

**EARLY DEVELOPMENT OF NEW VENTURES: THE ROLE
OF CAPABILITIES IN OVERCOMING THE LIABILITIES OF
NEWNESS AND FOREIGNNESS**

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DECLARATION

This is to certify that:

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- ii. Due acknowledgement has been made in the text to all other material used;
- iii. Due acknowledgment has been made in the text to my co-authors with whom I have worked on research manuscripts;
- iv. The thesis is less than 100,000 words in length, inclusive of table, figures, bibliographies, appendices and footnotes.

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ABSTRACT¹

This dissertation studies the early development of new ventures and the role of capabilities in overcoming the liabilities of foreignness and newness in these ventures. Motivating my research is the belief that the creation and configuration of capabilities by the entrepreneur is critical for economic success, both for new ventures and society. Organisational capabilities are a key driver in explaining differences in firm performance. However, an important question that remains is whether capability development differs between young and established firms. New ventures, which are typically resource constrained, need to overcome the legitimacy challenges of entering a new market. While prior research has examined capability development in established firms, it has largely ignored the context of new ventures. To address this gap, I investigate the role of capabilities in overcoming the liabilities of newness and foreignness in the context of new ventures.

The empirical context used in this study provides an interesting window on the early development of capabilities in new ventures. I use a longitudinal dataset of 4 928 new ventures tracked over their first seven years of existence. I study three different aspects of capability development in new ventures. In the second chapter I examine the role of new ventures' business model in overcoming the liability of foreignness. In the third chapter I investigate the performance effects of aligning human capital investments with capability deploying decisions. In the fourth chapter I examine new venture resource allocation into the development of key capabilities and I test the effect of the resulting capability configurations on survival.

¹ This research was supported by the Ewing Marion Kauffman Foundation through access to the KFS data in the NORC Data Enclave.

Results show that new ventures' capabilities can be a major driver of entrepreneurial performance when they are configured effectively. Finally, I highlight the crucial role of the entrepreneur in developing, configuring and orchestrating the various elements of the business enterprise.

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CHAPTER 1 – INTRODUCTION

This dissertation studies the early development of new ventures and the role of capabilities in overcoming the liabilities of foreignness and newness in these ventures. Motivating my research is the belief that the creation and configuration of capabilities by the entrepreneur is critical for economic success, both for new ventures and society. Therefore, better understanding of these phenomena would lead to better prescriptions for firms in selecting their resources and capabilities, and for policymakers in providing policies that support entrepreneurial efforts.

PREVIOUS RESEARCH ON CAPABILITIES

Organisational capabilities are a key driver in explaining differences in firm performance (Eisenhardt & Martin, 2000; Helfat & Peteraf, 2003; Nelson & Winter, 1982; Penrose, 1959; Rothaermel & Hess, 2007; Teece, Pisano, & Shuen, 1997). The literature on dynamic capabilities seeks to explain how firms develop the skills and competences that allow them to gain and maintain a competitive advantage (Helfat & Peteraf, 2003; Teece, 2007; Winter, 2003; Zahra, Sapienza, & Davidsson, 2006). Dynamic capabilities are defined as “the abilities to reconfigure a firm’s resources and routines in the manner envisioned and deemed appropriate by its principal decision-maker(s)” (Zahra et al. 2006:8). Capabilities are classified² as either ‘operational’ or ‘dynamic’. An operational capability can be defined as a collection of routines that enable an organisation to produce significant outputs of a specific type whereas dynamic capabilities are ‘those that build, integrate or reconfigure operational capabilities’ (Helfat & Peteraf, 2003; Winter, 2003). Dynamic capabilities have been further

² Zero-level capabilities correspond to ordinary capabilities, that is, those that allow a firm to “make a living” in the short term (Winter, 2003), or to substantive capabilities, that is those used to solve a problem (Zahra et al., 2006). In contrast, dynamic capabilities are higher-level capabilities that operate to change ordinary capabilities or substantive capabilities (Barreto, 2010).

conceptualised as the capacity (1) to sense and shape opportunities and threats, (2) to seize opportunities, and (3) to reconfigure assets and structures to maintain competitiveness (Teece, 2007:1319). Prior research has analysed the antecedents and characteristics of dynamic capabilities (Benner & Tushman, 2003; Danneels, 2008; Eisenhardt & Martin, 2000; King & Tucci, 2002; Kor & Mahoney, 2005; Winter, 2003; Zollo & Winter, 2002), their relation to environmental factors (Eisenhardt & Martin, 2000; Teece et al., 1997; Zahra et al., 2006), and to performance outcomes (Eisenhardt & Martin, 2000; Slater, Olson, & Hult, 2006; Teece et al., 1997; Zahra et al., 2006; Zott, 2003).

Prior studies, which are mainly focused on established firms (Eisenhardt & Martin, 2000; Helfat et al., 2007; Nelson & Winter, 1982; Tripsas & Gavetti, 2000; Winter, 2003), have shown that well developed capabilities can benefit companies in many ways. Dynamic capabilities can help firms enter new markets; overcome inertia (King & Tucci, 2002); realise advantages of multinationality (Kotabe, Srinivasan, & Aulakh, 2002); learn new skills (Bowman & Ambrosini, 2003); achieve strategic renewal (Capron & Mitchell, 2009) and innovation (Rothaermel & Hess, 2007). However, most of the extant capability literature has failed to address the creation and development of dynamic capabilities in new ventures (Arthurs & Busenitz, 2006; Autio, George, & Alexy, 2011; Newbert, 2005; Sapienza, Autio, George, & Zahra, 2006; Zahra et al., 2006). This is an important gap, because dynamic capabilities may operate differently in young, as opposed to established firms. Importantly, young firms typically lack the resources, established routines, and integrating mechanisms to build a complete portfolio of diverse functional capabilities (Zahra et al., 2006). Whereas established firms have more latitude to pursue several different capability development paths simultaneously and can draw on already developed capabilities when shaping new ones, resource-poor young firms often need to invent capabilities from scratch and strike difficult

trade-offs in terms of which capability development paths to pursue. Thus far, however, little is known about how those choices are made, and which choices lead to best outcomes. Therefore, the process by which new ventures build their capability portfolio needs further investigation, given that these firms face significant liabilities of newness (Stinchcombe, 1965) which require them to identify unique configurations of capabilities that will allow them to survive, achieve legitimacy and reap the benefits of their innovation (Teece, 2007; Zahra et al., 2006).

More specifically, new ventures lack the resources, slack, legitimacy and routines required for making day-to-day operations controllable and predictable (George, 2005; Stinchcombe, 1965; Wiklund, Baker, & Shepherd, 2010). In the absence of established routines, new ventures have the additional learning costs of defining new roles and tasks within the firm (Stinchcombe, 1965). Apart from the lack of existing routines, entrepreneurs, who are typically resource constrained, face significant pressures when allocating their investments among different capabilities (Rahmandad, 2011). Because investing in capabilities can be costly and risky, entrepreneurs need to successfully obtain and assemble resources (Penrose, 1959) to devise and reconfigure existing capabilities that will allow them to realise strategic advantages (Augier & Teece, 2009; Helfat & Peteraf, 2003; Sapienza et al., 2006; Sirmon, Hitt, Ireland, & Gilbert, 2010b). Therefore, choosing which, and how many capabilities to develop is a crucial strategic choice of the entrepreneur (Grant, 2002; Zahra et al., 2006). Several researchers point to the need to examine the managerial actions of decision-makers, especially in the early stages of capability formation (Augier & Teece, 2009; Autio et al., 2011; Eisenhardt & Martin, 2000; Sirmon, Hitt, & Ireland, 2007; Teece, 2007; Zahra et al., 2006) where the role of individuals is heightened because of environmental uncertainty. However, most research and theory building on dynamic

capabilities has focused on established firms while ignoring the context of new ventures (Zahra et al., 2006). To address this gap, I investigate new venture capability development and specifically the role of the entrepreneur in selecting, deploying and configuring capabilities to overcome the legitimacy challenges faced by the new venture.

In this dissertation I study three different aspects of capability development in new ventures. In the second chapter I examine the role of the new venture's business model in overcoming the liability of foreignness. In the third chapter I investigate the performance effects of aligning human capital investments with capability deploying decisions. In the fourth chapter I examine new venture resource allocation into the development of key capabilities and I test the effect of the resulting capability configurations on survival.

RESEARCH QUESTIONS

My objective in this thesis is to theoretically and empirically investigate the following research questions:

1. How does the choice of business model regulate the extent to which new ventures are exposed to the liability of foreignness? (Chapter 2)
2. What are the performance effects of aligning resource investments with capability deploying decisions for new ventures? (Chapter 3)
3. Are new ventures with a balanced capability portfolio more likely to fail, and if so under what conditions? (Chapter 4)

OVERVIEW OF THE CHAPTERS

Chapter 2 (paper titled "Liabilities of Foreignness and New Venture Internationalisation: Examination of IP-based and Product-based Business Models") investigates the effect of adopting intellectual property-based and product-based business

models on the liability of foreignness experienced by US start-ups. Using the longitudinal Kauffman Firm Survey (DesRoches, Robb, & Mulcahy, 2010) I find that the entrant's business model choice regulates the degree to which the start-up is exposed to liabilities of foreignness when entering a foreign market. Chapter 2 draws attention to the role of the entrepreneur in selecting viable business models for internationalisation which is foundational to dynamic capability creation and reflects the entrepreneur's ability to seize opportunities in foreign markets (Teece, 2007; Zott, Amit, & Massa, 2011). This chapter also seeks to extend the concept of liability of foreignness beyond product entry mode by distinguishing between two types of liability of foreignness: liability as a "*foreign operator*" in the case of adopting product-based business models and liability as a "*source of technology*" in the case of adopting IP-based business models.

Chapter 3 (paper titled "Resource Orchestration in Start-ups: The Effect of Synchronising Human Capital Investment and Leveraging Strategy on Performance") examines the performance effects of aligning resource investments with capability deploying decisions. Building on the resource orchestration and resource management frameworks (Sirmon & Hitt, 2009; Sirmon et al., 2007; Sirmon et al., 2010b) and using a sample of US high-tech start-ups I find that higher human capital investments relative to rivals are negatively associated with start-up performance, unless they are coupled with a leveraging strategy that focuses on innovation. I find that for firms with research and development (hereafter R&D) capabilities, superior performance is produced when human capital investments and a leveraging strategy focused on exploiting the firm's R&D capabilities are purposefully synchronised by the entrepreneur. This chapter has important implications for resource management and value creation in start-ups. It provides insights into the

contingencies that affect resource orchestration and highlights the role of the entrepreneur in orchestrating the various assets of the business enterprise to create value.

Chapter 4 (paper titled “Putting All Eggs in One Basket: Capability Configurations and Survival in Entrepreneurial Start-ups”) examines new venture resource allocation into the development of key capabilities and tests the effect of the resulting capability configurations on survival. Building on configuration research, I examine how different capability configurations relate to the survival of new ventures. Using the longitudinal Kauffman Firm Survey (DesRoches et al., 2010) I find that investing either in R&D, marketing or production capability configurations improves the chances of survival in start-ups, however this pattern is different across industries. Moreover, I find that the simultaneous development of different capabilities (i.e. a balanced capability portfolio) exposes start-ups to a higher risk of exit due to the liability of newness that these firms face. This chapter provides a detailed investigation of the effect of R&D, production and marketing capabilities on the hazard of new venture exit and demonstrates the link between capability development and environmental contingencies in the new venture context.

Chapter 5 provides a conclusion as well as implications for theory and practice. It also addresses the limitations of this dissertation and provides directions for future research.

CONTRIBUTIONS

Firstly, this dissertation seeks to contribute to the emerging literature on dynamic capabilities in new ventures (Arthurs & Busenitz, 2006; Autio et al., 2011; Newbert, 2005; Sapienza et al., 2006; Zahra et al., 2006). Although firm capabilities are crucial for creating and sustaining a competitive advantage, extant literature has not adequately explored new venture capability development (Zahra et al., 2006). This is an important gap that confounds

both the dynamic capabilities and the entrepreneurship literature, as new ventures face the challenge of coping with different types of liabilities and lack slack resources (George, 2005; Rahmandad, 2011; Sapienza et al., 2006; Stinchcombe, 1965; Zaheer, 1995; Zahra et al., 2006) which limit their potential to build a portfolio of diverse³ capabilities. To fill this gap I investigate capability development in the context of new ventures to improve our understanding of this phenomenon.

By conceptualising a dynamic capability as ‘the capacity to reconfigure a firm’s operational capabilities to adapt to its environment’ this dissertation advances knowledge on the link between capability development and survival in new ventures. The analysis in this dissertation provides evidence that a balanced capability portfolio can threaten start-up survival due to the constraints that arise from the liabilities of newness. In contrast, developing one specific capability (R&D, production or marketing capability) can benefit new ventures when it is aligned with the environment that the start-up competes in.

This dissertation seeks to contribute to the debate regarding the type of external environments that are relevant for dynamic capabilities. Researchers within the field are divided among those who clearly ascribe the concept to highly dynamic environments and those who acknowledge its relevance in both stable and dynamic environments (Barreto, 2010). Some studies suggest that dynamic capabilities may be more valuable to established firms in rapidly changing environments (Teece et al., 1997; Teece, 2007) because of the need to overcome rigidities that build with experience and accumulation of resources and routines. As rigidities build, firms are in need of dynamic capabilities in order to alter search paths and

³ New ventures lack the expertise in building and integrating diverse capabilities compared to established firms and may therefore be less successful in developing different capabilities (Zahra et al. 2006). In addition, because building capabilities is an investment-intensive process it may even threaten start-up survival (Sapienza et al., 2006).

identify new opportunities. However, new ventures which are usually founded as a reaction to opportunities in a changing environment (Sine, Mitsuhashi, & Kirsch, 2006) lack established routines and the associated rigidities. Instead, these firms suffer from liabilities of newness which involve higher learning costs, lack of legitimacy and resource constraints. Environments low in munificence heighten the importance of effectively using dynamic capabilities in new ventures because resources may not be readily available to the firm (Sirmon et al., 2007). Therefore, the ability of the entrepreneur to select, deploy and effectively configure dynamic capabilities becomes increasingly important for success. The analysis presented in this thesis offers the opportunity to study capability development in highly uncertain environments (e.g. foreign markets) as well as environments with resource constraints where new ventures typically operate, therefore enriching our understanding of this concept.

Secondly, this dissertation provides evidence that both configurational and contingency approaches can reveal important insights into the process of capability development in new ventures. Although the concept of organisational configurations has been applied extensively in organisational and strategy research, it has been very limited in entrepreneurship research (Lepak & Snell, 2002; Short, Payne, & Ketchen, 2008; Wiklund & Shepherd, 2005). New ventures face significant liabilities of newness and lack resources and prior routines. In order to achieve a competitive advantage they need to possess specific organisational resources or skills that cannot be imitated or purchased by others (Barney, 1991). Orchestrating the various elements of the business (e.g. skills, resources, technologies, environment) and maintaining a complementarity among these can give start-ups unique

capacities that are impossible to copy (Miller, 1998). Therefore, configurations⁴ in new ventures are likely to be a far greater source of advantage than any single aspect of strategy (Miller, 1998). This dissertation proposes that instead of investigating separately specific elements of a firm (e.g. resources or capabilities), scholars should study the interdependencies between those elements with contingency or configuration models which can reveal important insights on the relationship between the different elements of the entrepreneurial strategy.

Thirdly, this dissertation seeks to contribute to the international entrepreneurship literature. Although previous research has analysed the disadvantages of foreign subsidiaries of multinationals, we lack a perspective of liabilities of foreignness in start-ups. By investigating the effect of business model choice (Amit & Zott, 2001; Teece, 2010) on the liability of foreignness experienced by new ventures, this dissertation contributes to the literature on dynamic capabilities and value creation in new ventures (Teece, 2007; Zott et al., 2011). The ability of the entrepreneur to sense and seize opportunities in international markets by selecting viable business models is foundational to dynamic capabilities (Teece, 2007). This dissertation also seeks to extend the concept of liability of foreignness by distinguishing between two types of liability of foreignness: liability as a “*foreign operator*” and as a “*source of technology*”. We find that the extent to which start-ups are exposed to the liability of foreignness depends on their choice of business model which reflects the way they exploit their knowledge-base in international markets. This dissertation also extends the literature on commercialisation strategies of start-ups which so far has mainly focused on explaining the market choice of start-ups (Gans, Hsu, & Stern, 2002). However, there is a

⁴ Organisational configurations are defined as multi-dimensional constellations of conceptually distinct characteristics that commonly occur together (Meyer et al. 1993: 1175). The interdependencies among the elements (strategy, environment, resources) are the essence of configuration (Miller, 1998) .

limited understanding of the potential implications of operating in technology versus product markets for internationalisation. This dissertation addresses the aforementioned gap by empirically testing the propensity to internationalise and the international intensity of start-ups using IP-based versus product-based business models.

Finally, this dissertation contributes to the resource management and asset orchestration perspectives (Helfat et al., 2007; Sirmon et al., 2010b) by investigating the contingencies that affect resource orchestration in new ventures. Specifically, it advances our knowledge of the conditions under which start-ups' deviation from rivals' investment choices becomes favourable. Despite the theoretical and practical importance of aligning resources with leveraging strategy, there have been limited tests of this relationship (Sirmon & Hitt, 2009). Leveraging is the process by which start-ups apply their capabilities to augment the value proposition offered to customers (Sirmon et al., 2007). Building on the recent resource orchestration stream I develop a model that depicts the process by which new ventures synchronise the various elements of the business enterprise. I find that superior performance is produced when human capital investments and a leveraging strategy focused on innovation are purposefully synchronised by the entrepreneur.

From a practical viewpoint, this dissertation encourages entrepreneurs to actively synchronise the various strategic, organisational and human resource decisions in order to ensure firm success. In order to succeed in foreign expansion, entrepreneurs should acquire and manage their resources and capabilities for internationalisation in an effective way. They need to be aware of the relative merits and threats of an IP-based versus a product-based business model in international markets. Finally, entrepreneurs must be aware of the trade-offs involved in developing different capabilities and investigate the costs and benefits of each capability investment decision before building a portfolio of capabilities.

CHAPTER 2 – LIABILITIES OF FOREIGNNESS AND NEW VENTURE INTERNATIONALISATION: EXAMINATION OF IP-BASED AND PRODUCT-BASED BUSINESS MODELS⁵

INTRODUCTION

The ‘new venture internationalisation’ literature has emphasised the positive outcomes of an early and proactive internationalisation strategy, such as exploiting the “learning the advantages of newness” to achieve faster growth and establish a platform for sustained organisational expansion subsequent to internationalisation (Autio, Sapienza, & Almeida, 2000; Mathews & Zander, 2007; Oesterle, 1997; Oviatt & McDougall, 1994; Zahra, Ireland, & Hitt, 2000). This tradition has emphasised the positive effects of early and proactive internationalisation for new venture performance (Cumming, Sapienza, Siegel, & Wright, 2009). However, this focus on the ‘positives’ of an early and proactive internationalisation strategy has tended to overlook many of the ‘negatives’ associated with this strategy (Sapienza et al., 2006). The most important of these is the increased threat to short-term survival that an early and proactive internationalisation strategy imposes upon young internationalisers (Sapienza et al. 2006). Although the economic globalisation has increased the opportunities for new and small firms to internationalise, it does not automatically eliminate the risks associated with internationalisation – notably those arising from ‘liabilities of foreignness’, i.e., the disadvantages that non-domestic market operators face relative to domestic market operators when they try to enter foreign markets (Zaheer, 1995). Such disadvantages may arise from, e.g., the costs of setting up foreign subsidiaries,

⁵ This research was supported by the Ewing Marion Kauffman Foundation through access to the KFS data in the NORC Data Enclave. This chapter is co-authored with Erko Autio and Johan Bruneel.

lack of legitimacy and other political and cultural barriers (Hymer, 1960; Mezas, 2002; Zaheer, 1995).

Thus far, most of the empirical work on ‘liabilities of foreignness’ has focused on foreign subsidiaries of multinational enterprises relative to domestic firms, while largely ignoring the context of new ventures (Buckley & Casson, 1998; Mezas, 2002; Zaheer & Mosakowski, 1997). This is an important gap in our current understanding of how new ventures are exposed to liabilities of foreignness, as internationalising new ventures face the dual challenge of coping with *both* the liabilities of newness (Stinchcombe, 1965) and the liabilities of foreignness. Because of insufficient attention to new internationalising firms, we do not yet know whether all internationalising new firms suffer similarly from liabilities of foreignness, and whether different foreign market entry strategies expose new ventures differently to this liability. In this paper, we explore the effect of two entry strategies to examine the extent to which internationalising start-ups experience liabilities of foreignness depending on their chosen business model.

As the empirical window to study the relationship between liabilities of foreignness and business models for foreign market entry, we focus on product-based vs. IP-based commercialisation strategies of start-up companies. This is an important empirical window, as the choice between product and IP-based commercialisation strategies has implications for the way with which new firms exploit their knowledge base for internationalisation. In the international new venture literature, it is a well-established notion that start-ups are differentially able to enter international markets due to the differences in the way they exploit their knowledge base (Autio et al., 2000). In general, the literature suggests that knowledge-intensive firms are less constrained by distance or national boundaries due to the mobility of knowledge assets (Liebeskind, 1996; Madsen & Servais, 1997; Oviatt & McDougall, 1994).

In deciding how to leverage their knowledge base for internationalisation, new ventures need to choose a business model that will allow them to successfully commercialise their knowledge assets in foreign markets. Given the wide-ranging implications on business models, new ventures need to choose early on between operating in ‘markets for products’ and ‘markets for technology’ (Arora, Fosfuri, & Gambardella, 2001). In the former strategy, the firm adopts a product-based business model and seeks to embody its knowledge into physical products, which are then either exported abroad or manufactured there. In the latter strategy, the firm adopts an “IP-based” business model, under which the firm exports its knowledge through licensing and other IP arrangements (Gambardella & McGahan, 2010). We may expect that as these two different types of business models have important implications for the shape the firm’s foreign market entry will take, they will expose the internationalising firm to very different forms of liabilities of foreignness.

Specifically, this paper attempts to verify empirically whether there are differences in the liability of foreignness between start-ups that *license-out* intellectual property rights (hereafter IPRs) in the market for technology and those that sell their *products* via the market for products. To do so, we examine the propensity to internationalise and the international intensity of US start-ups that employ an IP-based⁶ business model versus those using a product-based business model. We develop a theoretical model that we test using the Kauffman Firm Survey which is a large panel of 4 928 US start-ups founded in 2004 and tracked over the first seven years of their operation (DesRoches et al., 2010).

Our study seeks two distinctive contributions to the international entrepreneurship and strategy literatures. First, this study builds on and extends the concept of liability of

⁶ We use the terms “start-ups with IP-based business models” and “IP-based start-ups” interchangeably. Similarly, we use the term “product-based start-ups” to refer to start-ups with product-based business models.

foreignness by focusing on the effect of business model choice of start-ups on internationalisation propensity and intensity (measured as the ratio between foreign sales and total sales). We argue theoretically and show empirically that start-ups adopting a product-based business model face a higher liability of foreignness in foreign markets than start-ups adopting an IP-based business model. Our analyses reveal that IP-based business models are associated with a higher international propensity and intensity as measured by the percentage of international sales out of total sales, compared to start-ups that adopt product-based business models. Our findings therefore suggest that business model choice regulates start-ups' exposure to liabilities of foreignness, leading us to distinguish between liability of foreignness as a "*foreign operator*" and liability of foreignness as a "*source of technology*".

Second, we extend the literature on business model innovation (Amit & Zott, 2001; Teece, 2010) by examining two distinct business models that new ventures adopt to commercialise their underlying assets and create value in foreign markets. The study of business models is an important topic for strategic management research because business models are foundational to dynamic capabilities and define how firms organise for value creation and value capture (Teece, 2007; Zott et al., 2011). Therefore, researchers and managers need to know how business models impact internationalisation processes in start-ups. Finally, we extend the literature on commercialisation strategies of start-ups which so far has mainly focused on explaining the choice between markets for technology and markets for products (Gans et al., 2002). There is only a limited understanding of the potential implications of operating in technology versus product markets from the perspective of internationalisation. This study addresses this gap by empirically testing the propensity to internationalise and international intensity of start-ups using IP-based versus product-based business models.

The paper is organised as follows. First, we describe sources of liabilities of foreignness in the light of resource dependence theory. We then develop a model of how business model choice may influence the liability of foreignness in start-ups. In the third section we describe the analytical methods used and the operationalisation of our constructs. We subsequently present our results and end with a conclusion and discussion of our contributions for theory and practice.

