The role of external resource acquisition in firm strategy: The case of biopharmaceuticals

by

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Table of Contents

Acknowledgements 6
Abstract 7
CHAPTER 1. INTRODUCTION 9
CHAPTER 2. LITERATURE REVIEW 22
2.1 Introduction 22
2.2 ERA and the dynamics of the biopharmaceuticals industry 23
2.2.1 New industrial dynamics in the biopharmaceuticals industry: The introduction of the biotechnology paradigm 24
2.2.2 Interfirm collaborative agreements in the biopharmaceuticals industry: Current trends 29
2.3 Review of empirical ERA related work 31
2.3.1 ERA and organizational performance 33
2.3.2 ERA and knowledge-based resources 41
2.3.3 Interorganizational modes as mechanisms of ERA 42
2.3.4 Strategic motives for ERA 46
CHAPTER 3. THEORETICAL PERSPECTIVES ON EXTERNAL RESOURCE ACQUISITION 50
3.1 Introduction 50
3.2 Resource-driven firm behaviour and the RBV 53
3.2.1 Origins of the RBV: from competitive structures to advantageous resource positions 54
3.2.2 Resources, firm strategy and competitive advantage 56
3.2.3 Emerging RBV Models: Resources residing outside firm boundaries as source of sustained Competitive Advantage 62
3.2.4 RBV Assumptions & ERA 66
3.2.5 Towards a dynamic view of the RBV: competing through external resources in dynamic competitive environments 73
3.3 Competitor-driven behaviour and theories of imitation 78
3.3.1 Competitive explanations of strategic similarity and imitative behaviour 78
3.3.2 Noncompetitive explanations of strategic similarity and imitative behaviour 81
CHAPTER 4. CONCEPTUAL FRAMEWORK 85
4.1 Introduction 85
4.2 Theoretical Background 89
4.3 Conceptual development 93
4.3.1 Definitions and boundaries of the study 93
4.3.2 Basic assumptions & conceptual framework 94

4.3.3 ERA as a competitor-driven action 98
4.3.4 ERA as a resource-driven action 102
4.3.5 The interaction effect between firm- and competitor- level views of ERA 105
4.3.6 Firm ERA behaviour and the two extremes of strategic choice 110
CHAPTER 5. METHODOLOGY 115
5.1 Introduction 115
5.2 Research design 116
5.3 Empirical context 118
5.4 Sample and data collection 120
5.5 Operationalization and measurement 128
5.5.1 Coding ERA actions using the RECAP alliances database 129
5.5.2 Dependent variables 132
5.5.3 Independent variables 142
5.5.4 Control variables 147
5.6 Econometric modelling of dependent variables 149
5.6.1 Modelling the likelihood of a firm engaging in ERA (ERA_BIN) 151
5.6.2 Modelling the intensity of a firm engaging in ERA (ERA_COUNT) 153
5.6.3 Modelling strategic similarity (STRAT_DEV) 155
5.6.4 Implementation of econometric models using STATA 10.0 156
CHAPTER 6. RESULTS 159
6.1 Introduction 159
6.2 Descriptive statistics and model fit 160
6.3 Results on hypotheses predicting firm ERA likelihood 171
6.4 Results on hypotheses predicting firm ERA intensity 176
6.5 Marginal effects 179
6.6 ERA and strategic choice: Predicting strategic deviation 182
6.7 The significant effect of firm size in predicting firm ERA activity . 192
6.8 Sensitivity analysis 194
CHAPTER 7. DISCUSSION 198
7.1 Introduction 198
7.2 Strategic choice theories and ERA 200
7.2.1 ERA and the resource based view of the firm 202
7.2.2 ERA, imitation and competition 211
7.2.3 The interaction effect of firm-specific propensity factors and competitors' ERA activity 218
7.3 Limitations and further research 224

CHAPTER 8. CONCLUSION.....227
References 230
APPENDIX A – QUERYING THE RECAP ALLIANCES DATABASE....244

Table of figures

Figure 2-1. Major Mergers and Acquisitions in the biopharmaceuticals industry, 1980-1992 (Grabowski & Vernon, 1994).....28

Figure 4-1. Research questions and theoretical "map".....89

Figure 4-2 Conceptual framework.....96

Figure 5-1. Overall ERA activity (1987-2006).....124

Figure 5-2. Frequency distribution of ERA_COUNT.....153

Figure 6-1 The effect of firm size on ERA likelihood.....193

Figure 6-2 the effect of firm size on ERA intensity.....194

Figure 6-3. Cook's statistic for full specification Logit model 196

Figure 7-1. Predicting ERA intensity at different levels of FIRM_EXP and FIRM_RES.....208

Figure 7-2 Total ERA activity of sample firms 214

Figure 7-3 the moderating effect of firm propensity factors and competitors' ERA activity.....220

