship between HC investment and performance. We argue that simply making higher human capital investments than rivals may deplete new ventures' shallow stock of resources, while making lower HC investments than rivals may be detrimental to the motivation and productivity of employees

and facilitate rapid turnover. Instead, startups that conform to the norms set by rivals can achieve better performance.

Finally, these findings have important implications for practitioners. Entrepreneurs play a key role in asset selection and coordination. Therefore, the entrepreneur needs to be aware that simply investing more in human capital resources may not produce the best outcome. Instead, entrepreneurs should align their resource investment choices with their leveraging strategy. Overall, the entrepreneur should employ the firm's assets and orchestrate these internally to augment the value proposition offered to customers.

Limitations and future research

This study has some limitations which suggest avenues for future research. The sampled firms were startups that operated in the U.S., so future studies should investigate resource orchestration in startups operating in other countries. In addition, human capital investment was measured as wages per employee. This assumes an efficient labor market in which wages reflect the marginal productivity of employees. Owing to data limitations, this study did not measure investments in employees' education or training. Future studies might investigate whether human capital investments, as reflected in the education and training of employees, improve startups' performance when they are aligned with the leveraging strategy adopted by the entrepreneur.

Future research might also build on the micro-foundations of resource orchestration developed in this study. Specifically, studies could integrate micro theories of individual motivation and behavior with macro theories explaining firm level activities. In addition, how do the skills, abilities and knowledge of the founders regulate resource orchestration activities? Shifting attention to the motivation and attributes of entrepreneurs and the processes they use to organize innovation might help us gain a better understanding of the micro-foundations of resource orchestration.

Our findings regarding startups' deviation from rivals' human capital investments have implications for research in other organizational contexts involving significant resource constraints. For instance, given that internationalization tends to exacerbate both positive and negative performance outcomes in new ventures (Sapienza *et al.*, 2006), future research might fruitfully explore the implications of conformity or differentiation in the process of internationalization. New ventures experience significant external resource dependencies in foreign markets which might exacerbate deviations from rivals' resource investments. To what extent do deviations from rivals' investments differ across these contexts? How do resource orchestration activities change in less munificent environments? Further research might usefully explore how entrepreneurs acquire, mobilize and configure resources in different competitive environments.

While this study examines human capital investments as key contingencies in resource orchestration in startups, other types of resources may be needed to establish a startup as a viable operating entity (Sirmon *et al.*, 2010b). For instance, future research on resource orchestration might investigate physical capital investments, such as land and buildings, equipment and inventory; or investments in production and manufacturing activities, such as production, planning and quality control. Such activities might substitute or complement other resources. Future studies might also test how different configurations affect other important outcomes in startups, such as survival and the likelihood of an IPO.

In conclusion, this study has important implications for resource management and value creation in startups. Specifically, it provides insights into the contingent effects of aligning resources with leveraging strategy and founder startup experience to achieve a resource-based advantage.

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Table 1: Industry distribution

Industry	NAICS code	% of sample
Agriculture, Forestry, Fishing and Hunting	11	0.70
Utilities	22	0.10
Construction	23	4.22
Manufacturing	31-33	39.06
Wholesale Trade	42	5.02
Retail Trade	44-45	4.32
Transportation and Warehousing	48-49	1.10
Information	51	3.31
Finance and Insurance	52	2.31
Real Estate and Rental and Leasing	53	1.00
Professional, Scientific, and Technical Services	54	25.80
Administrative and Support	56	5.52
Educational Services	61	0.60
Health Care and Social Assistance	62	1.41
Arts, Entertainment, and Recreation	71	1.31
Accommodation and Food Services	72	1.10
Other Services	81	3.11
Total		**100.00**