THEORETICAL BACKGROUND AND HYPOTHESES

Liability of foreignness: legitimacy and economic challenges of foreign operation and resource dependence in foreign markets

The idea of the ‘stigma of being foreign’ was coined by Hymer (1960) who theorised about the costs of doing business abroad that are not incurred by local firms. These costs of foreign operation can result in a ‘*liability of foreignness*’ as manifested in lower survival rates and poorer performance by firms entering foreign markets relative to local competitors (Zaheer, 1995; Zaheer & Mosakowski, 1997). Zaheer (1995) defined the liability of foreignness as the costs of doing business abroad that result in a competitive disadvantage for the non-domestic firm. This work emphasises that firms operating abroad face certain barriers that purely domestic firms do not.

We distinguish between two types of barriers in foreign operation; first, *lack of legitimacy* and second, *economic costs* of operating in a foreign country. The lack of organisational legitimacy (i.e. non-acceptance by relevant stakeholders) can act as a barrier to entry in the foreign market⁷ (Caves, 1971; Kostova & Zaheer, 1999), especially for start-ups

⁷ The lack of information about the foreign market places the foreign firm at a disadvantage compared to local firms who “know where to look”. As Caves (1971) explains, foreign firms must pay a price premium for what local firms have acquired either for free or at a very low price due to their knowledge of the market.

that lack a track record of operation in that market. In addition, cultural and other differences, as manifested in unfamiliar laws, rules, regulations and cultural values of the host country can increase the adaptation costs for foreign firms⁸. For example, Canadian subsidiaries operating in the US were found, due to cultural differences, to suffer from poorer performance compared to their US counterparts (O'Grady & Lane, 1996). Differences in institutional environments can create unique challenges for foreign firms, as these seek to adapt to local environments and exploit firm-specific advantages⁹ that differentiate them from domestic competition (Miller & Eden, 2006; Zaheer & Mosakowski, 1997).

Apart from the lack of embeddedness with the foreign environment, foreign firms also incur higher economic costs when doing business abroad. First, there are costs directly associated with spatial distance (Hymer, 1960; Zaheer, 1995) such as transportation costs and coordination costs from managing dispersed international markets (Buckley & Casson, 1998; Calhoun, 2002; Eden & Miller, 2004). A second set of costs for foreign firms originates from setting up production plants in the host country. Foreign firms that set up subsidiaries will need to train foreign workers to use their technology, and they may also lose plant-level economies of scale due to lower production at the home plant (Buckley & Casson, 1998). When opting for distributors, foreign firms will have to incur the cost to search appropriate local partners, negotiate and implement contracts which involves significant transaction costs (Williamson, 1981). Maintaining strong contractual governance mechanisms further exacerbates the coordination costs of these transactions.

⁸ For instance, corruption in the host environment will place a foreign firm headquartered in a country with lower corruption levels at a disadvantage, because of its lack of knowledge of this significant element of the institutional environment (Calhoun 2002).

⁹ Foreign subsidiaries are more likely to rely on firm-specific intangibles that differ from those of domestic firms in order to overcome the adversity of doing business in a foreign location (Eden and Miller 2004).

The resource-dependence theory advocates that organisational performance is dependent on the ability to access and mobilise external resources to mitigate environmental uncertainty and pursue opportunities (Casciaro & Piskorski, 2005; Pfeffer & Salancik, 1978). However, although young firms in particular are dependent on external resources, they can also engage in legitimacy building in order to mitigate their dependence on external resources. Foreign start-ups operating in different countries face unique challenges when trying to attract customers overseas¹⁰ (Kostova & Zaheer, 1999; Miller & Eden, 2006). These start-ups lack a track record and thus appear less legitimate to potential customers, partners and suppliers. They face significant transmission hurdles which drive their prices up and negatively affect their international sales. Start-ups operating in foreign markets should act to minimise their dependencies and enhance their legitimacy in order to eliminate the liability of foreignness.

Liability of foreignness as a “source of technology” or “foreign operator”

Previous studies have shown that the lack of legitimacy as well as economic barriers can increase the liabilities of foreignness that are associated with a product market entry by foreign entrants (Bell, Filatotchev, & Rasheed, 2012). However, new ventures may choose to license-out their technologies to distant markets instead of producing and selling products that embody those technologies (Arora et al., 2001). Exchanges in the markets for technology i.e. transactions in technological alliances, licensing agreements, R&D contracts, have grown rapidly in recent years (Arora et al., 2001). High-tech industries such as chemicals, electronics and software have seen a proliferation of small specialist technology producers who operate upstream and license their technologies in the markets for technology. Given the

¹⁰ Legitimacy pressures on foreign firms are especially strong in the early years of a population's life (Miller and Eden 2006).

substantial growth in technology transfer activities, it is important to identify whether the sources of liabilities of foreignness in technology markets are different to the ones in product markets.

There are important distinctions between markets for products and technologies in terms of the nature of the products traded, the knowledge production environment and the relationship between the buyers and the sellers. First, technology markets trade knowledge-based products e.g. proprietary technologies, whereas product markets trade consumption or industrial goods (Bell et al., 2012). In product markets, the reputation of sellers is determined by the quality and durability of the products, whereas in markets for technology, technology providers create their reputation through the intrinsic technological performance and usability of their technologies. In addition, knowledge-based resources are sold in an intermediate stage which implies that these resources are not fully embedded in the local environment¹¹. Second, participants in technology markets rely on the accreditation of their inventions by a third party e.g. the US Patent and Trademark office which grants enforceable patent rights to the inventors and disseminates information about their inventions. Third, transfers of technology sometimes involve significant transaction costs between the seller and the buyer¹². However, once firms invest in knowledge codification, external transfers are subsequently promoted (Kogut & Zander, 1993).

When intellectual property rights are well defined and protected through IPRs, licensing can work well. Therefore, new ventures with strong intellectual property rights can

¹¹ This makes IP-based start-ups less susceptible to disadvantages to transfer knowledge-based resources across foreign markets. Expansion is more difficult when firms need to adapt their products to the local environment.

¹² The challenges faced by sellers and buyers of technology have been highlighted by several scholars (Arrow, 1962; Mowery, 1983; Nelson & Winter, 1982; Polanyi, 1962; Williamson, 1981). Tacit knowledge is not easily transferred and firms that possess it prefer to internalise market transactions through hierarchies. However, making knowledge explicit can allow firms to use licensing to commercialise their technologies.

signal the quality of their IPRs (Hsu & Ziedonis, 2013) and can create value by adopting an IP-based business model to enter international markets. In turn, new ventures with production-related capabilities realise value by embodying their knowledge into physical products which are then exported abroad. There is growing evidence that the liability of foreignness is prevalent in other types of markets than product markets alone, thus, understanding the sources of liabilities of foreignness in different markets is important in order to devise appropriate strategies that will help firms overcome these liabilities (Bell et al., 2012).

In the following section we develop hypotheses that explicate how the extent to which ventures experience liabilities of foreignness is different depending on whether they employ a licensing-based or a product-based business model. First, we hypothesise that due to higher uncertainty and costs, product-based start-ups face a higher liability of foreignness than IP-based ones. This hampers product start-ups' entry to foreign markets. Second, we argue that this higher liability of foreignness has an enduring effect on the international performance of product-based start-ups subsequent to foreign market entry.

Liability of foreignness and international propensity of product versus IP-based business models

Competing in foreign markets with a product-based business model is substantively different from competing with an IP-based business model¹³. Those engaged in the former may face significant *legitimacy* challenges and higher costs than IP-based start-ups that enter foreign markets. Moreover, key constituents such as customers, partners and suppliers in a

¹³ Start-ups adopting IP-based business models create value by licensing-out their technologies and by investing in IPR stocks which provide them with competitive advantage when trading their technologies in international markets, whereas start-ups with product-based business models create value from production-related activities (Teece, 1986; Arora et al. 2001).

foreign market may lack knowledge about the start-up and thus withhold support. The lack of track record in start-ups intensifies the need to establish legitimacy in order to successfully operate in foreign environments.

IP-based start-ups can acquire legitimacy by securing exclusive rights to their inventions by an accreditation agency. The US Patent and Trademark office functions as a certification agency for IP-based start-ups by (1) granting enforceable patent rights¹⁴ to the inventors, and by (2) disseminating information about their inventions (Lamoreaux & Sokoloff, 1999). By issuing a patent, the US Patent and Trademark office essentially undertakes due diligence for potential customers who are planning to license a technology from a young venture. In addition, public disclosure¹⁵ of the specifications of each invention through the Patent office encourages the diffusion of technologies by linking inventors with partners with capital to invest, and with potential customers that want to purchase licensed patented technologies. Therefore, start-ups with IP-based business models can eliminate some of the uncertainties associated with foreign operation. Even if IP-based start-ups choose to invest in production-related capabilities (by operating in both product and technology markets), they would still benefit from the legitimacy provided by their IPRs (Hsu & Ziedonis, 2013).

In contrast, start-ups adopting product-based business models lack a uniform accreditation agency that validates their products and will, as a result, face a significant challenge of establishing legitimacy in foreign markets (Hymer, 1960; Miller & Parkhe,

¹⁴ The federal courts have the responsibility for patent enforcement and protection of the rights of patentees as well as the rights of people who purchased licensed patented technologies. The provisions under U.S. law allow inventors to reveal some information about their technologies and still be protected against exploitation of their ideas by someone else without compensation (Lamoreaux and Sokoloff, 1999).

¹⁵ In addition, published periodic lists of patents awarded by the Patent office and other private journals e.g. Scientific American, disseminate information about inventions and keep producers informed about patents of interest.

2002; Xu & Shenkar, 2002). Product-start-ups will have to incur the significant costs of adapting their products to the local needs (Buckley & Casson, 1998; Fan & Phan, 2007). In comparison, valuable IPRs of IP-based start-ups can signal their quality (Hsu & Ziedonis, 2013) and their strong technological and innovatory capabilities (Stuart, Hoang, & Hybels, 1999). These high-quality scientific and engineering competences can attract investors (Gans et al., 2002) and lead to beneficial alliances (Colombo, Grilli, & Piva, 2006; Gans et al., 2002). For example, Luo and colleagues (2002) found that contract protection reduces the liabilities of foreignness in start ups (Luo, Shenkar, & Nyaw, 2002).

Furthermore, start-ups with product-based business models will face considerable economic costs in foreign markets. Setting-up subsidiaries and distribution channels in the host country is very resource intensive (Katila & Shane, 2005). In addition, exporting physical products puts pressure on prices, thus making product-based start-ups face overall higher transmission hurdles¹⁶. Taken together, product start-ups face a wide variety of foreign market entry costs such as researching the foreign market, investing in legitimacy building, and the sunk cost investment of entering that market (Karakaya, 2002). These market entry costs may deter start-ups with product-based business models from entering foreign markets.

Thus, we contend that start-ups with IP business models face *relatively lower legitimacy and economic challenges when doing business abroad* that result in a *higher propensity to internationalise* compared to product-based start-ups. We hypothesise:

Hypothesis 1: Start-ups with product-based business models are less likely to internationalise sales than start-ups with IP-based business models.

¹⁶ The economic costs of foreign operation in start-ups with IP-based business models are not absent. These start-ups will still need a sales force to sell IP-based products abroad; however, the legitimacy advantages from their IPRs combined with the fungibility of knowledge-based resources will reduce their relative costs of foreign entry.

Liability of foreignness and international intensity of product versus IP-based business models

Knowledge accumulation in foreign markets is one of the most important challenges in internationalisation. Firms selling products abroad have to gain a very good understanding of local customer preferences. However, seeking out such knowledge is an on-going, costly and time consuming process that impedes the expansion of international activities of foreign operators (Johanson & Vahlne, 1977). As a result, product start-ups are confronted with a limited transferability of the advantage provided by their products in the domestic market (Cuervo-Cazurra, Maloney, & Manrakhan, 2007). To overcome this inability to transfer advantage, firms have to invest in the continuous development of alternative products suited to specific local market needs. To do so, they develop a set of resources that adapt to the local needs of the local market (Porter, 1985). These market-specific resources may create an advantage in this environment but may be incompatible with the characteristics of another foreign market. This disadvantage of transfer reduces the leveraging of firm resources across a variety of foreign markets.

These start-ups are also confronted with an increased organisational complexity (Kostova & Zaheer, 1999). Foreign product start-ups can have various subunits performing different tasks within different geographic locations (Mudambi & Zahra, 2007). This regular interaction with a large number and variety of other organisations to procure critical resources promotes a higher liability of foreignness (Stearns, Hoffman, & Heide, 1987). In addition, the economic costs of doing business abroad are considerable for product start-ups because of the enduring difficulties in transportation and coordination across geographic distances and time zones (Zaheer, 1995). Hence, adaptation to host environments and doing

business in foreign markets leads to a higher liability of foreignness for start-ups with a product-based business model.

Start-ups licensing-out IPRs are less constrained by distance as knowledge is more geographically mobile than physical products (Liebeskind, 1996; Madsen & Servais, 1997; Oviatt & McDougall, 1994). Start-ups with IP-based business models are better able to scale their business faster as licensing allows them to expand their geographical scope without incurring the additional costs related to local adaptation. These start-ups can also benefit from faster internationalisation because it does not demand scale economies to successfully enter international markets (Andersson, Gabrielsson, & Wictor, 2004). The mobility of knowledge-based resources provides international growth opportunities for IP-based start-ups at a relatively low cost. In contrast to product firms that need to assemble manufacturing resources and manage expensive distribution channels (Katila & Shane, 2005) IP-based start-ups sell IPRs through one time transfers of technology. Consequently, the transfer of firm resources to foreign markets is relatively small compared to product start-ups.

Thus, start-ups with product-based business models will –at least in the early years– exhibit a lower international intensity as these firms have to make investments in product adaptation to local market needs and customer preferences. This process is both time and resource intensive. In contrast, one would expect that start-ups with IP-based business models that operate internationally can achieve a higher international intensity since they can scale their business faster and they can benefit from legitimacy advantages gained through their IPRs. Therefore, start-ups with IP business models will be exposed to a *lower* degree of liability of foreignness compared to start-ups with product-based business models and the former will be able to achieve a higher international intensity than start-ups selling products. Thus, we hypothesise:

***Hypothesis 2:** Start-ups with product-based business models will exhibit a lower international intensity than start-ups with IP-based business models.*

METHODOLOGY

We used the Kauffman panel to test our hypotheses. This panel was formed from a random sample of 32 469 firms from Dun and Bradstreet's database of all start-ups formed in 2004 in the United States, excluding non-profit firms, those owned by an existing business, or firms inherited by someone else (DesRoches et al., 2010). The Kauffman Firm Survey¹⁷ team interviewed the founders of 4 928 start-ups and surveyed them annually for six years (DesRoches et al., 2010). Approximately 94% of start-ups with international sales had adopted a product-based business model whereas 6% had adopted an IP-based business model. For the purpose of this study, we only include firms with revenues which results in an unbalanced panel of 3 892 observations. In order to correct for possible unobserved heterogeneity due to the inclusion of only start-ups with revenues we employ a two-step selection correction technique which is described in more detail later. By including only start-ups with revenues we conduct a clean test of the effect of a product vs. IP-based business model on the propensity of the start-up to have international sales. So we directly test for the effect of adopting product-based versus IP-based business models on internationalisation propensity and international intensity of start-ups.

Due to data limitations we only have information on the internationalisation activities of start-ups from their fourth year of operation up to (including) their seventh year of operation (four years of panel data). We lagged all our independent variables by one year (t-

¹⁷ There are six follow-up surveys (after the baseline survey of 2004) that cover the period 2005-2010. To be eligible for the KFS, businesses had to indicate whether they had: 1) used an EIN; 2) paid schedule C income; 3) paid state unemployment taxes; 4) paid Federal Insurance Contributions Act taxes; 5) the presence of a legal status. At least one of these activities should have been performed during 2004 and none prior to 2004 to be eligible.

1). Although this means we had to sacrifice one year of data, we chose to use the lagged technique to enhance the accuracy of our predictions. Approximately 21% of start-ups in our sample internationalise their activities.

Table 1: Industry distribution (chapter 2)

Industries	NAICS¹⁸ code	% of sample
Food, textiles, apparel, leather manufacturing	31	3.4
Paper, printing, petroleum chemical, plastics manufacturing	32	7.1
Primary metal, fabricated metal product and machinery	331-333	16
Computer and electronic product manufacturing	334	6.4
Electrical equipment, appliance and component manufacturing	335	2.2
Transportation equipment, furniture manufacturing	336-337	2.4
Miscellaneous manufacturing	339	3.5
Professional, scientific and technical services	541	59
Total		100

Table 1 displays the industry distribution in our sample. In total, the analysis included 3 892 firm-year observations. The number of start-ups adopting product or IP-based business models in this study was 1564. These start-ups operated in the manufacturing and scientific services sectors. The most frequent industries in the sample are NAICS 541 (scientific services), with 59% of the sample; NAICS 331-333 (metal and machinery manufacturing), with 16% of the sample; NAICS 334-335 (computer and electric equipment manufacturing), with 8.6% of the sample and NAICS 32 (chemical and plastics manufacturing), with 7.1% of the sample.

¹⁸ North American Industry Classification System

Dependent variables

Internationalisation propensity and international intensity. The effects of liabilities of foreignness are typically determined using performance indicators (Denk, Kaufmann, & Roesch, 2012). We therefore opt to capture these effects by examining the internationalisation propensity and international intensity of new ventures. The first dependent variable internationalisation propensity is equal to 1 if the start-up engages in international sales and 0 if it does not engage in internationalisation (Westhead, Wright, & Ucbasaran, 2001). International intensity is an ordinal categorical variable that records the percentage of firms' total sales generated outside the US (below 5%, 5-25%, 26-50%, 51-75% and 76-100%) (Westhead et al., 2001).

Independent variable

Product business model. Building on the definition of Gans and colleagues (Gans et al., 2002), we measured the business model of the start-up with a binary variable equal to 1 when the start-up provides a product and 0 when the firm licenses-out IPRs¹⁹ at time *t* (patents, copyrights or trademarks). Firms that license-out IPRs adopt an IP-based business model whereas those that provide products create value through a product-based business model.

¹⁹ Because technologies can be either disembodied, or embodied in products, we cannot rule out the possibility that some of the IP-based start-ups have also reported having products. We found that 69 observations were both providing a product and licensing-out IPRs, and thus treated these observations as IP-based start-ups. This is consistent with our theory as IP-based business models that also adopt a product-based business model will still benefit from the legitimacy provided by their intellectual property rights in foreign markets.

Control Variables

We controlled for founder, firm, and industry characteristics as well as geographic location.

College degree. We control for the level of education of the entrepreneur with a dummy that equals 1 if the entrepreneur has a college degree and zero otherwise as prior studies have shown that it can positively influence internationalisation (Nummela, Saarenketo, & Puumalainen, 2004) as well as new venture performance (Gimeno, Folta, Cooper, & Woo, 1997).

Work experience. Companies founded by individuals with prior work experience can positively influence firm strategy and performance as it can provide them with a wide range of skills (Gimeno et al., 1997) as well as valuable contacts with customers, suppliers and investors (Shane & Stuart, 2002). We measure work experience by summing the number of working years across owners and taking its natural log.

Start-up experience. Prior start-up experience of the owners can also positively influence firm strategy and performance as serial entrepreneurs have gained knowledge from setting-up a business and developing new products as well as managing early-stage organisations (Shane & Stuart, 2002). We measure start-up experience by summing the number of prior businesses created across owners and taking the log of this number.

Active owners. We control for multiple owners and their involvement in running the business with a dummy variable that equals one when a firm has more than one active owners and zero otherwise at time t (George, Wiklund, & Zahra, 2005). The size of the management team can influence firms' decision to internationalise (Buckley, 1993) and multiple owners

can also affect start-ups' access to resources, foreign networks (Reuber & Fischer, 1997) and partnerships (Eisenhardt & Schoonhoven, 1996).

Number of employees. The size of the firm has been found to affect internationalisation. We control for firm size at time t by taking the log of the number of employees (Reuber & Fischer, 1997)

High-tech. Our measure of high-tech industry, adapted from Hecker's (2005) definition of high technology industries, is a dummy variable indicating whether start-ups compete in high technology areas²⁰ (Hecker, 2005). This variable was created by matching 4-digit NAICS code. We also include industry dummies.

Limited Liability. We control for the legal form of the organisation with a binary variable as this can influence the extent of internationalisation (Mata & Portugal, 2002).

R&D. R&D intensity is frequently related to internationalisation (Kumar, 2009). We measure a firm's focus on R&D by taking the number of R&D employees as a percentage of the total number of employees at time t.

²⁰ 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).

Hotspot. We create a dummy variable indicating whether the start-up is located in one of top ten U.S. states ranked as high in technology and science assets using the Milken State Technology and Science Index²¹ (O'Shea, Allen, Chevalier, & Roche, 2005).

Assets vehicles. This variable represents the asset value of vehicles owned by the start-up and is measured with an ordinal categorical variable that ranges from 1 to 9 at time t .

Bonus plan. This is a binary variable indicating whether the start-up offers full-time employees or owners a bonus plan at time t .

Cash. We use a continuous variable to measure start-ups' liquidity by taking the log of the amount of cash that the start-up holds at time t .

Model and Econometric Approach

We estimate the maximum likelihood of start-ups' propensity to internationalise given their business model (product versus IP) by using a panel logistic regression model with robust standard errors clustered on the firm²² (Miranda & Rabe-Hesketh, 2006). We subsequently correct for selection bias with the use of the Heckman two-stage method. Because our sample is not random since it includes only start-ups that *generate revenues* we employ a two-stage estimation method that allows us to correct for selection bias (Hamilton & Nickerson, 2003; Heckman, 1979). In the first stage of this method we estimate the probability of having revenues with a probit regression and two additional variables. To be effective these variables should be exogenous (i.e. not related to the variable predicted in the second stage, but they should be related to the variable predicted in the first stage). We

²¹ This index ranks the U.S. states based on high-tech growth indicators such as research and development expenditures, the percentage of population with postgraduate degrees, venture capital investment and number of patents issued.

²² Standard errors clustered on the firm allow us to deal with the problem of dependence of observations.

identified two variables meeting these criteria, *vehicles as assets* and *bonus plan to full time employees*. In the second stage we correct for selection bias by including a transformation of the above predicted probability as an additional explanatory variable. Although we expect that start-ups having vehicles in their assets or offering bonuses to their employees may be generating revenues, we do not expect that these will directly affect their propensity to internationalise sales.

In the second part of the analysis we employ an ordered logistic regression to examine the international intensity of foreign firms. This method is designed for ordinal dependent variables and can be used with the Heckman selection correction when the intervals between adjacent categories are equal (Rabe-Hesketh & Skrondal, 2008). This is the preferred technique to deal with the self-selection bias of observing firms that have international sales. Finally, we calculated the variance inflation factor (VIF) which showed no multicollinearity problems.

RESULTS

Table 2 shows the descriptive statistics and correlations table. The average start-up has twenty years of work experience across all its owners who have previously founded, on average, about two businesses. In addition, start-ups in our sample are endowed with a high level of education among their founders. More than ten percent of start-ups come from a high-tech sector and about thirty percent come from a location ranked as high in technology and science assets. We performed additional t-tests where we compare start-ups with and start-ups without international sales. We found that in general, start-ups with international

Table 2: Descriptive statistics and correlations (chapter 2)

	Mean	s.d.	Internat. Intensity	Limited liability	High- tech	Hotspot	R&D	Number of employees	Active multi owner	College degree	Work experience	Start-up experien ce	Product business model	Internat. propensi ty	Assets vehicles	Bonus Plan	Cash
Internat. Intensity	1.92	1.16	1.00														
Limited liability	0.34	0.47	-0.05*	1.00													
High-tech	0.12	0.33	-0.03*	0.01	1.00												
Hotspot	0.32	0.46	0.01	-0.03	0.03*	1.00											
R&D	0.09	0.09	0.04*	0.04*	0.14*	0.03	1.00										
Number of employees	8.11	10.6	-0.07*	0.04	0.04*	-0.04*	0.24*	1.00									
Active multi owner	0.42	0.49	0.04*	0.14*	0.06*	-0.01	0.07*	0.24*	1.00								
College degree	0.57	0.49	0.06*	0.09*	0.08*	0.02	0.05*	-0.10*	0.01	1.00							
Work experience	20.55	19.6	0.06*	0.06*	0.10*	0.01	0.03*	0.11*	0.28*	-0.01	1.00						
Start-up experience	1.77	7.21	0.06*	0.06*	0.03*	0.00*	0.03*	0.10*	0.20*	0.05*	0.14*	1.00					
Product business model	0.94	0.22	-0.04*	0.01	-0.11*	-0.02	-0.11*	-0.05*	0.00	-0.05*	-0.01*	-0.07*	1.00				
International propensity	0.21	0.40	0.47*	0.03	0.15*	0.00	0.07*	0.12*	0.08*	0.11*	0.10*	0.10*	-0.07*	1.00			
Assets vehicles	2.31	3.02	-0.05*	0.04	-0.08*	-0.09*	-0.10*	0.13*	-0.05	-0.11*	0.08	0.05	0.03*	-0.06*	1.00		
Bonus plan	0.30	0.45	-0.04	0.02	0.05*	-0.01*	0.01	0.01*	0.05	0.06*	0.12*	0.07*	-0.06*	0.10*	0.12*	1.00	
Cash	147.3	630	0.10*	0.03	0.14*	0.05*	0.04	0.27*	0.14*	0.04*	0.23*	0.13*	-0.10*	0.17*	0.17*	0.34*	1.00

N=3892 observations. We report correlation coefficients and the significance level for p-values with $p < 0.05$. Minimum and maximum values for each variable are not provided due to confidentiality constraint associated with the KFS confidential microdata. Cash is reported in thousand dollars.