Table 2-1. ERA related factors and organizational performance.....38

Table 2-2. Motives for external resource acquisition.....48

Table 3-1. Resource types and competitive advantage 67

Table 5-1. Top 50 biopharmaceutical firms *(Pharm Exec 2005)*.....122

Table 5-2. Final Sample of 37 firms 126

Table 5-3. Example of an agreement coded as ERA action.....129

Table 5-4. RECAP interfirm agreements codes.....130

Table 5-5. Operationalization and measurement of constructs.....134
Table 6-1 Descriptive Statistics 162
Table 6-2 Alternative Logit models for predicting firm ERA likelihood (ERA_BIN) 165
Table 6-3 Alternative negative binomial regression models for predicting ERA intensity (ERA_COUNT) 167
Table 6-4. Marginal and factor change of variables predicting firm ERA likelihood and intensity.....181
Table. 6-5. Alternative GLS estimation SINGLE TERM fixed effects models for predicting strategic deviation (STRAT_DEV).....187
Table 6-6. Alternative GLS estimation LOG TERM fixed effects models for predicting strategic deviation (STRAT_DEV).....188
Table 6-7. Alternative GLS estimation SINGLE TERM random effects models for predicting strategic deviation (STRAT_DEV).....189
Table 6-8 Random effects GLS estimation LOG TERM models for predicting strategic deviation (STRAT_DEV).....190
Table 6-9 Robustness check - OLS alternative models for predicting strategic deviation.....191
Table 7-1 Two time periods effect of COMP_ACT to ERA 215
Table 7-2 competitors' ERA activity and ERA across therapeutic markets 218
Table 7-3 Summary of contributions 222

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Abstract

This dissertation investigates the role which the acquisition of external resources plays in firm strategy. External Resource Acquisition (ERA) is a core strategic action for firm survival, especially when firms are faced with high munificence and uncertainty in regards to their resource environment. Primarily driven by the theoretical premises of the Resource Based View (RBV) of the firm (Barney, 1991; Wernerfelt, 1984), scholars have conceptualized ERA as predominantly a *resource-driven* action. Under this view, firms engage in ERA to alleviate their resource constraints (Combs & Ketchen, 1999), access complementary resources (e.g., Rothaermel, 2001b), and further enhance their knowledge base (e.g., Ahuja & Katila, 2001).

These contributions significantly advance understanding on various dimensions of ERA, but they treat the competitive environment of the firm as an exogenous factor. While there is a good theoretical rationale of the exclusion of the competitive environment in terms of the explanatory power of the RBV and its theoretical limits (Peteraf & Barney, 2003), the treatment of ERA as *solely* a resource-driven action, I argue, significantly fails to provide a holistic assessment on the strategic implications of ERA. I address this gap by a) developing a conceptual framework of ERA that takes into account both the firm's idiosyncratic attributes and its competitive environment, and b) providing an extensive empirical analysis on the patterns of ERA activity among competing firms. Departing from this resource-driven view of ERA, I argue that ERA can be also seen as a *competitor-driven* action. I propose that

firms engage in ERA to also respond to their competitive environment and more specifically to their competitors' ERA-related actions. To build the competitive side of my argument, I draw upon the competitive dynamics literature and theories of interorganizational imitation. Taking these two views together, I argue that ERA can be seen as a strategic action that leads to a broader set of strategic choices.

Drawing from an extensive sample of 4,729 ERA actions among the top 50 biopharmaceutical firms between 1987 and 2006, my empirical analysis provides overall support for both the resource- and competitor- driven views of ERA.

This dissertation makes at least three contributions to the field of strategy. First, it illustrates that firm strategy, at least in the context of ERA, can be better explained when both firm- and competitor- specific explanations of firm action are taken into account. This particularly important for scholars who view firms from a RBV point of view, and tend to exclude the competitive environment of the firm from their conceptual development and analysis. Second, to better understand complex strategic actions, such as ERA, scholars must adopt a broader theoretical perspective of strategic choice. The empirical support of ERA as both resource- and competitor- driven, illustrates that firm strategy cannot be sufficiently explained by one theoretical view. Third, my empirical analysis provides support for the temporal dimension of strategy, when firms are faced with changing technological paradigms. In the case of the biotechnology paradigm, for example, the extent which firm- and competitor-specific factors explain patterns of ERA changes over time.

CHAPTER 1.

INTRODUCTION

This dissertation investigates the acquisition of external resources, and its link with firm strategy. The acquisition of external resources has been of crucial strategic importance in the knowledge-based economies of the 21st century. In today's economic environments, firms merely compete on volume and price. The proliferation of knowledge and innovation, raise significant strategic challenges for competing firms. For example, in high-technology industries, rapid technological change intensified competition by decreasing time to make decisions, increasing strategic actions among competitors, and increasing the speed and frequency that new products come to market (Grimm, Lee, Smith, Hitt, Ireland, & Hoskisson, 2006).