Table 2: Descriptive statistics and correlations

	Mean	s.d.	Performance	Leveraging strategy focused on innovation	HC investment below rivals	HC investment above rivals	Founder startup experience	High-tech	Owner education	Work experience	Industry experience	VC	Number of employees	Location
Performance	0.32	1.11	1.00											
Leveraging strategy focused on innovation	0.37	1.15	0.02	1.00										
HC investment below rivals	0.10	0.15	0.12*	-0.04	1.00									
HC investment above rivals	0.10	0.18	-0.06	0.10*	-0.40*	1.00								
Founder startup experience (raw)	2.52	4.93	0.11*	-0.01	0.11	0.13*	1.00							
High-tech	0.34	0.47	-0.01	0.14*	0.01	0.01	0.01	1.00						
Owner education	0.73	0.44	0.05	0.14*	0.08*	0.07*	0.07*	0.19*	1.00					
Work experience (raw)	26.7	24.8	-0.01	0.03	0.16*	0.16*	0.22*	0.15*	0.03	1.00				
Industry experience			0.03	-0.01	0.013*	0.13*	0.52*	0.01	0.02	0.33*	1.00			
VC	0.02	0.14	0.03	0.09*	0.11*	0.16*	0.08*	0.08*	0.05	0.01	0.05*	1.00		
Number of employees (raw)	13.5	39.5	-0.01	-0.11*	0.02	-0.01	0.22*	0.06*	-0.01	0.27*	0.17*	0.10*	1.00	
Location	0.52	0.49	0.01	0.12*	-0.01	0.07*	-0.06*	-0.02	0.01	0.06*	0.02	0.04	0.01	1.00

N= 996. Minimum and maximum values for each variable are not provided due to confidentiality constraint associated with KFS confidential microdata. Performance is the percentage change in revenues from the previous year. Because this variable ranges widely we take the log of this number and present the mean revenue change for the seven years in this table. * Significant at $p<0.05$

Table 3: Panel fixed effects analysis: the effects of human capital investment below and above rivals, leveraging strategy and founder startup experience on performance

	(1) Direct effect	(2) Moderation	(3) Triple interaction
	Performance	**Performance**	**Performance**
HC below rivals	1.4402**	1.5510**	1.4807+
	(0.5006)	(0.5301)	(0.7750)
HC above rivals	-1.2356***	-1.5950***	-0.4035
	(0.3436)	(0.3840)	(0.6546)
Focus on innovation	0.0638	0.0336	0.0847
	(0.0539)	(0.0782)	(0.1069)
Founder startup experience	0.5292*	0.5228*	0.6310*
	(0.2465)	(0.2449)	(0.2518)
HC below rivals X Focus on innovation		-0.4179	0.4073
		(0.3918)	(0.5212)
HC above rivals X Focus on innovation		0.5778*	-0.5160
		(0.2816)	(0.5115)
HC below rivals X Focus on innovation X Founder startup experience			-1.3695*
			(0.5420)
HC above rivals X Focus on innovation X Founder startup experience			0.8790*
			(0.4031)
HC below rivals X Founder startup experience			-0.0538
			(0.6281)
Focus on innovation X Founder startup experience			-0.0224
			(0.1020)

HC above rivals X Founder startup experience			-0.9334*
			(0.4476)
High-tech	0.5305+	0.5383+	0.3698
	(0.3076)	(0.3055)	(0.3052)
Owner education	0.4229	0.5664	0.6912
	(0.8157)	(0.8120)	(0.7996)
Work experience	-0.1676	-0.1642	-0.1381
	(0.2004)	(0.1991)	(0.1971)
Industry experience	-0.3721	-0.3350	-0.1710
	(0.3532)	(0.3514)	(0.3502)
Number of employees	-0.2726	-0.2857	-0.2755
	(0.1780)	(0.1769)	(0.1751)
VC financing	0.4876	0.4620	0.4641
	(0.4354)	(0.4327)	(0.4285)
Location	-0.5409	-0.6638	-0.3854
	0.8281	0.8247	(0.8146)
Constant	1.5379	1.6116	1.2558
	(1.1742)	(1.1670)	(1.1556)
Year and industry dummies	Yes	Yes	Yes
Observations	996	996	996
Number of firms	520	520	520
R-squared	0.156	0.171	0.208