Table 3: Results of panel logistic regression and two step heckman selection correction – Predicting internationalisation propensity (chapter2)

	(1)	(2)	(3)	(4)
	Controls	Direct effect	Selection first step	Selection second step
	<i>Internat. propensity</i>	<i>Internat. propensity</i>	<i>Have revenues</i>	<i>Internat. propensity</i>
Limited liability	-0.36 (0.28)	-0.35 (0.28)	-0.03 (0.16)	-0.19 (0.18)
High-tech	0.21 (0.55)	0.17 (0.42)	-0.02 (0.30)	0.05 (0.28)
Hotspot	0.23 (0.35)	0.21 (0.36)	0.60*** (0.17)	0.16 (0.17)
R&D	2.70** (1.03)	2.63* (1.03)	-1.40* (0.58)	1.69** (0.60)
Active multi-owner	-0.13 (0.25)	-0.10 (0.27)	-0.05 (0.15)	-0.02 (0.15)
College degree	1.50*** (0.35)	1.46*** (0.37)	0.15 (0.16)	0.90*** (0.17)
Work experience	0.30 (0.16)	0.30 (0.18)	-0.07 (0.07)	0.15 (0.08)
Start-up experience	0.40 (0.24)	0.39 (0.21)	-0.10 (0.10)	0.20 (0.11)
Number of employees	0.39* (0.17)	0.37* (0.15)	0.41*** (0.08)	0.23** (0.08)
Product business model		-1.16* (0.49)	-0.42 (0.43)	-0.73* (0.29)
Assets vehicles			0.12*** (0.02)	
Bonus plan			0.65*** (0.18)	
Mills ratio				0.67 (4.64)
Year dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Observations	3892	3892	5795	5795
Number of firms	1564	1564	2282	2282
Log likelihood	-1390	-1387	-939	-1365
Prob>chi2	0.0000	0.0000	0.0000	0.0000
Robust standard errors clustered on the firm				

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

sales are endowed with a higher college education and experience among their owners ($p < 0.001$). These start-ups are also more likely to come from a high-tech sector and they tend to have a stronger focus on R&D and on licensing-out IPRs ($p < 0.001$).

Our model in table 3 tests hypothesis 1. In the first model we include only the control variables. We find that the R&D focus of the firm ($p < 0.010$), the degree of education ($p < 0.001$) and the size of the firm ($p < 0.05$) are all positively and significantly associated with internationalisation propensity. In model 2 we add our main independent variable ‘product business model which is negative and significant ($p < 0.05$) therefore providing support to hypothesis 1. This shows that young firms that focus on selling products rather than licensing-out IPRs in their first years of existence are less likely to pursue opportunities in international markets. These results are consistent prior findings that intangible assets (intellectual property rights) provide a competitive advantage to firms that enhances their propensity to internationalise (Dunning, 2000).

Models 3 and 4 of table 3 report the Heckman selection correction. We employ a two-stage estimation method to correct for selection bias that occurs due to the inclusion of only start-ups with revenues (Hamilton & Nickerson, 2003; Heckman, 1979). In model 3 we estimate the probability of having revenues with a panel probit regression. Both *vehicles as assets* and *bonus plan* are positively associated with the probability of having revenues. In the second stage we correct for selection bias by including a transformation of the above predicted probability as an additional explanatory variable. Thus, model 4 re-estimates model 2 and includes a correction term for selection bias (i.e. *Inverse Mills Ratio*). The Wald test indicates that the correlation is very significant ($p < 0.001$). Hence we should use Heckman’s technique. The inverse Mills ratio is not significant showing that selection is not a concern in our model. Our findings after using the Heckman’s technique demonstrate that for a one unit

increase in adopting product business models (rather IP business models), the probability of going international decreases by 0.73. Therefore, hypothesis 1 receives further support.

Table 4: Results of ordered logistic regression (foreign firms only) and two step heckman selection correction – Predicting internationalisation intensity (chapter 2)

	(1)	(2)	(3)	(4)
	Controls	Direct effect	Selection first step	Selection second step
	<i>Internat. intensity</i>	<i>Internat. intensity</i>	<i>Have revenues</i>	<i>Internat. intensity</i>
Limited liability	-0.31* (0.15)	-0.31* (0.15)	-0.01 (0.06)	-0.07** (0.02)
High-tech	-0.37* (0.18)	-0.42* (0.18)	0.01 (0.10)	-0.05 (0.03)
Hotspot	-0.10 (0.17)	-0.11 (0.17)	0.12 (0.07)	-0.01 (0.02)
R&D	0.81 (0.66)	0.73 (0.67)	-1.40*** (0.25)	0.09 (0.14)
Active multi-owner	0.10 (0.17)	0.13 (0.17)	-0.12 (0.07)	-0.01 (0.02)
College degree	0.26 (0.16)	0.24 (0.16)	0.04 (0.07)	0.09*** (0.02)
Work experience	0.05 (0.09)	0.04 (0.09)	-0.04 (0.03)	0.01 (0.01)
Start-up experience	0.14 (0.09)	0.14 (0.09)	-0.07 (0.04)	0.05*** (0.01)
Number of employees	-0.21* (0.10)	-0.23* (0.09)	0.13*** (0.04)	-0.01 (0.01)
Cash	0.12** (0.04)	0.11** (0.04)	0.02 (0.01)	0.03*** (0.00)
Product business model		-0.65* (0.28)	0.06 (0.19)	-0.24*** (0.07)
Assets vehicles			0.04*** (0.01)	
Bonus plan			0.46*** (0.08)	
Mills ratio				0.53** (0.19)
Year dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Observations	701	701	3410	3410
Wald chi2	53.99	58.83	257.30	257.30
Prob>chi2	0.0000	0.0000	0.0000	0.0000
Robust standard errors clustered on the firm				

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

In table 4 we employ an ordered logistic regression and a Heckman correction to test hypothesis 2 on the sample of firms that have international operations. Model 1 includes only the control variables. Model 2 adds the main independent variable. We examine whether international firms that focus on licensing-out IPRs are more likely to exhibit (compared to product-only start-ups) a high international intensity as measured by the percentage of international sales out of total sales. A negative effect would imply that IP business models allow start-ups to increase their international sales and thus manage their liability of foreignness. We can see that a product business model (as opposed to an IP business model) is associated with a lower international intensity thus confirming hypothesis 2 ($p < 0.05$). This result confirms that in the short run international new ventures can use licensing-out to facilitate an international expansion and mitigate the risks of foreignness.

In models 3 and 4 of table 4 we correct for sample selection bias that occurs due to the inclusion of only start-ups that have sales. Therefore, as previously, we employ a two-stage estimation (Hamilton & Nickerson, 2003; Heckman, 1979). We see that both *vehicles as assets* and *bonus plan* are good predictors of positive revenues in start-ups. In the second stage (model 4) we correct for selection bias by including a transformation of the above predicted probability as an additional explanatory variable. The Wald test indicates that the correlation is very significant ($p < 0.001$) and the inverse Mills ratio is significant too showing that a simple OLS model would provide biased estimates because of unobservables in the selection model that are correlated with unobservables in the second stage model. Therefore, we correct for sample selection bias and we subsequently compute the average selection effect.

We estimate the average selection effect which is calculated by multiplying the average mills value with the estimated selection coefficient λ . This gives us by how

much the conditional international intensity is shifted up due to the selection effect. We find that a start-up with sample average characteristics that selects (or is selected) into revenues secures a higher international intensity of $(e^{0.09} - 1) \times 100 = 9\%$ than a start-up drawn at random from the population with the average set of characteristics. The results with this model are consistent with model 2 of table 4 and show that the probability of exhibiting a high international intensity is 0.24 less in start-ups with product business models than start-ups with IP ones ($p < 0.010$). Therefore, hypothesis 2 receives further support. In addition, we find that start-up experience ($p < 0.010$), the degree of education ($p < 0.010$) and cash ($p < 0.05$) are all positively associated with international intensity.

We also used the margins command in STATA to obtain the predicted probabilities of being in each category of international intensity for IP-based versus product business models. In these tests we find that the probability of being in a higher category of international intensity is greater for IP-based start-ups. In other words, the probabilities of membership to each category of international intensity change as we vary the product business model variable and hold the other variables at their mean, thus further supporting our second hypothesis. International firms that sell IPRs seem to rely more on international sales (out of total sales) compared to product start-ups that have a systematically lower probability of being in a higher international intensity category.

We conducted several robustness checks to ensure the accuracy of our findings and eliminate other possible explanations of our results. First, in our main models we control for year and industry fixed effects²³. Second, because sample attrition is a potential concern as some firms go bankrupt in our 7 year panel we conducted the same analysis on a reduced

²³ We used year dummies with 2007 as the baseline and we control 4 digit naics code for biotech, software, computer electronics manufacturing, machinery manufacturing and equipment manufacturing firms.

sample (we removed the firms that went bankrupt). The results of the analyses on this subsample were fully consistent with the results reported here (see appendices 1a and 1b). Third, we performed a Heckman selection correction to address the sample selection bias of including only start-ups with revenues (Hamilton & Nickerson, 2003; Heckman, 1979).

In order to exclude any other possible explanations we ran a model where we excluded start-ups that have subsidiaries which allowed us to compare directly start-ups that export products with start-ups that license-out IPRs (see appendices 2a and 2b). Research suggests that firms may lower their exposure to liabilities of foreignness by choosing other entry modes than foreign direct investment (Barkema, Shenkar, Vermeulen, & Bell, 1997; Buckley & Casson, 1976). The results of this analysis show that exporting product start-ups have a lower propensity to internationalise ($\beta = -1.81, p < 0.01$) and also a lower international intensity ($\beta = -0.81, p < 0.05$) than IP-based start-ups. This provides further evidence that start-ups with *product business models*, regardless of entry mode (exports or subsidiaries), face higher liabilities of foreignness than technology start-ups.

DISCUSSION

We conducted this study with the purpose of shedding light on how the choice of business model (selling products versus licensing-out IPRs) affects the liabilities of foreignness in start-ups. Unlike prior studies which have focused on the disadvantages of foreign subsidiaries of multinational enterprises, we examined the influence of start-ups' business model on their liability of foreignness which was measured by the propensity to internationalise and international intensity. We argued that start-ups with product business models will suffer a higher liability of foreignness than start-ups with IP business models because of the higher uncertainty and costs of foreign operation of the former. As predicted,

we found that start-ups licensing-out IPRs a) have a higher propensity to internationalise and b) exhibit a higher international intensity than product start-ups. Our study shows that start-ups' business model choice regulates the extent of exposure to the liability of foreignness.

The contribution of this study is twofold. First, by examining the business model choice of start-ups we extend the concept of liability of foreignness, which has traditionally focused on multinational firm disadvantages, and we distinguish between two types of liabilities of foreignness: liability as a "*foreign operator*" and as a "*source of technology*". Second, we extend the literature on dynamic capabilities and business models by uncovering theoretical and practical implications of adopting product/IP business models for internationalisation (Gans et al., 2002; Teece, 2007; Teece, 2010). We elaborate on the implications of these contributions in the next paragraphs.

By examining how the liability of foreignness affects start-ups we extend prior research that has traditionally viewed firms as committing resources gradually and gaining incremental access to foreign markets (Johanson & Vahlne, 1977). Start-ups that license-out IPRs are more likely to enter foreign markets early because they can mitigate environmental uncertainty. Start-ups that license-out IPRs will face a lower liability of foreignness because of the legitimisation achieved through the certification service provided by the Patent office. In contrast, the liability of foreignness in product start-ups is in line with conventional views which suggest that internationalising firms have a deficient access to foreign markets due to lack of legitimacy, organisational complexity and costly mistakes (Zaheer, 1995).

Although previous research has analysed the disadvantages of foreign subsidiaries of multinationals, we lack a perspective of liabilities of foreignness in start-ups. Our analyses reveal that business model choice implies different liabilities of foreignness, leading us to

distinguish between liability of foreignness as a “*foreign operator*” in the case of product-based business models and as a “*source of technology*” in the case of IP-based business models. It is possible that start-ups that choose product-based business models gradually enter foreign markets because of the extensive resources required for adaptation, legitimacy building and foreign operation (Kumar, 2009; Miller & Eden, 2006; Pfeffer & Salancik, 1978). In contrast, start-ups that choose IP-based business models may benefit from a higher legitimacy and fungibility of resources and thus suffer less from liabilities of foreignness. Therefore, the extent to which start-ups are exposed to the liability of foreignness is not the same across all start-ups but depends on the business model choice which reflects the way they exploit their knowledge-base in international markets.

Our additional analyses show that start-ups with *product business models* face higher liabilities of foreignness irrespective of the entry mode used to serve foreign markets. Not only product start-ups with subsidiaries but also product start-ups pursuing exports (without physical presence in foreign markets) exhibit lower levels of internationalisation (compared to start-ups licensing-out IPRs). This finding responds to recent calls to examine the liabilities of foreignness beyond foreign direct investment (Denk et al., 2012) and suggests that the business model of start-ups rather than merely the type of entry mode influences the exposure to liabilities of foreignness.

Prior research on liabilities of foreignness has mainly compared foreign firms to local firms (e.g. Miller and Eden, 2006) ignoring that there might be differences in the liabilities of foreignness faced by local firms that internationalise through different business models (Denk et al., 2012). As a result, a number of studies provide valuable insights into the consequences of entering foreign markets but there is very limited work on the antecedents. In this paper, we compare the international propensity and intensity of start-ups that sell products with

those that license IPRs and we show that the business model adopted by the entrepreneur influences the extent to which start-ups will be exposed to the liabilities of foreignness. We therefore extend the liability of foreignness literature beyond product entry mode. Extant research has focused on how firms experience liabilities of foreignness when selling their products or services abroad by comparing performance of foreign versus local firms. Recently, Bell and colleagues (2012) provided insights into the liabilities of foreignness in capital markets. This paper extends prior work by considering the liabilities of foreignness faced by IP-based start-ups that operate via the market for technology.

In addition, our findings provide more fine-grained insights into the effect of knowledge-based resources on internationalisation. The international business literature suggests that the technology profile of firms plays a key role in firm internationalisation. Prior research shows that knowledge intensity and the level of technological resources contribute to international performance (Autio et al., 2000; Filatotchev & Piesse, 2009; Tseng, Tansuhaj, Hallagan, & McCullough, 2007). The underlying mechanism is the greater resource fungibility of technological resources which makes them easier to sell across foreign markets without having to incur the full cost of transferring (Martin & Salomon, 2003). Our findings show that the way knowledge-based resources are commercialised in foreign markets, i.e. licensing these resources or embodying them in products, has important implications for start-ups' international performance. Embodying knowledge-based resources in products can reduce their fungibility which hampers international growth.

Our findings uncover implications for dynamic capability creation in foreign markets. Research in business models shows that these play a central role in explaining firm performance. Firms can compete through their business models as these represent an important source of competitive advantage. Business models are important to strategy

research as they affect the way firms create and capture value (Zott et al., 2011). The ability of the entrepreneur to seize opportunities by designing viable business models is central to dynamic capability creation according to Teece (2007). Despite the growing amount of studies related to various business models, we lack an understanding on the link between a start-up's business model and the liabilities of foreignness it faces in international markets. We provide potential implications of adopting a product or IP business model for start-ups' internationalisation performance by comparing the liability of foreignness between product and technology markets. IP-based start-ups may achieve a higher international propensity and intensity than product start-ups because they can transfer their advantage (i.e. intangible resources) and appropriate value from it in foreign markets.

Finally, our findings have important implications for practitioners. Entrepreneurs and managers play a key role in asset selection, coordination and commercialisation. Therefore, they need to be aware of the relative merits and threats of an IP-based versus a product-based business model in international markets. Entrepreneurs should make the best use of their exclusive rights in intellectual property by licensing their technologies to foreign markets. This way they can exploit their *advantages of foreignness* by generating additional revenues and benefiting from increased legitimacy as well as fungibility of their resources (Autio et al., 2000). In addition, entrepreneurs should be aware of the risks in internationalisation when adopting a product-based business model. Because entrepreneurs lack a track record they may find it more difficult to compete with a product-based business model due to the extensive resources needed for adaptation and higher uncertainty. Overall, entrepreneurs should acquire and manage their resources and capabilities for internationalisation in an effective way in order to succeed in foreign expansion.

LIMITATIONS AND FUTURE RESEARCH

The generalisability of our results is limited by country and variable. Our study examines the liability of foreignness faced by US start-ups. A limitation of our study is that we could not distinguish between entry markets. In addition, start-ups in some industries are more likely to internationalise than in others, thus our results may have been driven by industry. Hence, in our analyses we controlled for confounding effects of industry. A prerequisite for our study was that we could observe start-ups in their first years of operation. However, it is possible that our findings reflect the short-term constraints of start-ups regarding the allocation of resources between a product, technology and internationalisation strategy (Kumar, 2009). Thus, in later stages, start-ups with successful product introductions and strong customer bases may benefit to a different extent from a licensing strategy especially if the knowledge to be transferred is tacit, non-codifiable and/or less protectable²⁴ (Kogut & Zander, 1993; Teece, 1986). To alleviate this concern of short-term constraints due to resource-intensive subsidiary building we performed a robustness check by excluding start-ups with subsidiaries. The results showed that even after the exclusion of these start-ups, start-ups with IP business models were more successful in internationalisation than start-ups with product exports.

An interesting avenue for future research is to examine the dynamics of liability of foreignness. It would be interesting to look at how the business model regulates the timing of formation of liabilities of foreignness in start-ups. A potential research direction is to examine the speed with which, and the conditions under which, business model choice reduces the liabilities of foreignness in start-ups. Over time, as legitimacy and market knowledge

²⁴ By licensing-out IPRs start-ups inevitably diffuse their technology and therefore cannot appropriate fully the gains from their innovation.

increases (Zaheer & Mosakowski, 1997), the liabilities of foreignness in product start-ups should decline. However, IP-based start-ups that build-up legitimacy could turn their foreignness into an asset at an earlier stage (Zaheer & Mosakowski, 1997).

Due to data limitations, we could not explore the role of inter-organisational relationships in mitigating the liabilities of foreignness experienced by start-ups adopting product-based and IP-based business models. Previous work indicates that collaboration with other firms may facilitate access to foreign markets and fuel international expansion (Barkema et al., 1997; Khanna, Gulati, & Nohria, 1998; Osborn & Baughn, 1990). Future work should examine how the breadth of the start-up's network across different types of partnerships as well as the international character of the partner network influence the business model – internationalisation relationship.

The dynamics of liability of foreignness could also be affected by the industry in which start-ups compete. Therefore, future research needs to examine the liability of foreignness in different industry settings and locations. Prior research has mainly focused on the liabilities of foreignness of multinational firms that compete in the financial industry. Future research on the liability of foreignness should take into account a variety of contexts and the impact of business model choice on the liabilities suffered by start-ups. Furthermore, because we used the proxy of international intensity to represent liability of foreignness, the underlying processes of how the liabilities of foreignness emerge in start-ups remain a black box. Future research should include case studies and other qualitative approaches to examine how these liabilities emerge.

CHAPTER 3 – RESOURCE ORCHESTRATION IN START-UPS: THE EFFECT OF SYNCHRONISING HUMAN CAPITAL INVESTMENT AND LEVERAGING STRATEGY ON PERFORMANCE²⁵

INTRODUCTION

One of the most important activities for managers is to combine different resources and capabilities to achieve superior performance (Helfat et al., 2007; Penrose, 1959; Sirmon et al., 2007; Teece et al., 1997). Although the resource-based view (RBV) highlights the value of strategic resources for organisational performance (Barney, 1991; Crook, Ketchen, Combs, & Todd, 2008; Dierickx & Cool, 1989; Wernerfelt, 1984){Barney, 2011 #8219}, it has been less able to address how managers use these resources to create value (Priem & 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 effectively evaluate, integrate, combine and exploit bundles of resources in order to achieve a resource based-advantage (Augier & Teece, 2009). As Helfat and colleagues (2007) note, 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 the above frameworks is the notion of fit between resources and deployment decisions. As Sirmon and colleagues (2007) note, developing a fit between the firm's resource investments and its leveraging strategy is important for value creation. Leveraging is the process by which start-ups apply their capabilities to augment the value proposition offered to customers. Despite the theoretical and practical importance of aligning

²⁵ This research was supported by the Ewing Marion Kauffman Foundation through access to the KFS data in the NORC Data Enclave.

resources with leveraging strategy (Sirmon et al., 2007) there have been limited tests of this relationship. Investigating 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 (Helfat et al., 2007; Sirmon, Gove, & Hitt, 2008). Based on the limited work available and their importance to effective management, investigating contingencies in resource orchestration seems especially promising.

In this study, I examine the performance effects of aligning resource investments with deploying decisions. Using a sample of US high-tech start-ups I focus on two key contingencies of resource orchestration: resource investment and leveraging strategy. Building on research on imitation (Deepphouse, 1999; Lieberman & Asaba, 2006; Sirmon & Hitt, 2009) and industry norms (Spender, 1989) I develop a model that depicts the process of managing resources in entrepreneurial start-ups to create value. I find that deviating from rivals’ resource investments negatively affects performance in start-ups. However, I also find that discrepancy from rivals’ human capital investments can be beneficial when it is aligned with a leveraging strategy focused on innovation.

This study makes three contributions to theory and practice. First, it empirically assesses the resource investment/leveraging strategy contingency suggested by Sirmon et al. (2007) and Sirmon and Hitt (2009) and it highlights the critical role of the *entrepreneur*, who is actively orchestrating the various elements of the business enterprise to create value. Second, by building on the recent resource management framework (Sirmon & Hitt, 2009) and work on imitation this study advances our knowledge of the conditions under which start-ups’ deviation from rivals’ investment choices becomes favourable. Third, this study

encourages entrepreneurs to actively synchronise the various strategic, organisational and human resource decisions in order to ensure firm success.

The paper is organised as follows. First, I briefly describe contingency theory as well as recent developments in asset/resource orchestration. Then, I develop a model of how resource investments and leveraging strategy will influence start-up performance. I then discuss the analytical methods, operationalisation of constructs and results. Finally, I end with a conclusion and discussion of the contributions for theory and practice.

THEORETICAL BACKGROUND AND HYPOTHESES

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

A recent research stream in strategy literature applies contingency theory to investigate the resource-strategy relationship (Gruber, Heinemann, Brettel, & Hungeling, 2010; Holcomb, Holmes, & Connelly, 2009; Morrow, Sirmon, Hitt, & Holcomb, 2007; Sirmon, Hitt, Arregle, & Campbell, 2010a; Sirmon et al., 2010b). Hitt et al (2006) demonstrate the importance of human and relational capital for internationalisation and firm performance (Hitt, Uhlenbruck, & Shimizu, 2006). Kor and Leblebici (2005) find that while

bundling senior partners with less experienced associates in law firms positively affects performance, combining that type of bundling with increased levels of service or geographic diversification harms performance (Kor & Leblebici, 2005). Sirmon and Hitt (2009) demonstrate that when managers' deployment decisions support investment decisions, then deviation from rivals' investment choices in physical and human capital enhances performance (Sirmon & Hitt, 2009).

Building on Helfat et al (2007) and Sirmon et al (2007), Sirmon and colleagues (2010b) integrate the resource management and asset orchestration perspectives into a unifying framework namely the resource orchestration framework. The resource orchestration framework proposes that the possession of resources does not warrant a competitive advantage; instead managing resources (through bundling, accumulation and coordination of co-specialised assets) can facilitate the creation of competitive advantage (Sirmon et al., 2010b). This framework is essentially a contingency model where firms pursue a 'fit' between the resources acquired and the strategies deployed in order to influence the performance outcome. The notion of dynamic managerial capabilities (Adner & Helfat, 2003) is central to the framework. Based on the limited work available and their importance to effective management, investigating contingencies in resource orchestration in the context of entrepreneurial start-ups can add richness to the resource orchestration framework and shed light on the value-creating strategies of entrepreneurial start-ups.