Of course, these emerging competitive conditions do not only raise strategic challenges for firms, but also provide opportunities to appropriate economic value. One of the key strategic challenges for firms is that they hardly possess all the necessary resources to seize rapidly emerging market opportunities (Alvarez & Barney, 2007). Additionally, even when they do possess a wide range of resources, their value is uncertain and also contingent to the environmental conditions firms are faced with. Competing firms can hardly afford to not respond to their changing competitive environment, as they may

be faced with a competitive disadvantage (D'Aveni, 1994; Wiggins & Ruefli, 2002). To keep up with the continuous race of competitive advantage, firms may engage in the strategic action to acquire external resources.

The acquisition of external resources, here referred to as External Resource Acquisition (henceforth ERA) is of crucial importance for firm survival, especially when firms compete in competitive environments as described above (e.g., Nicholls-Nixon & Woo, 2003). As such, in the broader field of strategy, scholars have been long concerned with the strategic implications of ERA, its dimensions and its consequences for competitive advantage. Contributions to this end have been offered at the resource-, firm- and dyadic level of inquiry. Scholars thus far have treated ERA as solely a *resource-driven* action. Primarily driven by the theoretical premises of the Resource Based View (RBV) of the firm (Barney, 1991; Wernerfelt, 1984), scholars thus far have argued that firms will engage in ERA to alleviate their resource constraints (Combs & Ketchen, 1999), access complementary resources (Rothaermel, 2001b), and further enhance their knowledge base (Ahuja & Katila, 2001; Prabhu, Chandy, & Ellis, 2005). Scholars have also focused their research efforts on understanding how externally acquired resources, especially knowledge-based, are transferred and utilized by the focal firm through alliance formation (Das & Teng, 2000; Simonin, 1999).

While there is a good theoretical rationale of the exclusion of the competitive environment in terms of the explanatory power of the RBV and its theoretical limits (Peteraf & Barney, 2003), the treatment of ERA as solely a resource-driven action significantly constrains our understanding of ERA. Recently, scholars have pointed out this theoretical lacuna, more broadly the

misalignment of RBV and the firm's resource environment (Capron & Chatain, 2008), but so far scant empirical evidence exist at this front.

However, any strategic action of a firm to enhance its competitive position is directly observable to its competitors (Ferrier, 2001). I argue that ERA is no exception. Incorporating the competitive environment to advance understanding on the link between ERA and firm strategy is a difficult but promising research endeavour. This dissertation addresses this important task. In doing so, this study explores the following research question: "***What is the role of firm strategy in ERA?***" In relation to my overarching research question, I explore the following empirical questions: *"What patterns of ERA actions do we observe among competing firms? To what extent do firm-level idiosyncratic attributes explain firm ERA activity (resource-driven view)? To what extent do competitors' ERA actions explain firm ERA activity (competitor-driven view)? Is there an interaction effect between firm- and competitor- level explanations of ERA, and if so what kind?*

Addressing these questions poses several research challenges. While scholars have devoted several theoretical and empirical efforts to the main concepts of the above research questions, their definitions remain ambiguous. To develop a strong base for my thesis and avoid conceptual confusion, I clarify relevant concepts further. In so doing, I illustrate my rationale on definitional and methodological choices that I make to empirically assess my research questions. While my choices have limitations, they also open avenues for theoretical and empirical contributions.

In their effort to identify mechanisms where resources direct firm strategy, and contribute to competitive advantage, scholars have conceptualized resources in numerous ways. Resources can be broadly defined as those "tangible or intangible assets that are tied semi-permanently to the firm" (Wernerfelt, 1984: 172). While the concept of resources, and their economic importance, dates back to Ricardo and his theory of scarcity rents, scholars in the strategy field have only recently been concerned with resources and its relation to the theory of the firm[1]. Under the main theme of the RBV, firms have been treated as entities of idiosyncratic and heterogeneously distributed resources (Barney, 1991; Wernerfelt, 1984). Therefore, firms "strategically" act to develop or acquire critical resources and achieve competitive advantage through unique product market strategies (Foss & Knudsen, 2003).While there is an overall agreement on the conditions that a resource must satisfy in order to be source of competitive advantage (Barney, 1991; Hoopes, Hadsen, & Walker, 2003), some scholars challenge the assumption that such resources must be owned and controlled by the firm (Dyer & Singh, 1998: 660). To clarify this point further, I explicitly define and distinguish between *internal*, *shared* and *external* resources. Briefly, internal resources are defined as those resources solely developed and owned by the firm. Shared resources are those resources that are embedded in idiosyncratic interfirm routines and processes (Dyer & Singh, 1998: 661). By external resources, I refer to critical resources, that is "those factors that enable the firm to participate in its product market

[1] Wernerfelt and Barney have very much reconceptualised the seminal work of Penrose (1959). While the concept of resources and its economic implications dates back to Ricardo (1817), Penrose was the first to provide us with a theory of the firm in relation to its resources. That seminal work very much provided the theoretical grounding for the resource-based view of the firm.

relatively more efficiently and effectively" (Peteraf & Barney, 2003: 316) which reside outside firm boundaries and can be acquired in strategic factor markets (Barney, 1986). In my empirical context, the global biopharmaceuticals industry, such critical resources take the form of technology based assets such as for example biological molecules, chemical libraries and other technological assets relevant to the drug development and discovery process.