Standard errors in parentheses Two tailed tests

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Table 4: Robustness with performance relative to rivals: the effects of human capital investment below and above rivals, leveraging strategy and founder startup experience on performance

	(1) Direct effect Performance relative to rivals	(2) Moderation Performance relative to rivals	(3) Triple interaction Performance relative to rivals
HC below rivals	0.3947**	0.5342***	0.0992
	(0.1263)	(0.1283)	(0.1677)
HC above rivals	-0.1977*	-0.3518***	0.2856*
	(0.0867)	(0.0929)	(0.1417)
Focus on innovation	-0.0043	0.0002	0.0198
	(0.0146)	(0.0189)	(0.0231)
Founder startup experience	0.1021	0.0982+	0.1287*
	(0.0622)	(0.0592)	(0.0545)
HC below rivals X Focus on innovation		-0.3933***	0.0852
		(0.0948)	(0.1128)
HC above rivals X Focus on innovation		0.2484***	-0.2896**
		(0.0681)	(0.1107)
HC below rivals X Focus on innovation X Founder startup experience			-0.7215***
			(0.1173)
HC above rivals X Focus on innovation X Founder startup experience			0.4124***
			(0.0872)
HC below rivals X Founder startup experience			0.6181***
			(0.1359)
Focus on innovation X Founder startup experience			-0.0060
			(0.0220)

HC above rivals X Founder startup experience			-0.4532***
			(0.0968)
High-tech	0.3578***	0.3627***	0.2519***
	(0.0776)	(0.0739)	(0.0660)
Owner education	0.0250	0.1107	0.1251
	(0.2058)	(0.1965)	(0.1730)
Work experience	-0.0692	-0.0678	-0.0433
	(0.0505)	(0.0481)	(0.0426)
Industry experience	-0.3863***	-0.3582***	-0.2816***
	(0.0891)	(0.0850)	(0.0758)
Number of employees	-0.0047	-0.0106	0.0008
	(0.0449)	(0.0428)	(0.0379)
VC financing	-0.0849	-0.1030	-0.0958
	(0.1098)	(0.1047)	(0.0927)
Location	-0.0086	-0.0958	0.0484
	(0.2089)	(0.1996)	(0.1763)
Constant	1.2441	1.2528	1.0498
	(1.0840)	(1.0782)	(1.0696)
Year and industry dummies	Yes	Yes	Yes
Observations	996	996	996
Number of firms	520	520	520
R-squared	0.163	0.243	0.422

Standard errors in parentheses Two tailed tests

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

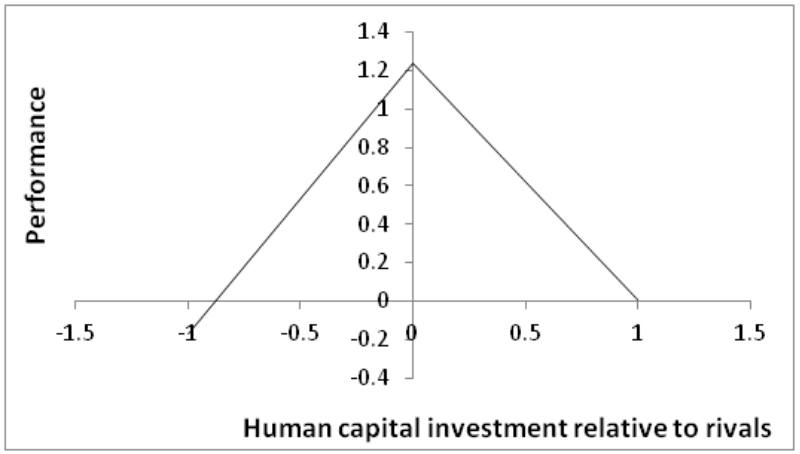

Figure 1 Effects of low and high investment relative to rivals in human capital on performance