Resource investment decisions relative to rivals

Managers frequently need to make judgments under uncertainty (Kahneman, Slovic, & Tversky, 1982; Miller & Shamsie, 1999; Milliken, 1987). Early in the start-up stage, managers need to select the type and level of resources they want to invest in. They are also

required to adequately hire and train employees in different functional domains and develop intangible assets. They need to estimate the potential demand for their product or services and assess the likelihood of receiving investment from external investors. Oftentimes, they need to assess the suitability of a strategic partner and evaluate the future value of a technology. The inability to forecast the future or predict the consequences of a specific decision encourages managers to look for mechanisms that help them cope with uncertainty.

Research shows that imitation is a common behaviour in highly uncertain environments where quick actions are necessary (Lieberman & Asaba, 2006). Firms imitate each other in a range of activities such as in the introduction of new products or services, in the adoption of organisational forms, in market entry but also in the allocation of resources (Deephouse, 1999; Sirmon & Hitt, 2009). Because most decisions are made under conditions of uncertainty, firms view imitation as a very attractive option. Imitation provides legitimacy (Hannan & Freeman, 1987), minimises risks (Katz & Shapiro, 1985), reduces uncertainty (DiMaggio & Powell, 1983), and economises on search costs (Cyert & March, 1963). In order to cope with limited information firms often imitate larger, prestigious firms that are linked by greater network ties and who have access to superior information (Gulati, Nohria, & Zaheer, 2000; Haveman, 1993). Moreover, by copying innovators, imitators can signal their own legitimacy (DiMaggio & Powell, 1983) but also they can reduce the innovator's profits and erode 'first mover advantages' (Lieberman & Montgomery, 1988).

Conformity to rivals' actions has been studied from a strategy perspective. Porter (1979) in his work on strategic groups suggested that firms in the same group behave similarly to reduce competition. Spender (1989) suggested that managers rely on 'industry recipes' or organisational routines that are necessary to compete in the field, and Haveman (1993) found that successful strategies are imitated (Haveman, 1993; Porter, 1979; Spender,

1989). In general, it is suggested that firms with comparable resource endowments imitate one another in order to maintain competitive parity or limit rivalry (Lieberman & Asaba, 2006).

However, there are situations where firms choose to pursue a differentiation strategy²⁶ (e.g. establishing a position in an unexploited niche) in an effort to insulate their actions from rivals (Deephouse, 1999), although it can often be a very risky strategy. As Lieberman and Asaba (2006) noted, a firm cannot be certain that the new position or niche will be superior (Lieberman and Asaba, 2006:374). Nevertheless, a differentiation strategy can help firms face less competition and can increase performance (Baum & Mezias, 1992; Deephouse, 1999; Porter, 1979). A distinct position allows firms to establish barriers to entry, locate profitable new niches, and benefit from local monopolies. These distinct positions can be viable when they are accompanied with valuable, rare, inimitable and non-substitutable resources (Barney, 1991), and when they are aligned with the firm's core competences (Prahalad & Hamel, 1990).

Human capital has long been argued as a critical resource in most firms (Helfat & Peteraf, 2003; Penrose, 1959; Teece, 1998; Youndt, Snell, Dean, & Lepak, 1996). Its tacit nature makes imitation of human resources (knowledge and skills of employees) difficult which can then provide the basis for a sustained competitive advantage (Teece, 1998; Youndt et al., 1996). Value creation in start-ups occurs as entrepreneurs manage resources (through bundling, accumulation and coordination) and align them with a leveraging strategy (Sirmon et al., 2007). Because start-ups are typically resource-poor and lack market acceptance they may imitate the resource levels of rivals to mitigate uncertainty. If, however, they choose a

²⁶ Despite the benefits of reduced competition, firms with a differentiation strategy face legitimacy challenges as potential exchange partners may not approve of the firm's strategy and/or they may price resources at less favourable terms (Deephouse, 1999).

differentiation strategy they may invest in specific resources at levels higher than their rivals which is likely to lead to significantly different capacities²⁷ (Castanias & Helfat, 1991; Kor & Leblebici, 2005; Sirmon & Hitt, 2009).

Past studies have shown that investments in human capital are important for service (Hitt et al., 2006; Hitt, Bierman, Shimizu, & Kochhar, 2001; Kor & Leblebici, 2005; Sirmon & Hitt, 2009), technology-based (Eisenhardt & Schoonhoven, 1990; Kor & Mahoney, 2005; McEvily & Chakravarthy, 2002; Shane & Stuart, 2002; Wright et al., 2007), and a broad range of industries (Geroski, Mata, & Portugal, 2010; Gimeno et al., 1997). In this study, I focus on high-tech start-ups and argue that deviation from rivals' investments will generally harm the performance of new ventures unless it is matched effectively with a leveraging strategy that requires high investments in human capital.

When start-ups choose to invest in human capital at a higher level than their rivals they can rapidly exhaust organisational resources. Firstly, paying higher salaries to attract good candidates can be risky for resource-poor start-ups that will refrain from allocating these additional resources to other areas. Entrepreneurs face significant liabilities of newness and smallness during the early development (Stinchcombe, 1965) that limit their potential to scale up effectively and efficiently. Due to limited slack, a high investment level in one resource may restrict cash flows to alternatives, which corresponds to expensive opportunity costs.

Secondly, because resource accumulation in start-ups may be path dependent, firms are locked into particular directions (David, 1985; Hannan & Freeman, 1984) that can lead to

²⁷ Many studies have highlighted the importance of human capital for the performance of technology-based firms (Eisenhardt & Schoonhoven, 1990; Kor & Mahoney, 2005; Shane & Stuart, 2002). Employees with more human capital endowments (in the form of education and experience) are highly useful to high-technology start-ups because they have a greater ability to solve problems, identify superior opportunities and adapt to changes in the external environment (Penrose, 1959; Wright, Hmieleski, Siegel, & Ensley, 2007).

areas of competitive deficiency or disadvantage (Leonard-Barton, 1992; Sydow, Schreyögg, & Koch, 2009). For example, past studies have found that production, marketing and technological resources are important for young ventures (Lichtenstein & Brush, 2001). If a start-up overfunds one type of resource over another it might be compelled to adopt cost minimisation practices such as buying cheap materials or investing in inferior technologies (e.g. software, databases). Therefore, the choice of overfunding one resource over the other can have a significant impact on the performance of new ventures and even threaten start-up survival²⁸.

Thirdly, paying a higher price than a competitor for a resource is risky because hiring for example, can be a costly process if the candidate turns out to be inadequate. Specifically, investing in higher levels of human capital compared to rivals may 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 & Hitt, 2009). Therefore, I expect that in general, a higher investment in human capital than rivals is risky and can often lead to inefficiencies and thus lower performance. Therefore, I hypothesise:

Hypothesis 1: A higher level of human capital relative to rivals is negatively associated with start-up performance.

Contingencies in resource orchestration: Aligning human capital investments with leveraging strategy

Mere possession of resources however, does not warrant a competitive advantage; instead managing resources can facilitate the creation of competitive advantage (Helfat et al.,

²⁸ Scholars have demonstrated that pursuing activities that require significant investments of resources can lead to trade-offs (Rahmandad, 2011) and poor performance in new ventures. For instance, short-run constraints may threaten start-up survival in internationalisation (Sapienza et al., 2006) and limit the number of opportunities they can exploit (Kumar, 2009).

2007; Helfat & Peteraf, 2003; Penrose, 1959; Priem & Butler, 2001). As Helfat and colleagues (2007) noted, the process of assembling and *orchestrating* particular constellations of assets for economic gain is a fundamental function of management (Helfat et al., 2007:23). Indeed, value is created only when resources are deployed effectively within the firm's environmental context (Lippman & Rumelt, 2003). 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.

A firm consists of bundles of resources that need to be evaluated, integrated, combined and exploited effectively to create value. One of the most important activities for start-ups is to accumulate and combine different types of resources to achieve superior performance. Value creation in start-ups occurs as entrepreneurs manage resources and match them to a leveraging strategy (Sirmon et al., 2010b). *Leveraging* is the process by which start-ups apply their capabilities to create value (Sirmon et al., 2007). For example, a start-up with a deep knowledge base can instigate investments 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.

Start-ups commonly concentrate their competences on a narrow market niche in order to establish a foothold in the market that is relatively free of competition (Hannan & Freeman, 1977). In their effort to create value for customers they may choose to exploit new opportunities by leveraging their R&D capability to create innovations e.g. new product offerings or new services in the market. In this study, the R&D deployment intensity in new products and services varied among high-tech start-ups. These differences in R&D intensity

should lead to significantly different capacities in *innovation* (Leiponen & Helfat, 2010; Nelson, 1961). However, the innovation process requires active orchestration of both intangible and tangible assets by entrepreneurs (Augier & Teece, 2009). In fact, human capital investment decisions made by an entrepreneur should match the value creating leveraging strategy.

Start-ups that pursue a leveraging strategy with a focus on innovation require qualified and skilled employees (Leiponen, 2005b) who have knowledge of the most recent scientific and technological developments in their field. They also require employees with industry experience as these presumably have better knowledge of customer preferences and can find solutions to customers' problems. Thus, investing generously in human capital is important when having a high R&D intensity. In order to benefit from a high R&D intensity, start-ups also need to motivate employees and reward innovation by investing in human capital at levels higher than their rivals. This ensures that tacit knowledge accumulates and remains within the firm, which then allows start-ups to assimilate, absorb and integrate knowledge from external sources (Cohen & Levinthal, 1990).

Indeed, start-ups benefit by attracting and retaining talent within the firm. Existing internal staff of technologists and scientists are familiar with the firm's idiosyncratic needs, organisational procedures and routines. By retaining employees that have firm-specific knowledge, start-ups can develop and renew internal competences by creating new knowledge, disseminating it internally, and embedding it in new goods or services that can be launched in the market (Augier & Teece, 2009). For example, prior experience within the firm provides employees with the background necessary to implement important changes to internal processes or reorganise production processes. Kor and Mahoney (2005) showed that firm-specific experience positively moderates the relationship between R&D deployment

intensity and performance in technology-based start-ups. Because of the tacit knowledge and experience with firm-level capabilities and organisational routines, managers are better able to identify and assess which opportunities in the environment should be exploited based on the firm's competences. Similarly, in a sample of new technology-based ventures, Shrader and Siegel found that the fit between strategy and human capital experience is a key determinant of performance in high-tech entrepreneurial firms (Shrader & Siegel, 2007). A differentiation strategy was positively related to performance when it was complemented by top management teams with high levels of technological experience.

Other scholars have highlighted the importance of managing effectively human capital in order to achieve superior performance (Augier & Teece, 2009; Castanias & Helfat, 2001; Mahoney & Pandian, 1992; Penrose, 1959; Wright, Smart, & McMahan, 1995; Youndt et al., 1996). Youndt and colleagues (1996) argued that firms that pursue quality or flexibility strategies must develop and maintain adaptable, highly skilled and technologically competent employees that can deal with situations that require problem-solving, creativity and initiative. In contrast, they found that traditional cost strategies that create customer value by reducing costs were complemented by a more low-skilled, manual workforce. Wright and colleagues (1995) also highlight the importance of congruence between a firm's strategy, human resources and performance. In general, a competitive advantage may be obtained when a firm's investments in human capital are effectively matched with its strategy. Therefore, high-tech start-ups pursuing a leveraging strategy based on innovative new products or services might benefit from high investments in human capital relative to rivals. Such investments would allow start-ups to acquire and retain talented employees who possess important problem-solving and technical skills which can enhance product features and facilitate innovation within the firm. Thus, I hypothesise:

Hypothesis 2: *The impact of a high level of human capital relative to rivals on start-up performance is positively moderated by a strategy focused on innovation.*

METHODOLOGY

Sample

I used the longitudinal Kauffman Firm Survey, and in particular the proprietary KFS dataset of US start-ups to test the above hypotheses. This panel was formed from a random sample of 32 469 firms from Dun and Bradstreet's database of all start-ups formed in 2004 in the United States, excluding non-profit firms, those owned by an existing business, or firms inherited by someone else (DesRoches et al., 2010). The Kauffman Firm Survey team interviewed the founders of 4 928 start-ups and surveyed them annually for six years (DesRoches et al., 2010). The sample includes 136 high-tech start-ups which were tracked annually for 7 years. This resulted in a panel of 418 (firm year) observations (unbalanced). Start-ups operated in 15 different four-digit North American Industry Classification System (NAICS) codes. Table 5 presents the industries in which start-ups compete in this sample. The most frequent industries in the sample are NAICS 5415 (Computer systems design and related services), with 31 percent of the sample; NAICS 3345 (Control instruments manufacturing), with 11 percent of the sample and NAICS 5417 (Scientific research and development services), with 8 percent of the sample.

Dependent variable

Performance. I measure start-ups' performance by taking the percentage change in revenues from the previous year and taking its natural logarithm²⁹ (Baum, Locke, & Smith, 2001). This was calculated by taking the difference between the revenues in year t and year $t-1$ and then dividing it by the revenues in year $t-1$. A *relative* measure of start-up growth is frequently used in the industrial organisation and labour economics literature. This approach is preferable than measuring the actual difference in start-up size (absolute) because it reduces the impact of firm size on the growth indicator. Firm growth is an appropriate measure for start-ups' performance and competitive advantage creation (Kor & Mahoney, 2003; Penrose, 1959).

Independent variables

Human capital investment. I follow Deephouse (1999) to measure deviation in human capital investments. Specifically, I create a variable that measures start-ups' human capital deviation from the industry (3 digit) mean. In a given year, the wages per employee for each start-up 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 start-up i in year t , where W_{it} is the wage per employee for start-up i in year t , W_t is the mean wage per employee in year t for start-ups in the same industry, and $SD(W_t)$ is its standard deviation:

$$\text{Human Capital Deviation}_{it} =$$

$$(W_{it} - M(W_t)) / SD(W_t)$$

²⁹ I measure start-up performance by taking the log of sales growth plus 1 to correct for zero values. Similarly Delmar and Shane (2006) take the log of employee growth plus one to measure firm growth (Delmar & Shane, 2006). The log transformation is used to reduce the dispersion in the growth rates of new ventures.

Table 5: Industry distribution (chapter 3)

Industries	NAICS code	% of sample
Computer systems design and related services	5415	31
Navigational, measuring, electromedical, and control instruments manufacturing	3345	11
Scientific research and development services	5417	8.0
Metalworking machinery manufacturing	3335	7.5
Software publishers	5112	7.0
Semiconductor and other electronic component manufacturing	3344	6.8
Pharmaceutical and medicine manufacturing	3254	6.3
Industrial machinery manufacturing	3332	5.4
Communications equipment manufacturing	3342	4.7
Other fabricated metal product manufacturing	3329	3.7
Computer and peripheral equipment manufacturing	3341	3.5
Other electrical equipment and component manufacturing	3359	3.3
Aerospace product and parts manufacturing	3364	1.6
Basic chemical manufacturing	3251	0.4
Manufacturing and reproducing magnetic and optical media	3346	0.3
Total		100

High investment relative to rivals in wages per employee indicates more concern about the employees' skills, motivation and retention (Sirmon & Hitt, 2009). Human capital is a critical resource for start-ups that is reflected by the cash flow directed to employees' salaries. Employees' wage is a valid measure for investments in human capital (Abowd, Kramarz, & Margolis, 2003). In labour economics, most of the differences in wages can be explained by differences in the attributes of employees. Hitt and colleagues (2001) found starting salaries to be positively correlated with the education of individuals (Hitt et al.,

2001). A smaller portion of wage differential can be attributed to the strategies of firms to retain employees. 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 employees³⁰ (Stiglitz, 1985). Empirical tests have shown that managers tend to retain workers with firm-specific human capital in order to avoid hiring and training costs (Campbell & Kamlani, 1997). Other studies have shown that this relationship is also prevalent among white-collar workers (Agell & Lundborg, 1995).

R&D intensity. Similarly, I measure a ‘leveraging strategy with a focus on innovation’ by the deviation relative to rivals in the proportion of employees responsible for the creation of *new products* and *services* out of total employment. A high deviation means that start-ups have a strong focus on innovation. Similarly, O’Brien (2003) measures 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 to measures of innovative output and new product introductions (Hitt, Hoskisson, & Hicheon, 1997). The R&D intensity ratio is widely used in studies of innovation.

I follow Deephouse (1999) to measure deviation in R&D intensity. Specifically, I create a variable that measures start-ups’ deviation in R&D intensity from the industry (3 digit) mean. In a given year, the proportion of employees responsible for the creation of *new products* and *services* for each start-up was compared to the equivalent industry mean proportion, and expressed as a standard deviation. The following equation measures the deviation in R&D intensity of start-up i in year t , where R_{it} is the proportion of employees

³⁰ In labour economics, the efficiency wage model suggests that the productivity of employees is positively related to the wages they receive.

responsible for the creation of *new products* and *services* for start-up *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 start-ups in the same industry, and $SD(R_t)$ is its standard deviation:

$$R\&D\ Deviation_{it} =$$

$$(R_{it} - M(R_t))/SD(R_t)$$

Control Variables

I controlled for founder and firm characteristics as well as year effects.

Owner education. I control for the education of the owner with a binary variable that equals one when the owner has a college degree and zero when the owner does not have a college degree (Geroski et al., 2010).

Prior start-up experience in the industry. I control for prior start-up experience in the industry with a binary variable that equals one when the founder has prior experience in the industry and zero otherwise. Companies founded by individuals with prior start-up experience in the industry can positively influence performance as serial entrepreneurs have gained knowledge from setting-up a business, developing new products as well as managing early-stage organisations (Shane & Stuart, 2002).

Work experience. Prior working experience can also positively influence performance as it can provide a wide range of skills (Gimeno et al., 1997) as well as valuable contacts with customers, suppliers and investors (Shane & Stuart, 2002). This variable was calculated by taking the log of the years that the founder was working before founding the business.

Number of employees. I control for the size of the start-up by taking the natural logarithm of the total number of employees (Geroski et al., 2010).

VC financing. I control for access to venture capital financing with a binary variable that equals 1 if the start-up has received VC investment and zero otherwise (Stuart et al., 1999).

Hotspot. To control for location I create a dummy variable indicating whether the start-up is located in one of top ten U.S. states ranked as high in technology and science assets using the Milken State Technology and Science Index³¹ (O'Shea et al., 2005).

Year dummies. Finally, I control for year effects.

Model and Econometric Approach

I estimate start-ups' revenue increase given their investments in human capital relative to rivals and their leveraging strategy by using fixed-effects panel regression. Fixed effect models control 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 & Leblebici, 2005). Fixed-effects help reduce heteroscedasticity and autocorrelation³² (Greene & Zhang, 1997).

The Hausman test which showed that the random effects estimator would be inconsistent (the assumption that random effects are orthogonal to the repressors was wrong). A large and significant Hausman test statistic confirmed that the fixed effects model was preferable. I calculated the variance inflation factor (VIF) which showed no multicollinearity problems (VIF was below the threshold level of 10). The fixed-effects regression model is of the following form:

³¹ This index ranks the U.S. states based on the high-tech growth indicators such as research and development expenditures, the percentage of population with postgraduate degrees, venture capital investment and number of patents issued.

³² I checked for the normality of residuals with a numerical test for normality (iqr). I did not find any severe outliers and the residuals had an approximately normal distribution.

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

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

RESULTS

Table 6 presents the descriptive statistics and correlations table. The average high-tech start-up has 12 employees and is endowed with a high level of education and experience among its founders. The first model of table 7 includes the control variables. We see that the coefficient of prior start-up experience in the industry is positive and significant. Model 2 adds the main effect of human capital deviation relative to rivals. A negative coefficient would confirm hypothesis 1. Indeed, this coefficient is negative and significant ($p < 0.001$) signifying that paying above rivals' investments in human capital is negatively associated with revenue growth. Therefore, deviation from rivals' human capital investments, in general, harms performance thus supporting hypothesis 1.

In the same model, the coefficient of prior start-up experience in the industry is positive and significant and that of start-up size is negative and significant. While the positive effect of prior start-up experience in the industry on performance may be expected, the negative effect of firm size needs further elaboration. When firm growth is measured as growth rates, small firms are observed to grow particularly fast, at levels higher than larger firms. This is because it is easier e.g. for a firm of 2 employees to grow to 4 employees (100% increase in employment), than for a large firm of 2000 employees to experience an

Table 6: Descriptive statistics³³ and correlations³⁴ (chapter 3)

	Mean	s.d.	Performance	R&D intensity	Owner education	Work experience	Prior start-up industry experience	VC financing	Number of employees	Hotspot	Human capital investment
Performance	0.38	1.60	1.00								
R&D intensity	0.86	0.91	0.04	1.00							
Owner education	0.78	0.41	0.01	0.11*	1.00						
Work experience (raw)	30.6	29.7	0.08	0.03	-0.03	1.00					
Prior start-up industry experience	0.37	0.48	0.01	0.01	-0.05	0.22*	1.00				
VC financing	0.02	0.14	0.03	0.12*	-0.01	-0.06	0.09	1.00			
Number of employees (raw)	12.3	17.2	0.10*	0.04	0.07	0.33*	0.25*	0.12*	1.00		
Hotspot	0.38	0.48	-0.01	0.12*	0.11*	-0.06	-0.02	0.08	0.04	1.00	
Human capital investment	0.22	1.03	-0.11*	0.08	0.04	0.15*	0.06	0.22*	0.07	0.11*	1.00

³³ N= 418. Minimum and maximum values for each variable are not provided due to confidentiality constraint associated with the 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 we present the revenue change for year 6 in this table.

³⁴ I report correlation coefficients and the significance level for p-values with p<0.05

Table 7: Panel fixed effects analysis: the effects of human capital investment and R&D intensity on performance (chapter 3)

	(1)	(2)	(3)
	Controls	Direct effect	Interaction effect
Owner education	-0.28 (0.43)	-0.27 (0.41)	-0.25 (0.40)
Prior start-up industry experience	0.91* (0.46)	1.02* (0.44)	0.97* (0.43)
Work experience	-0.26 (0.22)	-0.15 (0.21)	-0.20 (0.21)
Number of employees	-0.33+ (0.18)	-0.55** (0.18)	-0.53** (0.18)
VC financing	-0.27 (0.66)	0.20 (0.64)	-0.25 (0.66)
Hotspot	0.37 (0.80)	0.75 (0.77)	0.80 (0.76)
R&D intensity	0.08 (0.08)	0.04 (0.07)	-0.01 (0.08)
Human capital investment		-0.30*** (0.05)	-0.42*** (0.07)
R&D intensity * human capital investment			0.17* (0.07)
Constant	2.23** (0.80)	2.26** (0.76)	2.37** (0.76)
Year dummies	Yes	Yes	Yes
Firms	136	136	136
Observations	418	418	418
R-squared	0.166	0.247	0.262
Adjusted r-squared	-0.286	-0.166	-0.148
Prob>F	0.0000	0.0000	0.0000
Standard errors in parentheses			

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

increase of another 2000 employees. Therefore, it should not come as a surprise that smaller start-ups have higher expected growth rates than larger ones (Mansfield, 1962).

In order to test the hypothesis regarding the fit between human capital investment levels and R&D intensity I add the interaction in model 3 of table 7. To provide support to hypothesis 2 we expect to see a positive and significant coefficient. Indeed, the interaction between R&D intensity and human capital deviation is statistically significant and positive ($p < 0.05$) showing that when matching high investments in human capital to a high R&D intensity, performance improves. Hypothesis 2 gains further credence because the inclusion of the interaction term improved the overall fit of the model ($F = 5.19, d.f. = 265$) which was significant at the $p < 0.001$ level. Figures 1 and 2 plot the results of these tests and provide further support to the models presented. Figure 1 shows that deviation from the human capital investment of rivals negatively affects performance. However, when a high human capital investment is matched with the appropriate leveraging strategy (high R&D intensity), there is a positive effect on performance (figure 2).

I conducted several robustness checks to ensure the accuracy of these results and eliminate alternative explanations. First, the fixed-effects panel regression controls for unobserved heterogeneity and allows for an unbiased estimate of the relationship between human capital investments and firm performance (Kor & Leblebici, 2005). Second, I ran the same analysis on start-ups in later years (older than 3 years) to control for the fact that there may be more variation in human capital deviation in the first years. One may expect that in the earlier years some start-ups may be paying very high wages (e.g. CEO, CTO) compared to others, and then in later years this difference may be lower as start-ups grow older and add more employees. Therefore, we could observe larger deviations when start-ups are small, whereas in later years, wages would tend to move toward the industry average as start-ups

grow. The results with this test are consistent with the above findings. In addition, by scaling the wage equation by standard deviation I control for the fact that there may be more variation in the earlier years.