While I am not directly concerned with the conditions under which resources contribute to firm competitive advantage, I recognize that competing firms take strategic actions to improve their competitive position. In this sense, firm strategic behaviour is very much directed towards gaining and sustaining an advantage over competitors. Strategy research has been long concerned with how firms seek to obtain advantageous competitive positions (Ketchen, Snow, & Hoover, 2004). The origins of competitive advantage span the industry- (Porter, 1979), intraindustry- (Caves & Porter, 1977; Cool & Dierickx, 1993; Dranove, Peteraf, & Shanley, 1998; McGee & Thomas, 1986), and firm-level of inquiry (Barney, 1991; Dierickx & Cool, 1989; Peteraf, 1993; Wernerfelt, 1984). While these contributions play a significant role in the development of the strategic management field, some scholars have argued that these theoretical frameworks cannot be applied in competitive environments with the characteristics described above as they base their assumptions in the existence of an equilibrium state (Foss & Ishikawa, 2007; Priem & Butler, 2001).

Relevant to the field of strategy, several theories address the quest for competitive advantage. Such theories are driven primarily by neo-classical economic theory and sociology and hold different implications for firm

strategic behaviour (Rumelt, Schendel, & Teece, 1994). In relation to ERA, the main concept of this dissertation, scholars have primarily based their research efforts on the theoretical premises of the RBV. One explanation for this is that RBV has been the most prominent theoretical framework for understanding firm behaviour and competitive advantage (Hoopes et al., 2003). I will argue and show that by solely framing ERA in the context of RBV limits our understanding. In line however, with previous empirical efforts in this context I first discuss how ERA fits within the RBV.

In the context of the RBV, scholars have argued that competing firms will strategically act to acquire critical resources only when such resources can be purchased at a lower price than their discounted present value suggesting the existence of informational advantages not reflected in the price of the resource traded in strategic factor markets (Barney, 1986; Foss & Knudsen, 2003). Thus, the acquisition of critical resources, as a strategic action, will make sense when the focal firm possesses superior (and in that sense asymmetric) information for the value-generating potential of the resource to be acquired in relation to that of its competitors. Under this treatment of ERA, and in the presence of strategic factor markets, scholars suggested that firms must focus their strategic efforts to develop resources internally, as only such resources can lead to competitive advantage (Dierickx & Cool, 1989).

There is a considerable amount of empirical research that treats ERA in such way. Focusing at the firm level of inquiry, scholars have suggested that firms engage in ERA to access other firms' valuable resources through alliance networks (Das & Teng, 2000), to alleviate resource constraints (Combs & Ketchen, 1999), to access complementary resources (Rothaermel, 2001b), and

further enhance their knowledge base (Ahuja & Katila, 2001; Prabhu et al., 2005). In relation to RBV, other scholars have taken a process view of ERA. They focus their empirical efforts on understanding how external resources, especially knowledge-based, are transferred and utilized among partner firms (e.g., Simonin, 1999), and with interorganizational forms of acquiring or accessing external resources (e.g., Eisenhardt & Schoonhoven, 1996; Grant & Baden-Fuller, 2004).

While the above contributions advance the understanding of the conditions whereby firms will strategically act to acquire external resources, they view ERA as solely a *resource-driven* action and consequently treat the competitive environment that the firm operates in as an exogenous factor. This is surprising, as ERA has been a popular strategic action in several industrial contexts and has been perceived as a strategic response to environmental changes[2]. In recent critiques of RBV, scholars have pointed out that to better understand firm behaviour and its consequence for competitive advantage, the resource environment of the firm is of central importance (Capron & Chatain, 2008; Sirmon, Hitt, & Ireland, 2007). However, there is limited empirical evidence. This dissertation addresses this key gap in the literature by incorporating the competitive environment of the firm in the context of ERA.