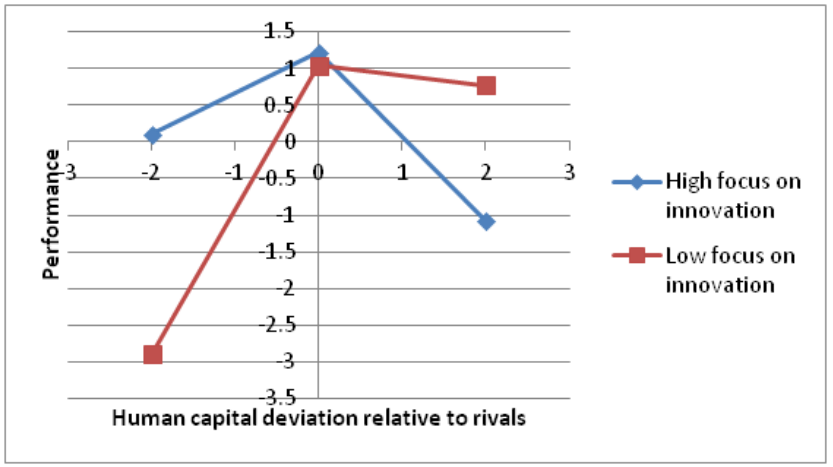

Figure 3a Three-way interaction with low founder startup experience

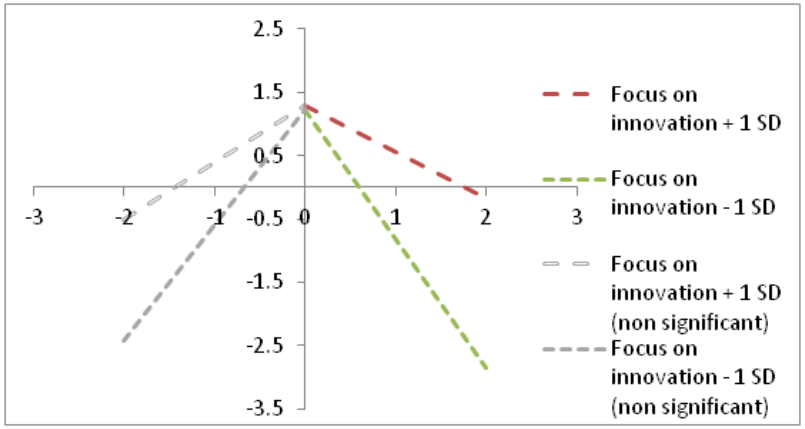

Figure 2 Interactive effects of low and high investment relative to rivals in human capital and leveraging strategy focused on

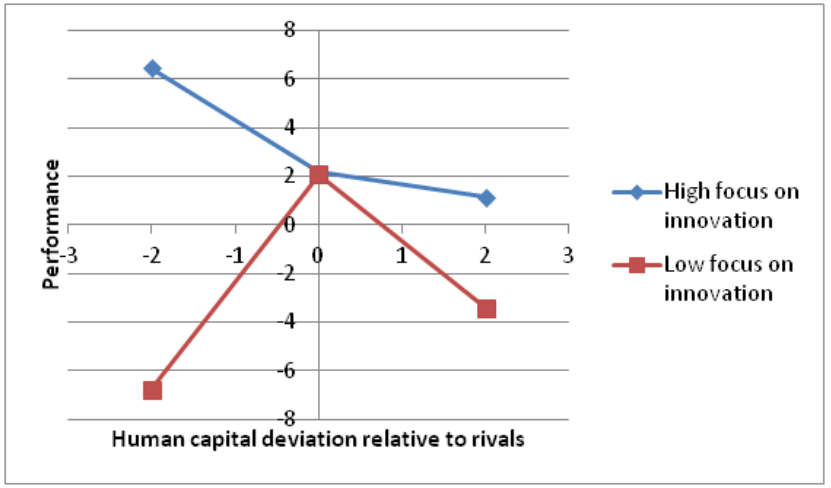

Figure 3b Three-way interaction with high founder startup experience