Figure 1: The effect of high human capital investment relative to rivals on performance (chapter 3)

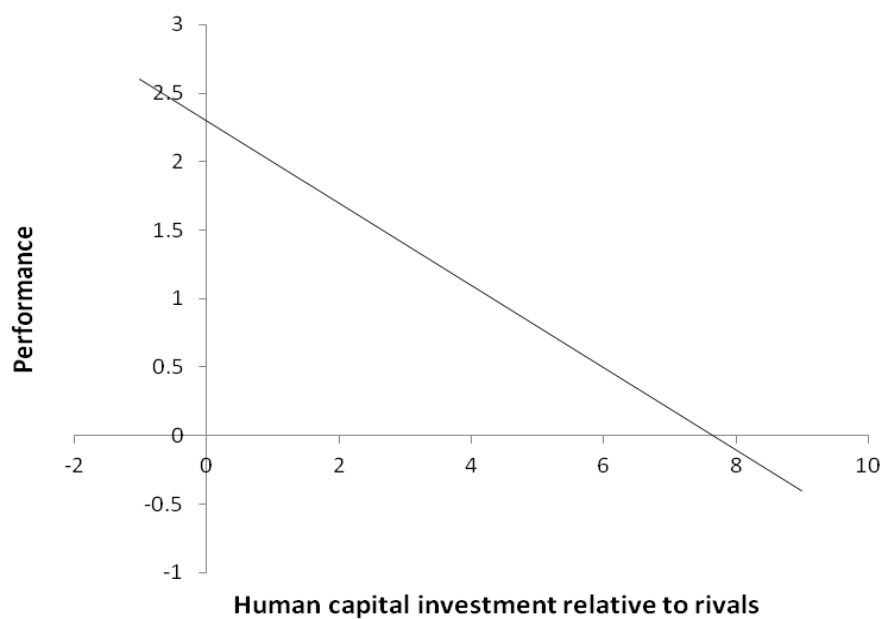
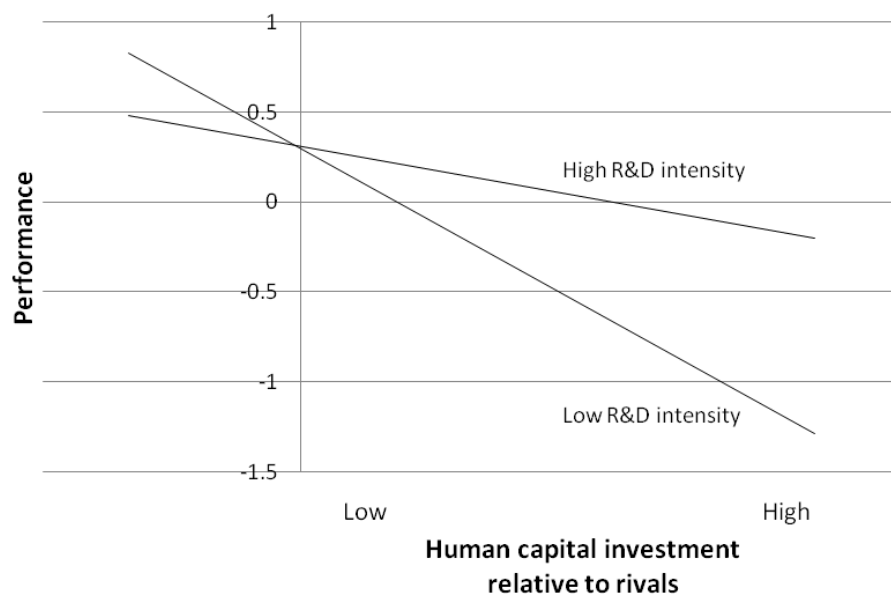


Figure 2: Effects on performance of the interaction of human capital investment relative to rivals and R&D intensity (chapter 3)



DISCUSSION

Long ago, Penrose highlighted the critical role of managers in the conversion of firm resources into firm capabilities, new product applications and value creation (Penrose, 1959). However, prior work on the resource-based view has failed to address how managers use resources to create value (Priem & Butler, 2001; Sirmon et al., 2007) or how these are connected with the strategies firms pursue (Sirmon et al., 2010b). Recent developments on asset orchestration (Helfat et al., 2007) and resource management (Sirmon et al., 2007) attempt to call attention to the role of managerial activity for value creation. This study responds to this call by developing a model that depicts the process of managing resources to create value. Specifically, this study advances knowledge on the role of entrepreneurs in orchestrating resources by focusing on two key contingencies: resource investment and leveraging strategy.

The findings indicate that deviation above rivals' investments in human capital negatively affects performance in start-ups. Specifically, higher investments in human capital relative to the industry norms harm the performance of start-ups. This suggests that in general, start-ups that conform to the norms set by rivals in terms of human capital investments may achieve better performance outcomes than those that invest above the industry norms. This result is consistent with Sirmon and Hitt (2009) who in a sample of banking firms in the US find that conformity to rivals' investment decisions was beneficial. Thus, based on a sample of high-tech start-ups, this study provides evidence that deviation above rivals' investments produces negative outcomes for performance.

However, this study also shows that only looking at investment decisions of new ventures is not sufficient when investigating performance differences. Indeed, mere possession of resources is a necessary but insufficient condition for value creation.

Specifically, I find that synchronising resource investment decisions in human capital with a leveraging strategy focused on innovation can produce superior performance outcomes. Thus, although higher investments in human capital relative to rivals can harm performance, superior performance can be produced when human capital investments and leveraging strategy are purposefully synchronised by the entrepreneur.

Specifically, start-ups with high R&D intensity require skilled and experienced employees who have knowledge of customers' preferences and can find solutions to customer problems. The firm-specific and tacit knowledge that these individuals possess becomes more valuable when it is accumulated and disseminated within the organisation. Thus, investing generously in human capital is important in order to attract and retain experienced employees. This study provides evidence that a higher investment in human capital relative to rivals complements a leveraging strategy that focuses on innovation. Indeed, simply allocating large expenditures to R&D is not enough to achieve superior performance unless it is coupled with a high investment in human capital relative to rivals. In contrast, start-ups that have low R&D intensity are not expected to require high investments in human capital since the knowledge possessed is less tacit and can therefore be more easily reproduced.

These findings suggest that for start-ups with high R&D intensity, discrepancy from the norm in terms of human capital investments can be beneficial, if they deviate in their right way. Therefore, a fit between resource investments and leveraging strategy induces a higher performance in start-ups. For example, when start-ups invest in human capital at high levels relative to rivals and their leveraging strategy focuses on innovation, performance is enhanced. These start-ups manage, by paying higher salaries, to attract and retain skilled and experienced employees who will thus have no incentive to change jobs (Shapiro & Stiglitz,

1984). Therefore, start-ups can accumulate and disseminate tacit knowledge and increase productivity.

Figure 1 graphically displays the effect of deviation from rivals' human capital investments on the performance of start-ups. Specifically, a positive deviation in human capital relative to rivals (paying higher salaries) is negatively related to performance. In general, a smaller deviation from rivals' investment choices can induce better performance outcomes. In figure 2, out of the start-ups that have higher human capital investments, best performance can be achieved when start-ups also invest in high R&D intensity. In contrast, low human capital investments should be complemented by an analogous low deployment in R&D.

Overall, these findings have important implications for both theory and practice. First, by empirically examining the resource investment/leveraging strategy contingency suggested by Sirmon and colleagues' resource management framework (2007, 2010b), this paper draws attention to the role of the entrepreneur who acts as a catalyst in asset orchestration (Helfat et al., 2007; Sirmon et al., 2007). Although existing theories suggest that in general, human capital resources lead to performance benefits (Eisenhardt & Schoonhoven, 1990; Hitt et al., 2006; Kor & Leblebici, 2005), the findings in this paper imply that human capital decisions must be aligned with the leveraging strategy selected by the entrepreneur in order to achieve a resource-based advantage. In fact, investing in superior human capital alone is not sufficient to augment the value proposition brought to customers. Instead, actively orchestrating human capital decisions with the innovation process is an important managerial ability which can enhance value. These findings combined with the recent work from Sirmon and colleagues (2008, 2009), Hitt and colleagues (2001, 2006), Kor and Leblebici (2005), Gruber and colleagues (2010) and Holcomb and colleagues (2009) suggest that contingencies that affect

resource orchestration lie at the heart of a resource-based advantage. Therefore, the selection of resources (structuring the resource portfolio and bundling) as well as deploying the resources to create value (leveraging capabilities) is a fundamental managerial function that affects performance.

Second, this study contributes to our understanding of the conditions under which discrepancy from rivals' investments can be beneficial. Although *imitation* of rivals' resource investments can secure some performance advantages (Deepphouse, 1999; Lieberman & Asaba, 2006), start-ups that synchronise high investments in human capital with a leveraging strategy focused on exploiting their R&D capabilities can improve their performance. Therefore, start-ups with high R&D intensity can benefit from discrepancy from the norm if they deviate in their right way.

Third, 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 is not going to produce the best outcome. Instead, entrepreneurs should align their resource investment choices with their deployment decisions. Thus, when they leverage firms' R&D capabilities they should invest generously in human capital to attract and retain experienced and skilled employees who have knowledge of customers' preferences and whose firm-specific, tacit knowledge can reside within the firm. Overall, the entrepreneur should employ the firm's assets and orchestrate them effectively to augment the value proposition offered to customers.

LIMITATIONS AND FUTURE RESEARCH

This study has some limitations which provide avenues for future research. The sampled firms were high-tech start-ups that operated in the US. Therefore, future studies

should investigate resource orchestration in start-ups that operate in other industries and countries. In addition, human capital investment was measured as wages per employee. This assumes an efficient labour market where wages reflect the marginal productivity of employees. Other studies have used wages to measure investments in human capital (Sirmon & Hitt, 2009). Employees' wage can be a valid measure for investments in human capital because most of the differences in wages can be explained by differences in the attributes of employees (Abowd et al., 2003). Due to data limitations this study did not measure investments in employees' education or training. Future studies should investigate whether human capital investments as reflected by the education and training directed to employees, improve start-ups performance when they are aligned with the leveraging strategy adopted by the entrepreneur. We may expect that high-tech start-ups competing on the basis of innovation will perform better when they invest in highly skilled and educated personnel. Prior studies have noted that more human capital endowments (in the form of education and experience) will enhance the performance of high-tech firms as these will be more capable in identifying superior opportunities and adapting to the external environment (Shane & Stuart, 2002; Wright et al., 2007).

Furthermore, this study examines human capital investments as key contingencies in resource orchestration in start-ups. However, other types of resources may be needed to establish a start-up as a viable operating entity. For example, start-ups often undertake experimental resource allocation patterns in order to select valuable capability configurations that will confer value to customers (Sirmon et al., 2010b). Indeed, a configuration of R&D, engineering and marketing capabilities may be needed to design innovative products and services that create value for customers. Research shows that firms that conduct their own R&D are better able to integrate external knowledge (Cohen & Levinthal, 1990). However,

direct involvement with manufacturing can also help them recognise new information (Rosenberg, 1982) and thus exploit entrepreneurial opportunities. For instance, future research on resource orchestration can investigate physical capital investments (e.g. land and buildings, equipment, inventory and other assets) or investments in production and manufacturing activities such as production, production planning and quality control. Perhaps these activities can substitute or complement other resources. Complementary marketing or manufacturing capabilities could protect firms' returns to innovation, especially in industries where patents are not an effective mechanism for appropriating returns to innovation (Cohen, Nelson, & Walsh, 2000; Levin, Klevorick, Nelson, & Winter, 1987). Thus, configurations of entrepreneurial firms deserve further empirical investigation as they would provide a natural extension of previous research on resource orchestration and configuration research (Doty, Glick, & Huber, 1993; Meyer et al., 1993).

In conclusion, this study has important implications for resource management and value creation in start-ups. Specifically, it provides insights into the contingent effects of aligning resources with leveraging strategy to achieve a resource-based advantage. Future research should investigate other contingencies in resource orchestration in start-ups as this can improve our understanding of the crucial link between early resource choices and value creation. Future studies should also test how different configurations affect other important outcomes in start-ups (e.g. survival).

CHAPTER 4 – PUTTING ALL EGGS IN ONE BASKET: CAPABILITY CONFIGURATIONS AND SURVIVAL IN ENTREPRENEURAL START-UPS³⁵

INTRODUCTION

The process by which firms allocate their investments among the different types of capabilities they choose to develop is central to the resource-based view (Grant, 2002; Helfat et al., 2007; Teece et al., 1997). Organisational capabilities defined as “routines that provide a firm with the option of producing specific outputs or changing other routines” are a key driver in explaining differences in performance (Nelson & Winter, 1982). Prior studies, which are mainly focused on established firms (Eisenhardt & Martin, 2000; Helfat et al., 2007; Nelson & Winter, 1982; Tripsas & Gavetti, 2000; Winter, 2003), have shown that well developed capabilities can help firms learn new skills, innovate and overcome inertia. However, building a repertoire of capabilities is likely to be prohibitively costly for new ventures which are typically resource constrained (Stinchcombe, 1965). Developing different capabilities requires significant investments in organisational resources which are often scarce in new ventures. Similarly, new ventures lack established routines and face significant liabilities of newness which may limit their potential to effectively manage different types of capabilities³⁶.

Despite the theoretical and practical importance of developing capabilities in the early years of the organisation’s lifecycle we know little about capability development in new ventures (Arthurs & Busenitz, 2006; Autio et al., 2011; Newbert, 2005; Sapienza et al., 2006;

³⁵ This research was supported by the Ewing Marion Kauffman Foundation through access to the KFS data in the NORC Data Enclave. This chapter is co-authored with Aija Leiponen, Erkko Autio and Johan Bruneel.

³⁶ Dynamic capabilities may operate differently in young versus established firms as the former lack the a) resources, b) established routines, and c) integrating mechanisms that will allow them to build a portfolio of diverse capabilities (Zahra et al., 2006).

Zahra et al., 2006) or about entrepreneurs' allocation of investments among different capabilities (Bardolet, Lovallo, & Teece, 2013; Rahmandad, 2011). Although the resource-based view highlights the critical role of resources and capabilities for the creation of competitive advantage, current theory is not sufficiently clear about how new ventures develop and configure their capabilities to achieve superior performance (Gruber et al., 2010). Should new ventures simultaneously develop all capabilities to maintain flexibility or should they limit full-scale investments to one specific capability which will require fewer resources? This is an important gap in our understanding of the influence of capability investments on start-ups' survival, as new ventures need to cope with liabilities of newness and smallness (Stinchcombe, 1965) which may limit their potential to effectively develop multiple capabilities at once.

Capability development requires investment in organisational resources such as production, marketing and technology to develop research capabilities, engineering know-how, commercial responsiveness and other types of capabilities (Capron & Mitchell, 2009). Resource constraints mean, however, that allocating resources in one capability restricts the firm's ability to allocate resources to other capabilities. Therefore, entrepreneurs need to be aware of the costs and benefits of each capability investment as these may significantly affect start-ups' performance. Prior studies show that capability-building entails trade-offs (Rahmandad, 2011) which may be especially critical for start-up performance³⁷. However, although resource investment is a key element of successful capability-building (Eisenhardt

³⁷ Survival and future performance impose conflicting demands on entrepreneurs when building their capability portfolio. Because building capabilities is a resource-intensive process which may threaten start-up survival, entrepreneurs need to decide which capabilities they can afford to develop (Sapienza et al., 2006; Zahra et al., 2006).

& Martin, 2000; Makadok, 2001), it is surprising how there has been very limited research on the resource allocation aspect of capability-building (Bardolet et al., 2013).

In this study we examine new venture resource allocation into the development of key capabilities and test the effect of the resulting capability configurations on survival. We build a model of how investing in a single capability either in R&D, production, or marketing may improve organisational longevity in the context of new ventures. We test our hypotheses using a 7-year panel of US high-tech start-ups established in 2004. Consistent with our theory, we find that developing either R&D, production or marketing capabilities is beneficial for start-ups and that this pattern differs across industries. In contrast, simultaneous development of the above capabilities has negative implications for start-up survival. This effect is stronger under conditions of low munificence – a contingency that becomes salient for start-ups' resource orchestration activities (Sirmon et al., 2007).

This paper makes three contributions to theory and practice. First, it advances knowledge on new venture capability development by focusing on the allocation of resources in key capabilities and testing the effect of the resulting capability configurations on performance over time. By testing specific configurations of well-defined capabilities in a large number of start-ups, this paper provides a detailed investigation of the effect of R&D, production, marketing and balanced capability configurations on the survival of new ventures across different industries. This study provides evidence that a configurational approach can reveal important insights into the process of capability development in new ventures and sheds light on the relationship between the different elements of the entrepreneurial strategy. Second, this paper improves our understanding of the link between capability configurations and environmental contingencies by showing that under conditions of low munificence, balancing R&D, production and marketing capabilities increases the likelihood of new

venture failure. Third, this study alerts entrepreneurs to be aware of the trade-offs involved in developing different capability configurations.

This paper is organised as follows. First, we describe configuration theory and present some recent applications in the strategy and management literature. Taking a configurational approach, we develop a model of how different capability configurations may influence start-up survival. Then, we consider the contingency effect of munificence and its effect on capability development. We then discuss the analytical methods, including the operationalisation of our constructs and present our findings. In the discussion section we summarise and describe our contributions for theory and practice.

THEORETICAL BACKGROUND AND HYPOTHESES

The conceptualisation of organisational activities as systems of interdependent elements has received considerable attention and inspired a number of theoretical developments in organisational and strategy research (Doty et al., 1993; Fiss, 2007; Kim & Lim, 1988; Meyer et al., 1993; Miller, 1981; Miller & Shamsie, 1996; Porter & Siggelkow, 2008). Organisational configurations are defined as multi-dimensional constellations of conceptually distinct characteristics that commonly occur together (Meyer et al. 1993: 1175). Organisations possessing these attributes can be meaningfully grouped into taxonomies and typologies. The interdependencies among the different elements (strategy, environment, decision making and market domain) are the essence of configuration (Miller, 1998). Two prominent configurational theories are those of Miles and Snow (1978) and Mintzberg (1980) which argue that deviation from an ‘ideal type’³⁸ of organisation has negative implications

³⁸ The ideal type is a theoretical construct that is used to represent a holistic configuration of organisational factors (or fit across multiple dimensions of organisational design) (Doty et al., 1993; Van de Ven & Drazin, 1984). Scholars propose that the degree of deviation from the ‘ideal’ or ‘pure’ type can lower organisational

for firm performance (Miles et al., 1978; Mintzberg, 1980). The idea of ‘equifinality’, i.e., the notion that more than one combination of traits might be effective under a given set of circumstances is central to configuration theory (Gresov & Drazin, 1997). Overall, configuration research predicts which sets of firms with internally consistent operations will be successful under particular circumstances.

A recent stream in strategy literature applies configuration theory to investigate the effect of different configurations on organisational performance (Bensaou & Venkatraman, 1995; Ebben & Johnson, 2005; Gruber et al., 2010; Hill & Birkinshaw, 2008; Ketchen et al., 1997; Short et al., 2008). Ebben and Johnson (2005) demonstrate that small firms that pursue either efficiency or flexibility strategies tend to outperform those that attempt to simultaneously pursue both. Gruber and colleagues (2010) identify four archetypes of capability configurations in the ‘sales and distribution’ function, two of which (Sales and Distribution Stars and the Efficiency Centrics), are associated with superior performance outcomes. Hill and Birkinshaw (2008) demonstrate that when configurations of corporate venture units are aligned with their strategic objectives they tend to perform better, and that exploitation-oriented units tend to survive for longer than exploration-oriented units. Overall, this stream of research suggests that distinct configurations of resources and capabilities can lead to superior equifinal performance outcomes.

Building on configuration research we examine how capability configurations relate to the survival of new ventures under different environmental conditions. Although the use of the organisational configurations concept has been applied extensively in the organisation

effectiveness (Miles, Snow, Meyer, & Coleman, 1978; Mintzberg, 1980). For instance, Miles and Snow (1978) identified four ideal types of organisation (the prospector, the analyser, the defender and the reactor) each of which had a unique configuration of contextual, structural and strategic factors.

theory and strategy fields, it has been very limited in entrepreneurship research³⁹ (Lepak & Snell, 2002; Short et al., 2008; Wiklund & Shepherd, 2005). This is surprising, since configuration research has much to contribute to the entrepreneurship field and would provide a natural extension of previous research in strategic management and organisational theory (Dess et al., 1997; Short et al., 2008). New ventures face significant liabilities of newness and lack resources and prior routines. In order to achieve a competitive advantage they need to possess specific organisational resources or skills that cannot be imitated or purchased by others. However, orchestrating the various elements of the business and maintaining a complementarity among these (e.g. skills, resources, technologies, environment) can give start-ups unique capacities that are difficult to copy. Therefore, configurations in new ventures are likely to be a far greater source of advantage than any single aspect of strategy (Miller, 1998). Based on the limited work available and their importance to entrepreneurship, investigating organisational configurations in the context of entrepreneurial start-ups can add richness to configuration research and shed light on the process of capability development in new ventures.

Capability development in start-ups

Capabilities are defined as routines that provide a firm with the option of producing specific outputs or changing other routines (Nelson & Winter, 1982). Capabilities are classified as either ‘operational’ or ‘dynamic’. An operational capability can be defined as a collection of routines that enable an organisation to produce significant outputs of a specific

³⁹ Recent developments in entrepreneurship and strategy research call for a multivariate approach to explore the relationship between entrepreneurial strategy making and performance (Dess, Lumpkin, & Covin, 1997; Miller, 1998; Miller & Shamsie, 1996; Short et al., 2008). Theory suggests that this relationship may depend on factors such as the firm’s resources, competitive strategies, learning mechanisms and market conditions. Therefore, rather than investigating separately specific elements of a firm (e.g. resources or strategies), scholars propose that the interdependencies between those elements should be studied with contingency and configuration models which can reveal insights on how new ventures implement a comprehensive strategy.

type whereas dynamic capabilities are ‘those that build, integrate or reconfigure operational capabilities’ (Helfat & Peteraf, 2003; Winter, 2003).

Start-ups allocate resources in different functional activities to develop capabilities in research and development (R&D), production or marketing (Lichtenstein & Brush, 2001). On the one hand, start-ups may focus on a single capability by investing primarily in, for example, R&D or marketing capabilities. On the other hand, start-ups may pursue a balanced capability portfolio whereby resources are equally allocated among the R&D, production and marketing functions. We are particularly interested in this resource allocation aspect of capability-building because similar to Bardolet and colleagues (2013), we believe that resource allocation processes are the mechanism by which dynamic capabilities influence performance in firms (Bardolet et al., 2013). By allocating resources in the development of a single capability, new ventures are likely to have a narrow but deep focus in their specialist area (specialists). In contrast, allocating resources equally in the development of R&D, production and marketing capabilities means that firms invest broadly in all three areas (generalists). In the next paragraphs we examine how these different types of resource allocation for capability-building may affect new venture survival.

Prior research indicates that *R&D*, *production* and *marketing capabilities* can be important for start-ups. Research and development on new products or services positively affects new product introductions (Hitt et al., 1997) and innovative performance (Laursen & Salter, 2006). Manufacturing and marketing capabilities are also important for start-ups’ commercialisation which if not available, need to be accessed by forming inter-organisational relationships (Gruber et al., 2010; Katila, Rosenberger, & Eisenhardt, 2008; Kor & Mahoney, 2005). However, new ventures lacking sufficient resources may need to choose between alternative capability investments. In addition, due to higher learning costs (Stinchcombe,

1965), new ventures may find the development of a single capability less complex to manage than developing all three capabilities. According to the law of comparative advantage, there are efficiency gains when specialising in one particular area (Ricardo, 1911; Smith, 1776; Stigler, 1951). As Smith (1776) and Stigler (1951) noted, an input produced under increasing returns is supplied more efficiently by specialised suppliers that serve many firms. Therefore, an increased division of labour allows firms in research to become more efficient at developing new knowledge⁴⁰ whereas firms that are more experienced in production or marketing become more efficient at exploiting their production or marketing capabilities (Arora et al., 2001).