I question the assumption of RBV that firms engage in ERA to improve their competitive position driven by their idiosyncratic attributes. I argue that firms engage in ERA to also respond to their competitive environment and more specifically to their competitors' ERA-related actions. I thus propose that ERA

2 In section 4.2, I illustrate how biopharmaceuticals firms engage in ERA to adapt to the new technological paradigm of biotechnology.

can be also seen as a *competitor-driven* action. In doing so, I adopt a multi-theoretical perspective on the relevant conditions that drive firms to engage in ERA. This is important in order to allow for a theoretical grounding of my assumption that competing firms engage in ERA in relation to the actions of their competitors. To build the competitive side of my argument, I draw upon the competitive dynamics literature and theories of interorganizational imitation. In contrast with RBV, which suggests that the firm's optimal goal is to devise unique strategies based on its idiosyncratic attributes and differentiate from its competitors, scholars concerned with Competitive Dynamics (CD) have long argued that firm behaviour may be contingent to that of its competitors. Scholars concerned with strategic actions of competing firms have illustrated that such actions are directly observable among competing firms and as such may result in strategic countermoves (Ferrier, 2001). As such, competing firms engage in strategic actions to respond to their competitive environment. In relation to the differentiation rationale of the RBV, competing firms may engage in ERA in order to pre-empt critical resources from their competitors (Fuentelsaz, Gomez, & Polo, 2002; Lieberman & Montgomery, 1988). Other CD scholars, however, have suggested that competing firms engage in strategic actions to conform to the strategic orientations of similar competitors (Garcia-Pont & Nohria, 2002). Such strategic conformity can be a result of adopting practices of successful organizations [mimetic isomorphism; (e.g., Haunschild & Miner, 1997)], strategic group membership [local mimetism; (Garcia-Pont & Nohria, 2002)], or resource similarities among competing firms (Chen, 1996).

To this point, I have proposed that when competing firms engage in ERA driven both by their idiosyncratic attributes but also by the ERA-related actions of their competitors. By investigating "*To what extent do firm-level idiosyncratic attributes explain firm ERA activity?"* I attempt to provide an empirical test of the resource-driven view of ERA. In relation to the firm's idiosyncratic attributes, I am specifically concerned with resource commitment and prior experience with ERA. In line with previous RBV empirical work in other contexts, I expect these two factors to be significantly and positively associated with the focal firm's ERA activity.

In relation to the competitor-driven view of ERA, I am also concerned with the competitive environment of the firm. By addressing the question "*To what extent do competitors' ERA actions explain firm ERA activity?"* I seek to provide new theoretical and empirical insights on the impact of competitors' actions on firm behaviour in the context of ERA. Scholars concerned with competitive dynamics have provided several theoretical explanations of strategic interdependence among competing firms. One explanation for example is that firms will engage in a strategic action in order to mimic the strategic behaviour of their competitors. I would like to further explore this assumption by providing empirical evidence on imitative behaviour among competing firms engaging in ERA, and address recent calls for more empirical evidence of such kind of strategic behaviour(Lieberman & Asaba, 2006: 378).

To provide a more complete understanding of ERA, it is important not to test these two proposed views of ERA in isolation, but to also investigate their interaction. By addressing the question *"Is there an interaction effect between firm- and competitor- level explanations of ERA, and if so what kind?"* I

empirically assess the existence of such interaction effect. Through my empirical analysis, I aim to complement recent attempts to provide new theoretical insights on how strategic behaviour is shaped both by the idiosyncratic attributes of the firm and its competitive environment (e.g., Park & Zhou, 2005).

To address my research questions, I make several methodological choices regarding the conceptualization and measurement of my main constructs, the empirical setting of my study, and the data needed to conduct my empirical investigation. I briefly provide my rationale behind choices on these methodological issues.

To operationalize ERA, I draw upon relevant studies that explicitly focus on the sourcing of external resources (e.g., Cassiman & Veugelers, 2006; Veugelers & Cassiman, 1999). As such, I measure an ERA-related action as the aggregate number of interfirm agreements that a firm engage in at any specific point of time. Interfirm agreements can take several forms (Hagedoorn, 1993), but here I am only concerned with R&D, licensing and marketing inward agreements. In contrast with Cassiman & Veugelers (2006), I exclude take-overs and M&A, and focus on non-equity based agreements. Such operationalization of external resource acquisition allows me to be consistent with my definition of external resources.

To empirically investigate my research questions, I draw upon the empirical setting of the global biopharmaceuticals industry. I do so for a number of reasons. First, the biopharmaceuticals industry is a knowledge-intensive competitive environment where competing firms are faced with rapid

technological change (Nicholls-Nixon & Woo, 2003). Second, emerging technological regimes such as the advent of biotechnology resulted in an exponential increase of ERA activity among competing firms, as it significantly altered new product development (Arora & Gambardella, 1990: 362; Rothaermel & Boeker, 2008). Third, interfirm collaborative agreements are well documented.

I construct a sample of the 50 biggest (in terms of sales) biopharmaceutical firms with global presence. I choose my sample under two main criteria. First, I would like to capture a large percentage of ERA activity in order to increase the validity of my study. Second, I would like to allow for some degree of variability in terms of firm behaviour but also focus on firms that compete for similar resources and exhibit some levels of multimarket contact. I collect longitudinal data on inward interfirm collaborative agreements between 1985 and 2006. Marked by the Genentech initial public offering, the biopharmaceuticals industry has experienced the emerging technological paradigm of biotechnology. Furthermore, to investigate patterns of ERA over time, the sample must allow for longitudinal observations. To measure ERA activity, I collect relevant data from the Recombinant Capital Alliances database[3]. This extensive database allows for detailed data collection for my sample and time frame, resulting in a total of 4,729 ERA-related actions (firm-year observations).