Apart from the efficiency gains of specialisation, new ventures can benefit from concentrating their competences on a narrow niche in the environment which allows them to establish a foothold in the market that is relatively free of competition (Carroll, 1985; Hannan & Freeman, 1977; Romanelli, 1989). In the organisational ecology literature specialisation is considered particularly suitable for new ventures that face liabilities of newness because it requires typically fewer resources than generalism (Carroll, 1985). Generalist organisations spread their capabilities and attempt to fit in a wider environment that requires them to simultaneously manage different strategies or even businesses. In contrast, new ventures that specialise on narrow market segments can acquire an important revenue base that can be used for later expansion and diversification. Romanelli (1989) has identified various conditions under which specialist new ventures have better survival rates than generalist ones.

In our study, we suggest that start-ups developing a single capability either in R&D, production or marketing (i.e. specialists) can increase their survival chances, and that this

⁴⁰ The question of how scientific knowledge is produced and used efficiently within firms has received considerable attention in the economic literature (Arrow, 1962; Chandler, 1977; Coase, 1937; Mowery, 1989; Nelson, 1959; Polanyi, 1962). Firms internalise assets through hierarchies to respond to market hazards such as imperfections in the market, uncertainty and investments in transaction-specific assets (Nelson & Winter, 1982; Teece, 1986; Williamson, 1981).

pattern will differ across industries. Significant R&D capabilities can help start-ups competing in high-tech sectors to gain a share in the market (by offering new products and services) and enable these firms to keep abreast of the latest developments in scientific research (Rothaermel & Hess, 2007; Tilton, 1971). Internal R&D capabilities allow start-ups to recognise, understand and evaluate internal knowledge (Rosenberg, 1990) and to absorb and assimilate external knowledge (Cohen & Levinthal, 1990). Finally, R&D capabilities enable new ventures to respond to radical technological changes that render existing technologies obsolete (Hill & Rothaermel, 2003).

In addition, manufacturing start-ups presumably need to invest in production capabilities whereas service start-ups would benefit from marketing capabilities. Production capabilities will enable manufacturing start-ups to improve their production processes by adding new features to products (e.g. to improve quality) or by economising on production costs which can finance future investments (Katila & Shane, 2005). Production capabilities can protect start-ups' profits due to invention especially in industries where patents are not an effective mechanism of appropriating the returns to innovations⁴¹ (Cohen et al., 2000; Levin et al., 1987). Finally, we expect marketing and sales capabilities to positively affect start-up survival in the service industry as these can improve customer service and customer relationships (Kor & Mahoney, 2005). Therefore, we posit:

Hypothesis 1a: *Developing a single capability in R&D will have a positive effect on start-up survival.*

Hypothesis 1b: *Developing a single capability in production will have a positive effect on start-up survival.*

⁴¹ In some markets innovation may be manufacturing-intensive (Katila & Shane, 2005). In these markets we may expect that both production and R&D capabilities are necessary for start-ups to compete. We therefore allow in our empirical model for configurations to exist between two different capability types.

***Hypothesis 1c:** Developing a single capability in marketing will have a positive effect on start-up survival.*

Trade-offs in capability development

Prior studies however have not investigated the trade-offs in capability investments (Rahmandad, 2011). Although the dynamics of a single capability development have been studied (Helfat & Peteraf, 2003; Tripsas & Gavetti, 2000), we lack an understanding of the potential trade-offs that occur in different capability investments⁴². Allocating investments among capabilities can be a major challenge for entrepreneurs who have limited investment resources. While capabilities are usually beneficial for start-ups, they contain their own costs and risks (Piao, 2010; Rahmandad, 2011). Finding an appropriate balance among different capabilities is often difficult to achieve (Rosenkopf & Almeida, 2003).

For example, managers have the tendency to allocate resources equally over all divisions (Bardolet, Fox, & Lovallo, 2011) due to the cognitive bias of naively diversifying when making investment decisions (Benartzi & Thaler, 2001). In addition, the evolutionary argument suggests that a firm's irreversible investments in specific routines constrain its ability to develop new capabilities (Cyert & March, 1963). Therefore, selecting which capabilities to develop and achieving a balance across these are crucial strategic decisions of the entrepreneur. Due to resource constraints, allocating resources in one capability restricts cash flows to alternatives thereby making the choice between alternative capability investments critical for survival (Grant, 2002).

⁴² Prior studies which are mainly focused on established firms have shown that well developed capabilities can benefit companies. However, most of the extant literature has failed to address capability formation in new ventures (Autio et al., 2011; Zahra et al., 2006). New ventures which typically lack resources and prior routines need to effectively assemble and orchestrate the resources and capabilities that will allow them to survive and achieve legitimacy. Therefore, choosing between alternative investments is a fundamental decision that entrepreneurs make in the early years which will have a great impact on the firm's subsequent performance (Grant, 2002).

Because of resource constraints in new ventures we expect that start-ups developing a single capability either in R&D, production or marketing will have better survival rates than start-ups that simultaneously develop all capabilities. Specialised start-ups developing one type of capability typically require fewer resources than generalist start-ups which allocate resources in different capabilities and attempt to serve a wider market (Carroll, 1985). Specialist organisations can more easily achieve economies of scale but they can also focus on small niche markets that are relatively free of competition by established players. The trade-offs in balancing different types of capabilities can threaten start-up survival especially in the absence of slack resources (George, 2005).

A related trade-off between exploration and exploitation has received a lot of attention in the organisational learning literature (Gupta, Smith, & Shalley, 2006; Lavie & Rosenkopf, 2006; Lavie, Stettner, & Tushman, 2010; March, 1991). The tension between exploration and exploitation occurs when resources are fixed since the more they are consumed for one purpose, the less they will be left for the other (March, 1991; Piao, 2010). Overall, this literature seems to suggest that attempts to balance exploration and exploitation can reduce the resources available inside the firm which will, as a result, negatively affect firm survival.

Apart from the lack of resources, new ventures also lack prior routines and knowledge of how to effectively combine R&D, production and marketing capabilities. Because start-ups with significant R&D competences will have particular organisational attributes that are not consistent with the characteristics of developing other types of capabilities, it is likely that attempts to achieve a balance between dissimilar capabilities will be detrimental for firms that lack integration and coordination skills. For example, although new ventures with significant R&D capabilities would benefit from manufacturing capabilities, these are very difficult to organise and coordinate internally because establishing routines to exploit

manufacturing resources often hinders innovation⁴³ (Katila & Shane, 2005). Katila and Shane (2005) show how new firms without established routines can have a higher innovation rate than established players in less manufacturing-intensive industries. Ebben and Johnson (2005) demonstrate that small firms mixing efficiency and flexibility strategies will be at a disadvantage compared with small firms that follow either strategy because of the conflict in pursuing both strategies at once.

As with other configurational theories, we suggest that deviation from the ideal type will lower organisational effectiveness (Miles et al., 1978; Mintzberg, 1980; Porter, 1980). Balancing R&D, production and marketing capabilities can be viewed as a hybrid configuration, whereas developing a single capability can be viewed as pure or ideal configuration (Doty et al., 1993). Attempts to simultaneously invest in different types of capabilities in new ventures should lower performance in the absence of slack resources and sophisticated managerial expertise. We argue that it is important for start-ups to develop the type of capability that matches the environment they compete in rather than attempting to simultaneously develop all capabilities and positioning themselves between different environments. The latter strategy could expose new ventures to a higher risk of failure since they lack the resources and routines to effectively combine different types of capabilities. We expect that start-ups cannot effectively combine and master the different types of capabilities under resource constraints, and thus, balancing different capabilities should negatively affect start-up survival. We hypothesise:

Hypothesis 2: Developing a balanced portfolio across different capabilities will have a negative effect on start-up survival.

⁴³ Established routines increase bureaucracy, prevent adaptation to changing environments and slow down the innovation process (Katila & Shane, 2005). Other scholars have argued that established routines impede organisational learning (Cohen & Levinthal, 1990; Cyert & March, 1963) and learning from foreign markets (Autio et al., 2000).

Environmental contingencies in capability development

Environmental munificence, ‘the scarcity or abundance of critical resources needed by firms operating within an environment’ is an important contingency factor which affects both firm growth and survival (Castrogiovanni, 1991). Specifically, environments with low munificence are substantially different from environments with high munificence and they have different implications for effective capability deployment (Sirmon et al., 2007). In particular, environments low in munificence heighten the importance of managing capabilities effectively, because resources may not be readily available to the firm in order to invest in capability development. Therefore, the level of munificence may significantly affect the relationship between capability development and start-up survival because of the resource constraints that start-ups face.

Environmental jolts demarcate dramatically different periods of munificence (Chakrabarti, Singh, & Mahmood, 2007; Park & Mezas, 2005; Wan & Yiu, 2009). As Park and Mezas (2005) and Chakrabarti and colleagues (2007) suggest, environmental jolts are significant and dramatic changes in the environmental munificence and thus the availability of resources in an environment (Dess & Beard, 1984). In environments with heavy competition for resources such as in the years following the financial crisis when resources become scarce, we expect that the negative effect of simultaneously developing different capabilities on survival will be stronger. When there is greater uncertainty about resource availability, new ventures should pursue specialist strategies which require fewer resources and which secure access to a narrow but relatively free of competition market segment (Romanelli, 1989). In contrast, in more munificent conditions, generalist organisations can improve their chances for early survival. Romanelli (1989) identified the conditions under which specialist firms would outperform generalist ones and showed that specialist

organisations had a higher likelihood of surviving their early years than generalist ones due to resource scarcity and entry to niche markets.

Therefore, we expect that if simultaneous capability development threatens start-up survival as a result of the liability of newness which implies higher costs in managing different capabilities, its effect should be particularly important in such low munificence environments. Prior studies show that firms should pace their activities in response to various environmental conditions to improve survival chances (Piao, 2010). We expect that attempts to balance different capability types will increase the failure likelihood of new ventures in the years following the financial crisis when resource availability is limited. Therefore we posit:

Hypothesis 3: *Under conditions of low munificence the negative effect of developing a balanced portfolio across different capabilities on start-up survival will be stronger.*

METHODOLOGY

We examine the effect of start-ups' capability configurations on the likelihood of survival and we test whether this effect is affected by the change in environmental munificence before and after the financial crisis. We distinguish between three types of capabilities: R&D, production and marketing capabilities. We focus on resource allocation in the above well defined capabilities which are based on core constructs in the literature, in order to ensure their theoretical and empirical relevance. We also test the effect of simultaneous capability-building on survival. We model the hazard rate of firm exit as a function of the different capabilities (R&D, product, marketing and balanced) that start-ups invest in. We follow Fiss's (2007) recommendation to define an appropriate domain for the study of configurations by investigating capability development separately in the manufacturing and service industry. Furthermore, we focus on three main functional

activities to avoid causing spurious relationships between variables that impede the detection of configurations in empirical data (Gruber et al., 2010).

Sample

We used the longitudinal Kauffman Firm Survey, and in particular the proprietary dataset of US start-ups to test our hypotheses. This panel was formed from a random sample of 32 469 firms from Dun and Bradstreet's database of all start-ups formed in 2004 in the United States, excluding non-profit firms, those owned by an existing business, or firms inherited by someone else (DesRoches et al., 2010). The Kauffman Firm Survey team interviewed the founders of 4 928 start-ups and surveyed them annually for six years (DesRoches et al., 2010). High-tech firms are oversampled in the panel. Our sample includes 775 start-ups (1 482 observations) that operate in a number of industries. Table 8 shows the industry distribution in our sample.

We further distinguish between high-tech and low-tech sectors and between manufacturing and service industries and compare the effect of different capability configurations on survival across these different industry types. Similar to Baron and colleagues (2001) we exclude micro firms from our sample because these have less than ten employees in total, and as such and our main independent variables would be ambiguous⁴⁴ (Baron, Hannan, & Burton, 2001). Finally, because the Kauffman Firm Survey has oversampled high-tech firms, we need to use survey weights to draw conclusions at the population level. Therefore, we use estimation techniques that allow us to take into account the stratified sampling methodology. Figure 3 graphically displays the effect of a balanced portfolio across different capability configurations on the probability of exit through the 7

⁴⁴ For example, we would have to define a start-up as balanced when it employs only four employees across three functional domains (R&D, production, marketing).

year panel. Figure 4 displays the effect of investing in either capability configuration (R&D, production or marketing) on the probability of exit through the 7 year panel. We can conclude from these graphs that, before controlling for any other characteristic, start-ups with a balanced focus across capabilities have higher exit rates than start-ups that focus in one capability configuration at a time.

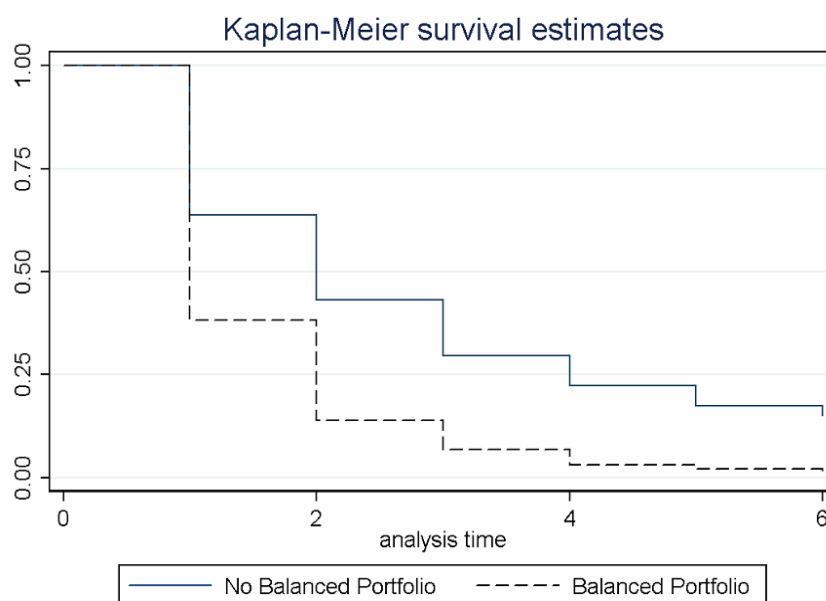
Table 8: Industry distribution (chapter 4)

Industries	NAICS code	% of sample
Agriculture, mining, construction	11-23	8.5
Food, textiles, apparel, leather manufacturing	31	2.0
Paper, printing, petroleum chemical, plastics manufacturing	32	3.2
Primary metal, fabricated metal product and machinery	331-333	10
Computer and electronic product manufacturing	334	5.0
Electrical equipment, appliance and component manufacturing	335	2.0
Transportation equipment, furniture manufacturing	336-337	2.0
Miscellaneous manufacturing	339	2.0
Wholesale and retail trade	42-49	17
Scientific research and development services	54	14
Finance and real estate	51-52	6.3
Administrative, educational, healthcare services	55-62	10
Other services	71-92	14
Total		100

The Kauffman Firm Survey (proprietary dataset) is particularly well-suited to study the effect capability configurations on survival for a number of reasons. First, we have information on the sampled firms from their year of founding, allowing us to study the effect of initial capability configurations on survival. Entrepreneurs need to build capabilities from

scratch since there are no prior routines to draw from; therefore examining resource allocation into the development of capabilities during the first 7 years of a firm allows us to study the effect of capability development when it is likely at its strongest (Autio et al., 2011). Second, this dataset tracks new ventures in a variety of industries which allows us to estimate the effect of capability configurations on survival separately in the manufacturing and service sectors (Gruber et al., 2010). Third, this dataset has information on alternative exit outcomes (e.g. M&A) allowing us to distinguish between different exits. For example, investors typically view mergers and acquisitions as good exits, therefore we are able to distinguish between good and bad exit outcomes (Shah & Winston Smith, 2013). In total, testing the effect of new ventures' capability configurations on survival during their first years of existence should be straightforward to examine using this dataset.

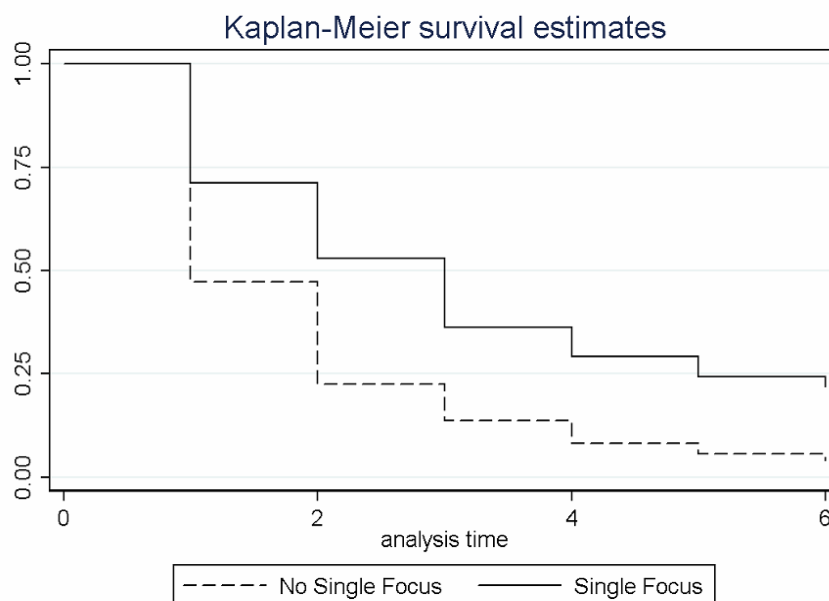
Figure 3: The effect of balanced portfolio across capabilities on the probability of survival (chapter 4)



Dependent variable

Start-up exit. The dependent variable is defined as the probability that a start-up exits during one particular year, given that it has survived until the beginning of that year, where exit includes only exit by closure -- start-ups that are out of business and have *permanently* stopped operations. We purposefully distinguish in our robustness checks between exit by closure and other modes of exit such as exit by acquisition or merger because these are qualitatively different. Start-up survival is a crucial performance indicator that has been used frequently in prior studies (Audretsch & Mahmood, 1995; Dencker, Gruber, & Shah, 2009; Geroski et al., 2010; Gimeno et al., 1997).

Figure 4: The effect of single focus on a particular capability on the probability of survival (chapter 4)



Independent variables

A number of authors have argued that locally embedded knowledge and skills may comprise a capability and ultimately a source of competitive advantage (Kazanjian & Rao, 1999; Kogut & Zander, 1992; Leonard-Barton, 1992). Examining capabilities in relation to investments in different functional areas of the firm has been widely used in prior research (Amit & Schoemaker, 1993; Grant, 1991; Snow & Hrebiniak, 1980). Consistent with this stream, we suggest that capabilities relevant to competitive advantage will reside in the R&D, production and marketing function of new ventures.

R&D focus. To measure start-ups' focus on developing R&D capabilities we create a binary variable that equals 1 if more than 50% of their employees are primarily responsible⁴⁵ for research and development on new products and services and 0 otherwise. This is an appropriate way of measuring capabilities in relation to R&D since a strong focus on R&D shows that the start-up specialises in research and development and that it must have reached some level of routine activity (Helfat & Peteraf, 2003). The R&D intensity ratio has been found to be positively associated to measures of innovative output and new product introductions (Hitt et al., 1997) and it is widely used in studies of innovation.

Product focus. Similarly, we measure start-ups' focus on developing production capabilities with a binary variable that equals 1 if more than 50% of employees are primarily responsible for production or manufacturing activities and 0 otherwise. The Kauffman Firm Survey asked entrepreneurs how many employees and owners were primarily responsible for production activities such as producing materials and products, production planning, production control, quality control and storage. Again, this measure of production

⁴⁵ The Kauffman Firm Survey asked entrepreneurs how many employees and owners were primarily responsible for conducting research and development on new products and services.

specialisation within new ventures reflects the development of production capabilities in new ventures. For instance, Kazanjian and Rao (1999) measured capabilities as engineering functional specialisation in technology ventures.

Marketing focus. We measure start-ups' focus on developing marketing capabilities with a binary variable that equals 1 if more than 50% of their employees and owners are primarily responsible for sales or marketing activities such as sales, market research, customer analysis, or promotional activities, and 0 otherwise. This measure is appropriate because it captures the extent of specialisation in the marketing function which reflects the marketing capabilities of new ventures.

Balanced portfolio. We measure start-ups' balanced portfolio across capabilities with a binary variable that equals 1 if start-ups equally employ between 30% and 35% of their employees and owners in the R&D, production and marketing functions, and zero otherwise.

Control Variables

We controlled for founder, firm, and industry characteristics.

Number of employees. We control for the size of the start-up by taking the natural logarithm of the total number of employees and owners that are primarily involved in the various functions of the business (Geroski et al., 2010).

Start-up experience. Prior start-up experience of the owners can positively influence start-up survival as serial entrepreneurs have gained knowledge from setting-up a business and developing new products as well as managing early-stage organisations (Shane & Stuart, 2002). We measure start-up experience by summing the number of prior businesses created across owners and taking the log of this number.

Intellectual property. We control for intellectual property as it can affect performance in start-ups (Shane & Stuart, 2002). Intellectual property is a binary variable equal to 0 when the firm has no patents, copyrights or trademarks, and equal to 1 when the firm has at least one patent, copyright or trademark.

Owner education. We control for the education of the owner with a binary variable that equals 1 when the owner has a college degree and 0 when the owner does not have a college degree (Geroski et al., 2010).

External financing. We control for access to external financing with a binary variable that equals 1 if the start-up has received, VC, angel, government funding or investment from other companies and zero otherwise (Stuart et al., 1999).

Munificence. We sample two different periods of environmental munificence, demarcated by the financial crisis in 2007. Specifically, high levels of munificence occur in the years from 2004 to 2007 whereas low munificence levels can be observed in the period after 2007 and up to 2010. Other studies have used environmental shocks e.g. technology sector crash in 2000 to demarcate dramatically different periods of munificence (Park & Mezas, 2005). Our measure intends to capture the limited available opportunities and resources that start-ups will have access to in the period after the 2007 financial crisis.

High-tech. Our measure of high-tech industry, adapted from Hecker's (2005) definition of high technology industries, is a dummy variable indicating whether start-ups compete in high technology areas⁴⁶ (Hecker, 2005) We also include industry dummies and

⁴⁶ 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

we distinguish between manufacturing and service industries. In our robustness checks we try different specifications of high-tech versus low-tech, manufacturing and service industries.

Model and Econometric Approach

We test the effect of start-ups' capability configurations on the likelihood of survival through the 7th year of start-ups' life. The model is estimated on censored data which are grouped into yearly intervals. The right censoring in our data is present because start-ups that survive through the last year of our panel may experience an exit event in the future. Because we do not have information on how long these start-ups will survive in the future (after the 7th year of our panel) we need to employ a statistical model that is capable of accommodating incomplete durations. Therefore, we choose to employ a semi-parametric hazard model because it can enable us to define start-up exit more rigorously than conventional approaches such as probit or logit analysis (Wooldridge, 2001).

Survival analysis is widely employed to examine firm survival (Audretsch & Mahmood, 1995; Dencker et al., 2009; Geroski et al., 2010; Gimeno et al., 1997). This methodology allows us to study how start-ups' exit rates evolve over time. The statistical model is a Cox proportional hazard model which is a semi-parametric model where no assumption is made regarding the underlying distribution of the baseline hazard (Cox, 1972). Thus, the Cox model for start-up i , industry j and entrepreneur k is of the form:

$$h_{exit}(t, R_i, P_i, M_i, B_i, Z_{i,j,k}) = h(t) \exp(\beta_o + \beta_\rho R_i + \beta_\pi P_i + \beta_\mu M_i + \beta_\beta B_i + \beta_z Z_{i,j,k})$$

where h_{exit} is the instantaneous rate of firm exit conditional on survival until time t (i.e. through the first 7 years of the start-up's life), R_i indicates the R&D focus of start-up i ,

(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).

similarly P_i is the product focus, M_i is the marketing focus, B_i is the balanced focus and $Z_{i,j,k}$ is a vector of attributes of entrepreneur k , firm i , and industry j . All covariates are updated yearly via the inclusion of their (1 year) lagged values. We therefore, take into account the influence of time-varying explanatory variables on the survival rate of start-ups by modelling the probability of start-up exit at time t as a function of entrepreneur k , firm i , and industry j observed at $t - 1$. We also carry out robustness checks where we check the sensitivity of our results to different specifications and subsamples. We report adjusted Wald tests (rather than likelihood ratio tests) because these are appropriate in the presence of clustering as observations are not independent in our sample (Wooldridge, 2001). In addition, in order to use the Cox methodology we tested for the proportional hazards assumption (with Schoenfeld residuals) (see appendix 3).