This dissertation is organized as follows. Chapter 2 illustrates in detail the rationale of choosing the biopharmaceuticals industry as the empirical context

[3] In section 5.4, I provide an in depth discussion on my rationale behind choosing the Recombinant Capital database for studying interorganizational relationships.

of this dissertation, and provides a review of empirical work related to ERA. More specifically, the first part of Chapter 4 illustrates how the emerging paradigm of biotechnology, altered competitive dynamics and raised unique strategic challenges for established biopharmaceutical firms. The second part of Chapter 2 provides a synthesis of relevant literatures concerned with the antecedents and consequences of ERA. This is an important section as it connects empirical work from several research streams in order to provide a current picture of our understanding of ERA.

Chapter 3 sets the theoretical foundations for my thesis. I start by discussing in more detail the theoretical premises of RBV and its treatment of ERA. While I do not aim to provide a complete review of the RBV, I draw upon seminal contributions and synthesize important implications for firm strategic behaviour in relation to ERA. I build on the fundamental assumption that firm-specific idiosyncratic resources can be a source of sustained competitive advantage (Barney, 1991; Wernerfelt, 1984). However, I criticize the persistent focus of initial RBV contributions on internal resources, and consequently their limiting conditions on the value-creating ability of external resources and their link with firm strategic behaviour. I draw upon recent theoretical models that revisit RBV and account for mechanisms where resources that span firms' organizational boundaries contribute to sustained competitive advantage (Eisenhardt & Schoonhoven, 1996; Dyer & Singh, 1998; Gulati, 1998; Gulati, Nohria, & Zaheer, 2000; Lavie, 2006). I then provide a summary on basic assumptions on my resource-driven view of ERA. Next, I move towards theoretical explanations of the competitor-driven view of ERA. In doing so, I

summarize important theoretical contributions in the competitive dynamics literature.

In turn, Chapter 4 provides my conceptual framework and a set of hypotheses based on the research questions posed above. More specifically, it builds the resource- and competitor- driven views of ERA by framing firm behaviour in the theoretical context of strategic choice.

Chapter 5 illustrates my methodological design. It is more specifically concerned with the rationale behind sample selection, operationalization of relevant constructs, and appropriate methods for modelling my dependent variables.

Chapter 6 illustrates my empirical analysis, and more specifically a detailed discussion on hypotheses testing. In relation to appropriate methods illustrated in chapter 5, I discuss the application of these methods and issues for best practice.

Chapter 7 provides a critical discussion on findings and draws implications for theory and practice. The dissertation concludes with a summary of potential contributions and avenues for further research.

CHAPTER 2.

LITERATURE REVIEW

2.1 Introduction

The first part of this chapter illustrates a competitive environment with such characteristics; the biopharmaceuticals industry. First, I illustrate how the introduction of biotechnology shaped new industrial dynamics in the biopharmaceuticals industry. I then provide an introduction on the historical development of the drug development and discovery prior and post the biotechnology era, along with implications for competitive dynamics.

The second part of this chapter provides a review of prior empirical work on ERA. Scholars, thus far, have predominantly treated ERA within the theoretical context of the RBV, and focused their empirical efforts on three main areas; a) organizational implications of ERA (and more intensively innovative performance), b) the process of acquiring critical resources (especially knowledge-based), and c) interfirm relationships, such as strategic alliances and M&A, as mechanisms of ERA.

In addition to the three main research areas identified above, I also review a broader set of strategic motives under which firms to engage in ERA. In doing so, I aim to provide a more holistic account of ERA as a strategic action.

2.2 ERA and the dynamics of the biopharmaceuticals industry

As it will be illustrated throughout this section, the biopharmaceuticals industry is an excellent setting for studying the link between firm strategy and ERA. First, the pharmaceuticals industry can be characterized as an environment driven by Schumpeterian competition. Faced with such competition, competing firms are unable to gain economic profits by simply producing a set of products with a well specified set of processes (Nelson, 1991: 68). Rather, competing firms must continuously innovate in order to survive (Nicholls-Nixon & Woo, 2003). In turn, innovation efforts are highly science driven and have a significant impact on competitive dynamics among rivals and the evolution of the industry (Malerba, 2002). Second, given new industrial dynamics in the biopharmaceuticals industry, biopharmaceuticals firms are intensively engaging into ERA, through several modes, to acquire critical resources. Third, external resource acquisition shapes competitive dynamics by enabling firms to alter their technological trajectories. In contrast with other industrial setting, incumbent pharmaceuticals have actively pursued a transformation strategy of their technological identity rather than pursuing underinvestment and incompetence in the face of radical innovation (Zucker & Darby, 1997: 431). Fourth, in a broader sense, the biopharmaceuticals industry provides several opportunities to study both success and failure of firms through changes in a series of technological paradigms (Galambos & Sturchio, 1998).

2.2.1 New industrial dynamics in the biopharmaceuticals industry: The introduction of the biotechnology paradigm

Innovation has been historically the primary driver of competitive survival in the biopharmaceuticals industry. During the 1950's, the biopharmaceuticals industry experienced an intensive innovation cycle which lead to the introduction of a series of innovative products (Lee, 2003). In terms of competition, biopharmaceuticals firms that were able to produce innovative compounds, in that case in the field of antibiotics, enjoyed sustained growth (Lee, 2003: 147). The biopharmaceuticals industry is faced with new industrial dynamics. The seminal discovery of recombinant DNA (r-DNA)[4] by Cohen and Boyer in 1972 based on the Watson and Crick double-helix DNA model (Quere, 2003: 256), and consequently the birth of biotechnology altered significantly the process of biopharmaceuticals discovery and development. Departing from organic chemistry as the basis of drug discovery, biopharmaceuticals firms moved away from "random screening" to a "rational design" approach based on molecular biology and the application of genomics. As such, prior to the "rational design" approach, the discovery of new drugs was based on random screening and in turn in the tacit knowledge of chemists (Gilsing & Nooteboom, 2006: 7).

Broadly speaking, the emergence of biotechnology can be perceived as a new technological paradigm in the biopharmaceuticals industry. Three major characteristics describe this emerging paradigm. First in terms of funding, the commercial exploitation of biotechnology was based on the availability of funds through venture capital especially in the case of USA. Second,

[4] The first successful cloning of foreign DNA (deoxyribonucleic acid) in a host micro-organism took place in 1973 (Grabowski & Vernon, 1994)

biotechnology was majorly organized in condensed geographical clusters. For example, whilst the invention of most critical discoveries in bioscience took place in the UK and Europe, the exploitation of several biotechnology innovations can be attributed to the aggressive funding of the American VCs organized in geographical clusters (i.e. 132 biotech firms in Greater Boston area) (Cooke, 2001). Third, the commercial exploitation of biotechnology was instrumented by collaborations between the public and private sector. Universities and their scientists played a crucial role on developing biotechnology. A recent example is the Nano-biotechnology center (NBTC) in the USA, a collaboration initiative between universities and public organizations, which focuses on the application of nanofabrication to biosystems (Thomas & Acuna-Narvaez, 2006).

The introduction of biotechnology in biopharmaceuticals drug discovery can be also described as a "dramatic case of competence-destroying innovation" (Schweizer, 2005: 1053) affecting not only biopharmaceuticals drug discovery and development but also competitive dynamics. More specifically, the genesis of dedicated biotechnology firms (DBF), marked by the Genentech Initial Public Offering (IPO) in 1980, as industrial actors of promoting biotechnology in combination with the inability of incumbent biopharmaceuticals firms to internalize this upcoming technological regime resulted into a new form of competition (Quere, 2003). As (Galambos & Sturchio, 1998: 252) point out "[biotech revolution was] the first twentieth-century transition in which the initial stages of applied research and commercial development were centered in small, startup companies rather than the large, well financed organizations that have form many decades been the primary innovators in pharmaceuticals".

As such, a new wave of collaborating activities between biopharmaceuticals firms and DBFs has emerged[5]. This emerging interface can be perceived as the backbone of today's competitive environment in the biopharmaceuticals industry (Quere, 2003: 258). Under such interface, biopharmaceuticals firms access innovative technologies and products through various forms of collaborations with their biotechnology counterparts. Collaborative activities under such motives can be perceived as "an aid in transitioning from old to new methods of drug discovery and development" (Rothaermel & Boeker, 2008: 53). DBFs are willing to supply biopharmaceuticals firms with their innovative products in order to secure funds for further research and development. Most importantly, DBF lack the downstream capabilities needed to develop, manufacture and conduct regulatory approval in order to bring their innovative compounds into the market (Danzon, Nicholson, & Pereira, 2005; Kollmer & Dowling, 2004). As Pisano (1990: 155) points out "while biotechnology was competence destroying on the R&D end, it was competence preserving at the commercialization end".

In terms of the biopharmaceuticals drug and discovery (D&D) process, this emerging model enables biopharmaceuticals firms to reduce associated risks and costs and increase productivity. For example, the application of genomic technologies (i.e. biomarkers) in drug discovery could lead to a 34% reduction of costs through more effective target validation (Riley, 2006: 43). More specifically, genetic engineering-based technologies such as monoclonal antibody technology, gene therapy, and high throughput screening have

[5] It is worth noticing, that U.S. based biopharmaceuticals firms were favoured in terms of conducting collaborations by the antitrust policy that emerged during the 1980s (Galambos & Sturchio, 1998).

multidimensional implications for D&D both as process and research tools (Gilsing & Nooteboom, 2006). Given that the D&D process spans across 12-15 years and costs approximately US$802m (DiMasi, Hansen, & Grabowski, 2003), the introduction of such technologies can significantly affect the time that a product reaches the market (Schweizer, 2005). However, (Cuatrecasas, 2006) argues that biotechnology advances impede the commercial success of biopharmaceuticals firms due to corporate policies that discourage innovation. By taking into account an exponential increase of R&D expenditures, Cuatrecasas suggests that the mismanagement of biotechnology across the D&D process and the reliance on mergers and acquisitions are the main drivers of low productivity.