RESULTS

Table 9 presents the descriptive statistics and correlations table. Only 5% of the start-ups in our sample had developed a research and development capability, whereas 20% and 26% had developed production and marketing capabilities respectively. About 17% of the start-ups had a balanced portfolio across R&D, production and marketing capabilities. Finally, out of the 1 482 observations about 32% of start-ups exit. The first model of Table 10 includes the control variables. Results of the Cox proportional hazard estimation are shown in terms of hazard ratios. A hazard ratio greater than one indicates a higher risk of exit (exiting the sample by permanently stopping operations) whereas a hazard ratio lower than one indicates a lower risk of exit. In the first model of Table 10 we find that start-up size which was measured as the number of employees is positively related to survival ($p < 0.001$). In

Table 9: Descriptive statistics and correlations⁴⁷ (chapter 4)

	Mean	s.d.	Startup exit	Balanced portfolio	R&D focus	Product focus	Marketing focus	Number of employees	Start-up experience	Intellectual property	College degree	External financing	Munificence	High-tech
Startup exit	0.32	0.46	1.00											
Balanced portfolio	0.17	0.38	0.22*	1.00										
R&D focus	0.05	0.22	-0.03*	-0.10*	1.00									
Product focus	0.20	0.40	-0.20*	-0.23*	-0.11*	1.00								
Marketing focus	0.26	0.44	-0.04*	-0.28*	-0.14*	-0.31*	1.00							
Number of employees	16.3	0.70	-0.32*	-0.07*	-0.03*	0.34	-0.13*	1.00						
Start-up experience	1.67	3.66	-0.16*	-0.07*	0.03*	0.03*	0.02*	0.13*	1.00					
Intellectual property	0.30	0.46	-0.07*	-0.06*	0.12*	-0.01	-0.05*	0.09*	0.11*	1.00				
College degree	0.58	0.49	-0.08*	-0.15*	0.13*	0.04*	0.04*	0.03*	0.09*	0.18*	1.00			
External financing	0.08	0.28	-0.07*	-0.06*	0.21*	-0.01	-0.03*	0.11*	0.11*	0.19*	0.09*	1.00		
Munificence	0.60	0.48	0.16*	0.11*	0.02*	-0.08*	-0.04*	-0.09*	-0.06*	-0.02*	-0.01*	0.07*	1.00	
High-tech	0.15	0.35	-0.11*	-0.06*	0.20*	0.10*	-0.15*	0.04*	0.04*	0.12*	0.18*	0.10*	-0.05*	1.00

⁴⁷ N=1482 . We report correlation coefficients and the significance level for p-values with p<0.05. Minimum and maximum values for each variable are not provided due to confidentiality constraint associated with the KFS confidential microdata.

Table 10: Estimated effects of capability configurations and balanced portfolio on the hazard of start-up exit (chapter 4)

	(1)	(2)	(3)	(4)	(5)
	Controls	Direct effect 1 _{a,b,c}	Direct effect 2	High munificence	Low munificence 3
Number of employees	0.55*** (0.03)	0.53*** (0.03)	0.52*** (0.03)	0.51*** (0.04)	0.51*** (0.05)
Start-up experience	0.81** (.05)	0.83** (0.05)	0.83** (0.05)	0.80** (0.06)	0.88 (0.08)
Intellectual property	0.96 (0.10)	0.94 (0.08)	0.95 (0.08)	0.88 (0.10)	1.01 (0.13)
Owner education	0.85+ (0.08)	0.90 (0.07)	0.93 (0.08)	0.91 (0.08)	0.96 (0.12)
External financing	0.84 (0.12)	0.85 (0.14)	0.88 (0.15)	0.80 (0.17)	1.01 (0.31)
High-tech	0.75* (0.13)	0.73* (0.11)	0.74+ (0.11)	0.74+ (0.11)	0.79 (0.20)
R&D focus		0.67* (0.12)	0.76 (0.15)	0.57* (0.15)	0.95 (0.26)
Product focus		0.49*** (0.06)	0.57*** (0.08)	0.61** (0.11)	0.53** (0.12)
Marketing focus		0.59*** (0.05)	0.68*** (0.07)	0.60*** (0.08)	0.76+ (0.11)
Balanced portfolio			1.41*** (0.12)	1.33** (0.13)	1.50** (0.21)
Industry dummies ⁴⁸	Yes	Yes	Yes	Yes	Yes
Observations	1482	1482	1482	628	854
Wald chi2	4212.63	4511.62	3873.78	3065.09	2343.97
Prob>chi2	0.0000	0.0000	0.0000	0.0000	0.0000

Robust standard errors clustered on the firm

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

- Hazard ratios are cited
- Cox proportional hazard model

⁴⁸ Industry dummies control for start-ups operating in the manufacturing, services, high-tech and low-tech industries.

addition, the number of prior businesses founded by the owners increase the likelihood of survival ($p<0.01$). The education of the owners has a moderate but positive effect on survival ($p<0.1$). Finally, high-tech ventures have a higher probability of survival compared to non high-tech ventures. Moving to model 2 in Table 10 we test hypotheses 1a, 1b and 1c. After controlling for industry characteristics we find that investing in a single capability in research and development ($p<0.05$), production ($p<0.001$) or marketing ($p<0.001$) can increase start-ups' survival chances, therefore providing support to hypotheses 1a, 1b and 1c. In model 3 in Table 10 we test hypothesis 2. In this model we see that investing in a balanced capability portfolio increases the likelihood of exit by 41% ($p<0.001$) thus confirming hypothesis 2.

Models 4 and 5 of Table 10 carry out the same analysis in two different environmental periods. In model 4 we find that in the period of high munificence, R&D ($p<0.05$), production ($p<0.01$) and marketing ($p<0.001$) capabilities are important for start-up survival whereas a balanced portfolio increases the likelihood of exit by 33% ($p<0.01$). Finally, model 5 shows that in periods of low munificence only production ($p<0.01$) and marketing ($p<0.1$) capabilities increase start-ups' chances of survival whereas a balanced portfolio reduces the survival rate by 50% ($p<0.01$). Adjusted Wald tests confirm this effect which together with the hazard ratio confirm hypothesis 2 ($p<0.01$). Although we cannot compare the magnitude of the change in coefficient across models 4 and 5, the direction is as we expected.

Table 11 presents the results for the different subsamples (e.g. capability configurations in manufacturing and service sectors). In the first model of Table 11 we see that the size ($p<0.01$), owner education ($p<0.01$) and external financing ($p<0.05$) increase survival rates of start-ups operating in the manufacturing sector. In addition, a balanced portfolio has a moderate but negative effect on start-ups' survival ($p<0.1$). In results not reported here and before adding the balanced portfolio variable we find that product ($p<0.01$) and marketing

($p < 0.05$) capability configurations increase the survival rate of manufacturing start-ups by 51% and 44% respectively. One finding that came as a surprise is that intellectual property increases manufacturing start-ups' exit ($p < 0.01$) (model 1 in Table 11). However, this finding

Table 11: Estimated effects of capability configurations and balanced portfolio on the hazard of start-up exit for the subsamples (chapter 4)

	(1)	(2)	(3)	(4)	(5)
	Manufacturing only	Services only	High-tech only	Low- tech only	Excluding Acquisitions & Mergers
Number of employees	0.56** (0.40)	0.47*** (0.04)	0.34*** (0.06)	0.55*** (0.04)	0.50*** (0.04)
Start-up experience	1.00 (0.17)	0.80* (0.07)	0.96 (0.20)	0.81** (0.05)	0.82* (0.06)
Intellectual property	1.86** (0.42)	1.01 (0.12)	1.33 (0.40)	0.92 (0.09)	0.92 (0.09)
Owner education	0.46** (0.11)	0.98 (0.11)	0.55* (0.14)	0.94 (0.08)	0.87 (0.08)
External financing	0.40* (0.17)	1.05 (0.22)	0.88 (0.33)	0.82 (0.17)	0.73 (0.16)
High-tech	1.33 (0.41)	0.60* (0.12)	0.81 (0.40)	0.60 (0.24)	0.65* (0.11)
R&D focus	0.75 (0.31)	0.59+ (0.18)	0.49* (0.17)	0.81 (0.19)	0.90 (0.18)
Product focus	0.58 (0.20)	0.74+ (0.12)	0.67 (0.38)	0.57*** (0.08)	0.50*** (0.08)
Marketing focus	1.07 (0.54)	0.64*** (0.08)	0.36+ (0.21)	0.70*** (0.07)	0.67*** (0.07)
Balanced portfolio	1.58+ (0.40)	1.38** (0.15)	1.82* (0.49)	1.39*** (0.12)	1.44*** (0.13)
Industry dummies	Yes	Yes	Yes	Yes	Yes
Observations	514	968	231	1251	1400
Wald chi2	4199.70	6828.71	1324.52	3874.57	9999.26
Prob>chi2	0.0000	0.0000	0.0000	0.0000	0.0000
Robust standard errors clustered on the firm					

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

- Hazard ratios are cited
- Cox proportional hazard model

may be driven by the presence of different types of exits e.g. good versus bad exit strategies. For example, investors typically view acquisitions and mergers as good exits, therefore, the positive effect of having intellectual property on start-ups' exit may be related to good exit outcomes (Hsu & Ziedonis, 2013; Shah & Winston Smith, 2013). This explanation is further confirmed in model 5 where we exclude acquisitions and mergers and we observe that the intellectual property indicator stops being a good predictor of start-ups' exit. Our second model in Table 11 examines start-ups' capability configurations in services. We find that the size ($p<0.001$), start-up experience ($p<0.05$) and coming from a high-tech sector ($p<0.05$) all increase start-ups' survival chances in the service industry. In addition, R&D ($p<0.1$), product ($p<0.1$) and marketing ($p<0.01$) capability configurations in service firms also increase start-ups' survival chances. We find that a balanced portfolio across capabilities decreases survival chances in the service industry by 38% ($p<0.01$). The next models in Table 11 test the above effects in high-tech and low-tech industries.

As expected, in high-tech sectors, an R&D capability configuration increases start-ups' survival by 51% ($p<0.05$), whereas marketing capability configurations also seem to positively affect survival ($p<0.1$). Start-ups in the high-tech industry that pursue a balanced portfolio have lower likelihood of survival by 82% ($p<0.05$). In low-tech industries start-ups' chances for survival are higher when they have a product ($p<0.001$) or marketing ($p<0.001$) focus. Low-tech start-ups with a balanced portfolio across capabilities have a 39% higher likelihood of exit. Lastly, model 5 of Table 11 excludes acquisitions and mergers (although these are a small proportion⁴⁹ of the exit outcomes we observe in our start-ups) because these are considered as good exit strategies compared to e.g. closure due to bankruptcy. As described previously, we need to ensure that our findings are not driven by good exit

⁴⁹ Out of the 1482 observations only 5% are associated with mergers and acquisitions.

strategies, we therefore conduct the same analysis on the sample of firms that did not experience an acquisition or a merger. Our findings are consistent as we find that a balanced approach increases the likelihood for exit by 44% ($p < 0.001$) whereas a product or marketing capability reduce firm exit by 50% ($p < 0.001$) and 33% ($p < 0.001$) respectively.

Robustness checks

First, all our results have robust standard errors clustered on the firm. Second, we check for sensitivity of our results to different specifications and subsamples. We tried several modifications to ensure that our analysis is consistent to alternative specifications. First, we ran the analysis separately in the manufacturing and service industries. We also carry out the same analysis in high-tech and low-tech firms. We defined two different high-tech classifications. We used the Kauffman Firm Survey's high-tech classification, but also created a high-tech indicator following Hecker (2005). These results confirm that a balanced approach increases the likelihood of exit in all start-ups, but more so in high-tech start-ups. Following Cohen et al. (2000), we split the manufacturing sample into discrete and complex technology industries. We also distinguished between network services and knowledge-intensive business services (Leiponen, 2005a).

Then, we change the specification of the capability configurations variables and consider one variable alone⁵⁰, rather than R&D, production, marketing and balanced, and find that the results remain consistent. Once again, a balanced portfolio (compared to all other configurations) increases start-ups' chances of exit and the effect is greater in less munificent environments. The results with this different specification are along the same lines. Start-ups that simultaneously develop all capabilities have a higher likelihood of exit ($\beta = 0.78$, $p < 0.001$)

⁵⁰ This variable equals to one if the start-up equally distributes (between 30% and 35%) its human resources in the R&D, production and marketing functions and equals zero in all other combinations.

compared to start-ups that do not equally invest their resources in R&D, production and marketing. In addition, in low munificence environments this effect increases ($\beta=0.87$, $p<0.01$). Thus, we show with this different specification that a balanced portfolio increases start-ups' exit rates (see appendix 4). We also tried an alternative specification for the balanced portfolio variable. Rather than employing 30% to 35% of employees and owners in the R&D, production and marketing functions, we created a similar variable that ranges from 20% to 35%. The results with this specification are presented in appendix 5.

Finally, we exclude from our analyses mergers and acquisitions to ensure that our findings are not associated with good exit outcomes. The results with this specification confirm our finding that balancing all capabilities increases the likelihood of a bad exit, i.e. start-ups permanently close their operations without being acquired by, or merged with another business.

DISCUSSION

Long ago, Penrose highlighted the critical role of resource and capabilities for firm performance (Penrose, 1959). Despite the theoretical and practical importance of developing capabilities, prior literature has failed to address the performance effects of allocating investments among different capabilities (Rahmandad, 2011). How firms *develop* and *configure* their capabilities to survive, achieve legitimacy and superior performance (Gruber et al., 2010) is an important caveat in our understanding of dynamic capability creation in new ventures. Recent developments in dynamic capabilities (Bardolet et al., 2013; Sapienza et al., 2006; Zahra et al., 2006) configuration research (Ebben & Johnson, 2005; Miller, 1998; Short et al., 2008) and resource management (Gruber et al., 2010; Sirmon et al., 2007; Sirmon et al., 2010b) attempt to call attention to the role of resource allocation and capability

configurations for firm performance. This study responds to this call by developing a model that depicts the process of configuring specific types of capabilities in new ventures. Specifically, we advance knowledge on new venture capability-building by arguing theoretically and showing empirically that simultaneous capability development lowers survival chances due to the liability of newness that these ventures face.

Our findings indicate that in general, investing in one type of capability is more beneficial than a balanced investment across different capabilities but that this pattern differs across industries. In particular, we find that a focus on either R&D, production or marketing capability configurations increases start-up survival. This suggests that start-ups that invest either in R&D, production or marketing capabilities in the first years of their existence and that do not attempt to pursue a mix of the three survive longer. This is consistent with configuration theory in that the capability chosen is not as important as whether it allows for consistency in operations (Doty et al., 1993; Ebben & Johnson, 2005). The idea of equifinality suggests that more than one combination of traits might be effective under the same circumstances (Gresov & Drazin, 1997). Using a sample of US start-ups, we provide evidence that focusing on *either* capability configuration can increase survival, whereas simultaneous development of these capabilities can decrease survival due to the higher learning costs and resource constraints of new ventures. However, this pattern differs across industries depending on the knowledge intensity and the high-tech nature of the industry.

Even more interestingly we show that capability development is subject to environmental contingencies. Environmental munificence is an important contingency in capability development (Sirmon et al., 2007). We demonstrate that balancing different capabilities increases the hazard of start-up exit in environments with low resource availability. We find that under conditions of low munificence, a balanced portfolio across

capabilities significantly increases the likelihood of firm exit. This finding has important implications for firms' investments in different capabilities. The literature suggests that in uncertain environments, where there is ambiguity regarding the resources and capabilities needed to develop a competitive advantage, firms might benefit from building flexibility, or acquiring real options (Bowman & Hurry, 1993; McGrath & Nerkar, 2004). This means that rather than full-scale investments in all capabilities, firms may need to increase the range of viable responses to environmental changes by acquiring flexible resources that allow better access to future opportunities (Bowman & Hurry, 1993; Sirmon et al., 2007). Therefore, under conditions of low munificence, rather than trying to balance costly investments in internal R&D, production *and* marketing capabilities, firms may tap into the resources of a strategic partner (Kotabe & Swan, 1995; Mowery, Oxley, & Silverman, 1996; Sirmon et al., 2007) who will have the complementary production or marketing capabilities critical for survival.

Our findings reveal that start-ups in both the manufacturing and service sectors have a lower probability of survival when choosing to balance different types of capabilities. In addition, both high-tech and low-tech firms have an increased likelihood of exit when pursuing a balanced portfolio, but the effect is more prominent in high-tech firms. This shows that in dynamic environments where competition is high, it is especially important to select and develop the appropriate capabilities both internally and externally, because failure to do so can threaten start-up survival. Start-ups competing in the high-tech sector need to be able to respond to radical innovations in the market that can render their technologies obsolete. They need therefore to successfully develop some skills and capabilities internally, but also acquire some resources from other organisations through the use of strategic alliances.

Alliances can reduce risks and provide access to information, technologies and markets (Kotabe & Swan, 1995; Mowery et al., 1996).

Furthermore, our findings reveal that different capability configurations are valuable for different types of firms. A focus on R&D capabilities was found to increase survival in high-tech start-ups and start-ups in services. These findings are important for understanding capability development in different types of industries. For example, Leiponen (2012) finds that contrary to earlier research, R&D investments seem to play a significant role in service innovation (Leiponen, 2012). Our findings show that in the service sector, R&D capabilities increase start-ups' survival, and are particularly beneficial in high-tech industries. In contrast, production capabilities are more important for low-tech and start-ups in services. A focus on marketing capabilities increases survival chances for most start-ups, although it matters more for start-ups in services and low-tech start-ups.

Overall, these findings have important implications for theory and practice. First, by testing specific configurations of well-defined capabilities in a large number of start-ups we provide a detailed investigation of the effect of R&D, production and marketing capability configurations on start-up survival. Our in-depth analysis clarifies not only the potential contribution of different types of capability configurations to survival outcomes, but also allows us to advance knowledge on the allocation of resources into the development of key capabilities in new ventures (Bardolet et al., 2013). In addition, although a number of studies examine how founding conditions affect start-up survival, few distinguish between different exit outcomes (Geroski et al., 2010). Acquisitions and mergers should be treated separately when examining firm capabilities as they are qualitatively different to exit due to failure.

Second, our study links capability configurations with environmental contingencies. We provide evidence that capability configurations are affected by environmental characteristics. Specifically, under conditions of low munificence a balanced portfolio across R&D, production and marketing capabilities increases the likelihood of firm exit. This finding provides support to prior theories of tension between conflicting strategies such as the efficiency and flexibility strategies proposed by Ebben and Johnson (2005) and the exploration and exploitation strategies proposed by March (1991). In particular, our findings indicate that the tension between conflicting capability configurations may be driven by resource constraints present in new ventures, as these seemingly different capabilities can rapidly deplete organisational resources. Although existing theories seem to suggest that tension between two conflicting strategies can exhaust organisational resources, very few studies have examined the allocation of investments among different types of capabilities and their effect on survival (Piao, 2010; Rahmandad, 2011). We believe that investigating the above can shed light on the development and configuration of capabilities within firms and therefore represents a fruitful area for future research.

Third, we show that a configurational approach can reveal important implications for the process of capability development in new ventures especially since the interdependencies between the different elements of the entrepreneurial strategy (resources, capabilities, environment, competitive strategy) can be a far greater source of advantage than any single aspect of strategy in new ventures (Dess et al., 1997; Miller, 1998). Finally, our findings have important implications for practitioners. Entrepreneurs play a key role in the allocation of investments in different capabilities. Therefore, they need to be aware of the costs and benefits of each capability they choose to invest in. In addition, they need a thorough examination of possible configuration types in order to match their capabilities with the

environment they compete in. Finally, they need to bear in mind the possible trade-offs between different types of capability configurations and to take into account both environmental and industry conditions.

LIMITATIONS AND FUTURE RESEARCH

One limitation of our study is that we split the sample before and after the financial crisis to examine different periods of environmental munificence. Therefore, our results need to be interpreted with this limitation in mind e.g. conditional on surviving until the year 2007, firms with a balanced capability portfolio will have a higher likelihood of failure in the subsequent period. Future studies could use state level entrepreneurial finance data (VC funding flows or variation in bank market structure) to illuminate the role played by financial constraints. In addition, future research could examine whether organisational slack moderates the relationship between simultaneous capability development and new venture survival (George, 2005). We may expect that when resources are abundant, new ventures will be able to balance different capabilities more effectively.

Another interesting avenue for research is to explore the micro-foundations of dynamic capabilities (Autio et al., 2011; Felin & Foss, 2011; Foss, 2011; Teece, 2007). Future studies could investigate how the cognitive characteristics of the entrepreneurs influence their capability choices e.g. how entrepreneurs develop and reconfigure their capabilities in response to market and technological changes (Teece, 2007), how they shift focus from one capability to the other (e.g. selection heuristics) (Bingham, Eisenhardt, & Furr, 2007; Laamanen & Wallin, 2009) and the role of emotions in overcoming escalation of commitment to failing courses of action (Hodgkinson & Healey, 2011). For example, there is substantial evidence that entrepreneurs can be overly optimistic, in that they overestimate the

probability of favourable outcomes and underestimate the probability of experiencing negative events (Cassar, 2010; Hmieleski & Baron, 2009; Ucbasaran, Westhead, Wright, & Flores, 2010). One interesting question to examine is whether optimistic entrepreneurs are more likely to invest in simultaneous capability-building. We may expect optimistic entrepreneurs to underestimate the costs of balancing different capabilities and overestimate their ability to manage these capabilities. Prior experience of the entrepreneur may also influence the allocation of resources into capabilities. Serial entrepreneurs who can draw from their past experience in capability-building may be more successful in coordinating different capabilities. On the other hand, serial entrepreneurs may accumulate biases which may impede their ability to manage a balanced capability portfolio.

Other types of biases can influence resource allocation decisions. For instance, the cognitive tendency to naively diversify when making investment decisions (Bardolet et al., 2011; Benartzi & Thaler, 2001) can lead to even allocation of resources over all capabilities. An interesting question to study is how entrepreneurs manage to overcome these biases and change resource allocation patterns that do not appear promising. And does prior entrepreneurial experience in the industry weaken or reinforce these biases? Also, what are the characteristics of successful entrepreneurial teams that manage to overcome these biases and effectively manage different capabilities? Finally, what is the role of emotions in the resource allocation decision? For instance, decisions based merely on information processing can exacerbate escalation of commitment to failing courses of action because individuals with rational thinking styles feel a higher pressure for vindication (Hodgkinson & Healey, 2011). More research is needed into the emotional and cognitive micro-foundations of capabilities in order to better understand the biases that undermine the entrepreneur's ability to sense, seize and reconfigure capabilities in new ventures.

Furthermore, future studies could investigate the learning implications of different resource allocation patterns and their effect on new ventures' performance. For example, although specialists develop a depth of knowledge in their specialist area, they have a narrow focus in that domain which over time may lead to inertia (Cohen & Levinthal, 1990; Zahra & George, 2002). Specialisation may be good for short-term survival but over time it could lead to lower responsiveness and flexibility due to a longer-run decay of adaptive capability in other domains (Levinthal & March, 1993). A solution would be for these start-ups to broaden their focus by searching in the near neighbourhood and allocating resources into a nearby domain. In turn, generalist start-ups with a broader but shallow focus may initially find it difficult to balance different capabilities but conditional on survival, they may enhance long-term growth prospects by introducing more structure and focused learning. For example, generalists could allocate more resources in a promising line of business in an effort to develop more specialised capabilities in that area. Therefore, generalists would need to learn how to integrate different capabilities and to focus attention on a successful or promising area.

To further explore learning in new ventures it is also important to study how firms learn and change to adapt to environmental forces. For example, the literature suggests that dynamic capabilities in new ventures may operate differently from established firms (Sapienza et al., 2006; Zahra et al., 2006). Entrepreneurs need to build dynamic capabilities from scratch as there is a lack of existing routines that entrepreneurs can draw from. Therefore routine-based explanations may be inappropriate for explaining capability formation in entrepreneurial firms (Autio et al., 2011). In addition, although the evolutionary perspective emphasises the role of repetitiveness and experience as important learning mechanisms in the creation and development of dynamic capabilities, entrepreneurship

scholars have pointed to several other mechanisms that may be more relevant for new ventures that operate under uncertainty e.g. trial and error and improvisation processes (Zahra et al., 2006). Therefore, to further advance knowledge on dynamic capabilities in new ventures, it is important to examine the different learning modes used to change focus and re-allocate resources from one capability to the other.

Finally, it would be interesting to investigate the dynamics of resource allocation into the development of capabilities. As previously described, new ventures may need to change their focus over time to avoid inertia, or alternatively, to focus their attention on one particular domain. Because resource investment and recombination is one of the key elements of dynamic capabilities (Helfat et al., 2007), scholars should examine the temporal dynamics of resource allocation processes. Future studies could use simulation methods to unpack the relationship between optimal focus, performance, and environment. Simulations allow researchers to study process phenomena over extended time periods that are difficult to observe with empirical data (Davis, Eisenhardt, & Bingham, 2009). With the use of a simulation model, scholars could examine the effects of different resource allocation patterns (e.g. resource re-allocation process) on performance in different environments.

In conclusion, this study has important implications for the theory on dynamic capabilities and configurations in entrepreneurial start-ups. Specifically, we examine new venture resource allocation into the development of key capabilities (R&D, production, and marketing) and test the effect of the resulting capability configurations on survival. Future research could examine the dynamics of resource allocation in different environments and the role of cognition in capability-building.

CHAPTER 5 – CONCLUSION

This dissertation examined the early development of new ventures and specifically the role of capabilities in overcoming the liabilities of foreignness and newness in these ventures. Through this investigation I highlighted the crucial role of the entrepreneur in a) selecting and implementing a business model when entering foreign markets; b) synchronising resource investments with capability deploying decisions; c) configuring the capability portfolio consistent with environmental and industry conditions.

Rooted in the resource-based view and evolutionary economics, the dynamic capabilities concept intends to explain how firms integrate, build and reconfigure their resources and capabilities to address rapidly changing environments (Helfat et al., 2007; Teece et al., 1997; Winter, 2003). Despite the substantial body of work examining dynamic capabilities, extant literature has largely failed to address the creation and development of dynamic capabilities in new ventures (Arthurs & Busenitz, 2006; Autio et al., 2011; Newbert, 2005; Sapienza et al., 2006; Zahra et al., 2006). Entrepreneurship scholars have pointed to the need to examine dynamic capabilities in the context of new ventures as capabilities may operate differently in younger firms who lack the established routines and/or resources that more established firms possess. Responding to this call, in this thesis I examined three different aspects of capability development in new ventures. In the second chapter I examined the role of new ventures' business model in overcoming the liability of foreignness. In the third chapter I investigated the performance effects of aligning human capital investments with capability deploying decisions. In the fourth chapter I examined new venture resource allocation into the development of key capabilities and I tested the effect of the resulting capability configurations on survival.

First, this dissertation has sought to contribute to the emerging literature on dynamic capabilities in new ventures (Arthurs & Busenitz, 2006; Autio et al., 2011; Newbert, 2005;

Sapienza et al., 2006; Zahra et al., 2006). I have provided evidence that allocating resources into the development of a balanced capability portfolio may threaten start-up survival due to constraints that arise from the liabilities of newness. In contrast, I have shown that developing a single capability in R&D, production or marketing can improve start-up survival, and that this pattern differs across industries. In this thesis I have investigated capability development in uncertain environments and environments with resource constraints where new ventures typically operate. Thus, I was able to enrich our understanding of capability development in different environmental conditions. Although prior literature emphasises the value of dynamic capabilities for firms operating in dynamic environments, in this thesis I highlighted the importance of building effectively capabilities in new ventures which typically lack the resources of established firms. New ventures usually suffer from liabilities of newness which involve higher learning costs, lack of legitimacy and resource constraints. Because in these environments resources are typically restricted, new ventures need to effectively deploy their capabilities in order to survive, achieve legitimacy and realise success (Zahra et al., 2006).

Second, this dissertation proposed that both configurational and contingency approaches can be usefully deployed to examine the process of capability development in new ventures. The concept of organisational configurations has seen limited application in entrepreneurship research (Lepak & Snell, 2002; Short et al., 2008; Wiklund & Shepherd, 2005). However, recent developments in entrepreneurship and strategy research call for a multivariate approach to explore the relationship between entrepreneurial strategy making and performance (Dess et al., 1997; Miller, 1998; Miller & Shamsie, 1996; Short et al., 2008). In this dissertation I have proposed that new ventures may achieve a competitive advantage by orchestrating the various elements of their business and maintaining a complementarity among their resources, capabilities and the environment they operate in. Configurations in new ventures can provide them with a competitive advantage that cannot

be imitated by competitors. Therefore, scholars should examine the interdependencies between the different elements of a firm's strategy with contingency and configuration models which can reveal insights on how new ventures implement a comprehensive strategy.

Third, this dissertation has sought to contribute to the international entrepreneurship literature. I have investigated how business model choice (Amit & Zott, 2001; Teece, 2010) influences the extent to which new ventures are exposed to the liability of foreignness. Through this investigation I have contributed to the literature on capability development and value creation in new ventures. The ability of the entrepreneur to sense and seize opportunities in international markets by selecting viable business models is foundational to dynamic capabilities (Teece, 2007). Similarly, business models affect value creation and value capture and are therefore an important topic for strategic management (Zott et al., 2011). In addition, by investigating the effect of business model choice on the liability of foreignness, this dissertation has contributed to the liability of foreignness literature by distinguishing between two types of liabilities: liability as a "*foreign operator*" in the case of adopting product-based business models, and as a "*source of technology*" in the case of adopting IP-based business models. This dissertation has also extended the literature on commercialisation strategies of start-ups by investigating the propensity to internationalise and international intensity of start-ups using IP-based versus product-based business models (Gans et al., 2002).

Finally, this dissertation has sought to contribute to the resource management and asset orchestration perspectives (Helfat et al., 2007; Sirmon et al., 2010b) by investigating the contingencies that affect resource orchestration in new ventures. Through this investigation I have highlighted the conditions under which start-ups' deviation from rivals' investment choices becomes favourable. Building on the recent resource orchestration stream I have developed a model that depicts the process by which new ventures synchronise the various

elements of the business enterprise. Consistent with prior findings in established firms (Sirmon & Hitt, 2009), I found that superior performance is produced when human capital investments and capability deploying decisions are purposefully synchronised by the entrepreneur. Specifically, I provided evidence that higher investments in human capital relative to rivals generally harm performance unless they are complemented by a strategy focused on innovation. Start-ups with strong R&D capabilities should be generously investing in human capital because of the need to attract and retain skilled employees whose firm-specific and tacit knowledge remains within the firm. Contrary to earlier studies which generally suggest that human capital resources lead to performance benefits (Eisenhardt & Schoonhoven, 1990; Hitt et al., 2006; Kor & Leblebici, 2005), this study found that human capital decisions must be aligned with the leveraging strategy selected by the entrepreneur in order to achieve a resource-based advantage (Sirmon et al., 2007).

This dissertation has several implications for practice. First, entrepreneurs should actively try to synchronise strategic, organisational and human resource decisions in order to survive and grow. In addition, they should carefully design their business models to seize opportunities in international markets. For instance, start-ups with IP-based business models may be more successful in early internationalisation than start-ups with product-based business models due to the higher costs of foreign operation for the latter. Furthermore, entrepreneurs need to be aware that capabilities have their own costs and risks. Therefore, they need to carefully evaluate whether they can afford to simultaneously develop different capabilities, especially since resources are limited during the first years of operation. Ultimately, entrepreneurs should investigate the costs and benefits of each capability investment decision before building a portfolio of capabilities.

LIMITATIONS AND FUTURE RESEARCH

This dissertation has some limitations that provide several avenues for future research. The generalisability of this dissertation's findings is limited by country. The data for this dissertation come from new ventures which were created in the US. Therefore, new venture capability development should be studied in other contexts. In addition, high-tech ventures were oversampled. To enable generalisability across the population of new ventures I used survey techniques that can take into account the stratified sampling methodology. The Kauffman Firm Survey uses a stratified sample design as businesses in the high-technology sampling stratum were substantially oversampled. Sampling weights allow us to take into account this oversampling in order to remove the potential bias in the estimates relative to unweighted estimates (DesRoches et al., 2010).

A related issue is the problem of sample selection. Sample selection bias is a systematic error due to non-random sampling of a population, causing some members of the population to be less (or more) likely to be included than others (Wooldridge, 2001). If the selection bias is not taken into account it can lead to false conclusions. To address possible sample selection bias due to the inclusion of start-ups with revenues, I performed a two-step Heckman selection correction (Hamilton & Nickerson, 2003; Heckman, 1979). This method was preferable to a simple OLS which would have provided biased estimates because of unobservables in the selection model that are correlated with unobservables in the second stage model. After estimating the average selection effect I found that a start-up with sample average characteristics that selects (or is selected) into revenues secures a 9% higher international intensity than a start-up drawn at random from the population with an average set of characteristics. Ideally, sampling procedures should avoid sample selection biases.

Third, the use of an unbalanced panel may cause problems if the data are not missing at random (Wooldridge, 2001). For instance, new ventures going out of business would be overlooked (since data will be missing) whereas “surviving” ones would be overrepresented in the sample. This can lead to false conclusions as new ventures that no longer exist are excluded from the analysis of new venture performance. This type of selection bias has been referred to as survivorship bias (Wooldridge, 2001). To overcome this problem I conducted a survival analysis to test the effect of capability development on performance. Future studies should take into account the nature of missing data when examining the effect of capability development on performance to reduce biased estimates.

In addition, the data are right censored as start-ups that survive through the last year of the panel may experience an exit event in the future. Because we do not have information on how long these start-ups will survive in the future I employed a statistical model that is capable of accommodating incomplete durations. The semi-parametric proportional hazard model was chosen for this analysis as this model predicts start-up exit more rigorously than conventional approaches such as probit or logit analysis (Wooldridge, 2001). Therefore, future studies examining how investments in capability development affect survival should study how start-ups’ exit rates evolve over time. Extensions of this model could allow for time-varying predictors or time-varying coefficients. For instance, the proportional effect of capability development may vary with time; for instance, building a portfolio of capabilities may not be very effective in the first years of a new venture, and may become more effective as new ventures learn to effectively integrate different types of capabilities and as they accumulate the necessary resources to do so.

Although the use of panel data and lagged variables was preferred when possible, there are still limitations in terms of inferring causal relationships between the variables of interest. Unlike in medicine where randomised experiments are common, there are often

elusive unobservables affecting the outcome variables in the social sciences (Hamilton & Nickerson, 2003). Thus, using an appropriate identification technique would enable scholars to make clearer causality claims. Therefore, this represents an avenue for future research.

Apart from the above methodological limitations there are a number of interesting avenues for future research. Building dynamic capabilities in new ventures depends on the cognitive characteristics of the individual/entrepreneur (e.g. ability to sense opportunities) and the organisational processes (the knowledge and learning capacities of the organisation to which the individual belongs) (Teece, 2007). Due to data limitations, I could not explore the role of cognitive characteristics of the entrepreneur in developing dynamic capabilities. Previous work indicates that when a capability reaches a satisfactory level (Winter, 2003) or when market conditions change (Teece, 2007), a shift of focus may be needed from one capability to the other (Laamanen & Wallin, 2009). Future research could examine the micro-foundations of capabilities (Felin, Foss, Heimeriks, & Madsen, 2012) and specifically how the cognitive characteristics of the entrepreneurs influence their capability choices in the absence of prior routines. In addition, understanding how individuals in the entrepreneurial team collectively decide to develop some capabilities over others and shift attention from one capability area to another is an interesting avenue for future research. Consequently, future research could explore how capabilities emerge in new ventures and investigate to what extent cognition influences entrepreneurial choices and organisational outcomes (Alvarez & Busenitz, 2001; Grégoire, Corbett, & McMullen, 2011).

One interesting avenue related to cognition and capability building is to examine whether optimistic entrepreneurs are more likely to invest in simultaneous capability building. For example, there is substantial evidence that entrepreneurs can be overly optimistic, in that they overestimate the probability of favourable outcomes and underestimate the probability of experiencing negative events (Cassar, 2010; Hmieleski &

Baron, 2009; Ucbasaran et al., 2010). Perhaps optimistic entrepreneurs are more likely to underestimate the costs of balancing different capabilities and to overestimate their ability to manage these capabilities. In addition, the prior experience of the entrepreneur may influence the allocation of resources into capabilities. Serial entrepreneurs with past experience in capability-building may manage to successfully coordinate different capabilities. On the other hand, serial entrepreneurs may accumulate biases from their prior experience which may impede their ability to manage a balanced capability portfolio. Other types of biases e.g. the cognitive tendency to naively diversify when making investment decisions (Bardolet et al., 2011; Benartzi & Thaler, 2001) may influence the allocation of resources into the development of capabilities. An interesting question for future research therefore would be to examine how entrepreneurs manage to overcome these biases and change resource allocation directions that do not appear promising. Also, does prior entrepreneurial experience in the industry weaken or reinforce these biases?

Moreover, an interesting research direction is to examine the learning implications of different resource allocation patterns and their effect on new ventures' performance. Although specialists (firms that mainly build a single capability) may benefit from depth of knowledge in their domain, they have a rather narrow focus in that area which may eventually lead to inertia (Cohen & Levinthal, 1990; Zahra & George, 2002). Thus, although specialisation may improve survival chances in the short-term, over time it could lead to a lower capacity to adapt to environmental changes unless these start-ups manage to broaden their focus by searching and allocating resources into a nearby domain (Levinthal & March, 1993). In contrast, generalists (firms that build a portfolio of capabilities) who start with a broader but shallow focus in various capabilities may have difficulties in managing these initially, but they may enhance long-term performance by introducing more structure and focused learning. For example, generalists in order to develop more specialised capabilities in

one area may need to re-allocate resources into a promising line of business. Therefore, generalists could improve their performance by focusing more attention on one successful or promising area and by learning how to coordinate different capabilities. More research into the temporal dynamics of resource allocation could shed light on the process of capability development in new ventures.

For example, new ventures may need to change their focus over time to avoid inertia, or alternatively, to focus their attention on one particular domain. Because resource re-allocation processes are essential for dynamic capability building (Bardolet et al., 2013) scholars should examine how firms re-allocate resources (and change focus) from one capability to the other. Future studies could use sequence analysis (Salvato, 2009) and/or simulation methods to examine the relationship between optimal focus, performance, and environment. Simulations allow researchers to study process phenomena over extended time periods that are difficult to observe with empirical data (Davis et al., 2009). Scholars could use simulation models to examine the effects of resource re-allocation into capabilities on performance over time and in different environments. In addition, studies that examine learning in new ventures should investigate the different learning modes used by new ventures to build dynamic capabilities. Although the evolutionary perspective stresses the role of repetitiveness and experience as important learning mechanisms in dynamic capability creation, entrepreneurship scholars have pointed to several other mechanisms that may be more relevant for new ventures e.g. trial and error and improvisation processes (Zahra et al., 2006).

To further explore the role of resource constraints in capability development it is important to study the role of organisational slack (George, 2005). This dissertation proposed that when resources are scarce, simultaneously developing different capabilities can threaten start-up survival due to the higher learning and coordination costs. However, when resources

are abundant, new ventures may be more successful in simultaneous capability-building. Future research could investigate whether organisational slack moderates the relationship between capability development and new venture survival. In addition, future studies could use state level entrepreneurial finance data (e.g. VC funding flows) to shed light on the role played by resource constraints.

Furthermore, this dissertation examined the alignment of human capital investments and leveraging strategy. Future research could investigate other contingencies in resource orchestration. For instance, apart from human capital investments, scholars could examine investments in other types of resources which are necessary to create value in start-ups. Direct involvement in manufacturing allows firms to recognise new information and can thus facilitate opportunity exploitation. Future research could examine how investments in physical capital e.g. production and manufacturing activities, complement capability deploying decisions. Start-ups with strong R&D capabilities could benefit by investing in complementary manufacturing activities to protect their returns to innovation, especially in industries where patents are not an effective mechanism for appropriating returns to innovation (Cohen et al., 2000; Levin et al., 1987).

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APPENDIX

Appendix 1a: Results of panel logistic regression (survived firms only) – Predicting internationalisation propensity (chapter2)

	(1)	(2)
	Controls	Direct effect
	<i>Internat. propensity</i>	<i>Internat. propensity</i>
Limited liability	-0.22 (0.33)	-0.21 (0.33)
High-tech	-0.12 (0.42)	-0.15 (0.42)
Hotspot	0.46 (0.33)	0.44 (0.33)
R&D	2.19* (1.03)	2.05* (1.03)
Active multi-owner	0.05 (0.29)	-0.08 (0.29)
College degree	1.35*** (0.34)	1.30*** (0.34)
Work experience	0.33+ (0.17)	0.32+ (0.17)
Start-up experience	0.46* (0.20)	0.45* (0.20)
Number of employees	0.42** (0.15)	0.40** (0.15)
Product business model		-1.04* (0.48)
Year dummies	Yes	Yes
Industry dummies	Yes	Yes
Observations	2519	2519
Number of firms	999	999
Log likelihood	-1068.62	-1068.29
Prob>chi2	0.0000	0.0000
Robust standard errors clustered on the firm		

Appendix 1b: Results of ordinal logistic regression (survived firms only) – Predicting internationalisation intensity (chapter2)

	(1)	(2)
	Controls	Direct effect
	<i>Internat. intensity</i>	<i>Internat. intensity</i>
Limited liability	-0.27 (0.18)	-0.28 (0.18)
High-tech	-0.42* (0.18)	-0.48* (0.19)
Hotspot	-0.01 (0.19)	-0.03 (0.19)
R&D	1.18 (0.73)	1.11 (0.74)
Active multi-owner	0.22 (0.19)	0.25 (0.19)
College degree	0.06 (0.19)	0.04 (0.19)
Work experience	0.15 (0.10)	0.14 (0.10)
Start-up experience	0.14 (0.10)	0.15 (0.10)
Number of employees	-0.29* (0.11)	-0.32** (0.11)
Cash	0.12** (0.04)	0.11* (0.04)
Product business model		-0.73* (0.31)
Year dummies	Yes	Yes
Industry dummies	Yes	Yes
Observations	561	561
Wald chi2	47.48	51.50
Prob>chi2	0.0002	0.0001
Pseudo R2	0.0313	0.0347
Robust standard errors clustered on the firm		

Appendix 2a: Results of panel logistic regression (excluding subsidiaries) – Predicting internationalisation propensity (chapter2)

	(1)	(2)
	Controls	Direct effect
	<i>Internat. propensity</i>	<i>Internat. propensity</i>
Limited liability	0.03 (0.39)	0.04 (0.39)
High-tech	-0.09 (0.48)	-0.13 (0.48)
Hotspot	-0.04 (0.38)	-0.08 (0.38)
R&D	2.81* (1.18)	2.49* (1.19)
Active multi-owner	-0.10 (0.35)	0.03 (0.35)
College degree	1.34*** (0.40)	1.30*** (0.39)
Work experience	0.16 (0.20)	0.16 (0.20)
Start-up experience	0.49* (0.24)	0.47+ (0.24)
Number of employees	1.06*** (0.17)	1.02*** (0.17)
Product business model		-1.81** (0.67)
Year dummies	Yes	Yes
Industry dummies	Yes	Yes
Observations	1789	1789
Number of firms	788	788
Log likelihood	-741.46	-737.66
Prob>chi2	0.0000	0.0000
Robust standard errors clustered on the firm		

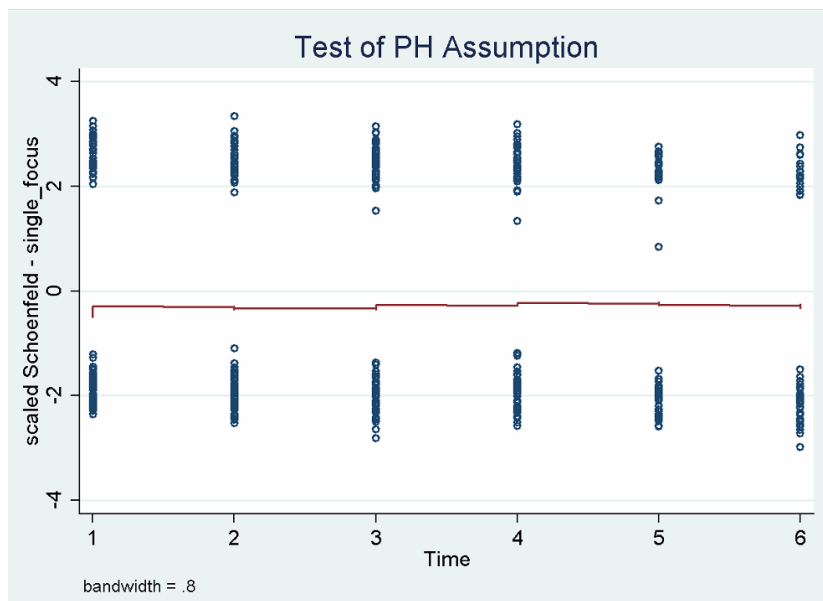
*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Appendix 2b: Results of ordinal logistic regression (excluding subsidiaries) – Predicting internationalisation intensity (chapter 2)

	(1)	(2)
	Controls	Direct effect
	<i>Internat. intensity</i>	<i>Internat. intensity</i>
Limited liability	-0.34 (0.20)	-0.33 (0.20)
High-tech	-0.44 (0.19)	-0.48* (0.20)
Hotspot	0.06 (0.20)	0.04 (0.20)
R&D	1.35 (0.78)	1.22 (0.79)
Active multi-owner	0.24 (0.21)	0.27 (0.21)
College degree	0.01 (0.20)	-0.02 (0.21)
Work experience	0.17 (0.11)	0.17 (0.11)
Start-up experience	0.04 (0.12)	0.05 (0.12)
Number of employees	-0.26* (0.12)	-0.29* (0.12)
Cash	0.12* (0.05)	0.11* (0.05)
Product business model		-0.81* (0.34)
Year dummies	Yes	Yes
Industry dummies	Yes	Yes
Observations	474	474
Wald chi2	40.38	46.06
Prob>chi2	0.0019	0.0005
Pseudo R2	0.0335	0.0372
Robust standard errors clustered on the firm		

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

Appendix 3: Testing proportionality assumption – Plot (chapter 4)



Appendix 4: Results of Cox proportional hazard model (alternative specification 1) – Predicting start-up exit (chapter 4)

	(1)	(2)	(3)	(4)
	Controls	Direct effect	High munificence	Low munificence
Number of employees	0.55*** (0.03)	0.52*** (0.03)	0.53*** (0.04)	0.50*** (0.05)
Start-up experience	0.81** (0.05)	0.83** (0.05)	0.03** (0.06)	0.88 (0.08)
Intellectual property	0.96 (0.09)	0.96 (0.09)	0.91 (0.11)	1.04 (0.13)
Owner education	0.85+ (0.07)	0.92 (0.08)	0.88 (0.07)	0.96 (0.12)
External financing	0.83 (0.14)	0.89 (0.15)	0.80 (0.18)	1.03 (0.31)
High-tech	0.75+ (0.11)	0.76+ (0.11)	0.77+ (0.11)	0.79 (0.20)
Balanced portfolio		1.78** (0.14)	1.71** (0.13)	1.87* (0.22)
Industry dummies ⁵¹	Yes	Yes	Yes	Yes
Observations	1482	1482	628	854
Wald chi2	4212.63	267.91	3094.86	2343.97
Prob>chi2	0.0000	0.0000	0.0000	0.0000
Robust standard errors clustered on the firm				

⁵¹ Industry dummies control for start-ups operating in the manufacturing, services, high-tech and low-tech industries.

Appendix 5: Results of Cox proportional hazard model (alternative specification 2) – Predicting start-up exit (chapter 4)

	(1)	(2)	(3)	(4)	(5)
	Controls	Direct effect	Direct effect 2	High munificence	Low munificence
Number of employees	0.59*** (0.03)	0.57*** (0.04)	0.52*** (0.03)	0.55*** (0.04)	0.54*** (0.06)
Start-up experience	0.79** (0.06)	0.81** (0.06)	0.83** (0.05)	0.77** (0.07)	0.85 (0.09)
Intellectual property	0.96 (0.09)	0.95 (0.09)	0.96 (0.09)	0.85 (0.11)	1.06 (0.14)
Owner education	0.86 (0.08)	0.92 (0.08)	0.92 (0.08)	0.94 (0.09)	0.97 (0.13)
External financing	0.79 (0.16)	0.82 (0.17)	0.89 (0.15)	0.94 (0.22)	0.78 (0.33)
High-tech	0.84 (0.13)	0.82 (0.13)	0.76 (0.11)	0.88 (0.13)	0.77 (0.24)
R&D focus		0.65* (0.12)	0.76 (0.15)	0.63+ (0.17)	0.88 (0.28)
Product focus		0.43*** (0.07)	0.52*** (0.09)	0.62* (0.12)	0.45** (0.13)
Marketing focus		0.60*** (0.06)	0.71** (0.07)	0.60*** (0.08)	0.83 (0.14)
Balanced portfolio			1.36*** (0.13)	1.31* (0.14)	1.50* (0.26)
Industry dummies ⁵²	Yes	Yes	Yes	Yes	Yes
Observations	1116	1116	1116	628	638
Wald chi2	2840.02	5156.53	2946.98	3094.86	1704.86
Prob>chi2	0.0000	0.0000	0.0000	0.0000	0.0000
Robust standard errors clustered on the firm					

⁵² Industry dummies control for start-ups operating in the manufacturing, services, high-tech and low-tech industries.