The above emerging model holds several implications not only for the D&D process but also for the competitive dynamics in the biopharmaceuticals industry. First, biopharmaceuticals firms are faced with an "open innovation" model as they are relying on external sources of knowledge (Badawy, 2004; Greis, Dibner, & Bean, 1995; Lim, Garnsey, & Gregory, 2006) residing outside of their technological boundaries (Pisano, 1990)**.** To access external technological knowledge, biopharmaceuticals firms engage into various interfirm collaborating activities in the form of strategic alliances or mergers and acquisitions (M&A). Through such collaborations, biopharmaceuticals firms were able to enter emerging markets or access newly developed biotechnologies. In terms of competition, extensive M&A activity resulted to industry consolidation (Grabowski & Vernon, 1994). In the case of Hoffman La Roche and Genentech acquisition (figure 4-1), for example, Roche's acquisition strategy was to first purchase equity stakes and then gain share

control. Such strategy enabled Roche to quickly acquire generalized biotech capabilities (Galambos & Sturchio, 1998: 265).

A second important factor that affects competition is the low concentration of the biopharmaceuticals industry. In their evolutionary simulation model of the biopharmaceuticals industry, (Malerba, 2002: 692) propose that low concentration is attributed to a) non-cumulative nature of innovation, and b) the fragmented nature of markets or put it differently the absence of economies of scope.

TABLE 1. Major Mergers and Acquisitions in the Pharmaceutical Industry, 1980–1992

(a)	*Market entry*		
	1981	Dow Chemical	Richardson-Merrell
	1985	Monsanto	G. D. Searle
	1988	Kodak	Sterling Drug
(b)	*Market extension*		
	1989	Beecham (UK)	Smith Kline
	1989	Dow Merrell	Marion
	1989	Bristol Myers	Squibb
	1990	Rhoune-Poulenc (France)	Rorer
	1991	Kodak (Sterling Drug)	Sanofi (France)
(c)	*Biotechnology*		
	1990	Hoffman La Roche (Switzerland)[a]	Genentech
	1991	Chiron	Cetus
	1992	American Cyanamide[a]	Immunex
	1992	American Home Products	Genetics Institute

[a] Acquisition of controlling interest.

Figure 2-1. Major Mergers and Acquisitions in the biopharmaceuticals industry, 1980-1992 (Grabowski & Vernon, 1994)

Before I go into further details on such collaborating forms, lets further explore implications for competition. Biopharmaceuticals firms are faced with a series of strategic challenges on identifying, accessing, assimilating and utilizing external technological resources. Firms must be able to intensively search their environment, local and distant, for technological opportunities that will result to new product innovations (Katila & Ahuja, 2002).Whilst, such process is inherently costly, firms that have been slow on developing necessary

absorptive capacity, the capability to acquire, assimilate and utilize external knowledge (Cohen & Levinthal, 1990), were unable to successfully adopt new biotechnologies (Gilsing & Nooteboom, 2006: 8). In their study of R&D trends in the biopharmaceuticals industry, (Grabowski & Vernon, 1994) observe a reduce in concentration of innovation output among established biopharmaceuticals firms as a consequence of new product introductions from new biotechnology firms. In so doing, biopharmaceuticals firms may need to adapt to new organizational forms by extending their technological boundaries through networks (Powell, Koput, & Smith-Doerr, 1996). Such competitive pressures become more evident when taking into account the short time of patent coverage for biopharmaceuticals products (15 years). After the expiration of patents, biopharmaceuticals firms are faced with intensive generic competition which can significantly impede revenue streams (Kowalski, Fekete, & Yvon, 2005).

2.2.2 Interfirm collaborative agreements in the biopharmaceuticals industry: Current trends

The biopharmaceuticals industry has been experiencing an exponential increase in interfirm collaborative agreements being one of the highest performing R&D partnering sectors (Hagedoorn, 2002) particularly after the introduction of biotechnology (Roijakkers & Hagedoorn, 2006). Two main factors attributed to the exponential growth of collaborations in the late 1980s and 1990s: a) the non-availability of venture capital fund due to the 1987 stock market collapse, and b) the rise of government funded research projects (i.e. Human Research Genome project) (Roijakkers & Hagedoorn, 2006: 433).

Between 1990 and 1998, total collaborative activity value was estimated at $21billion (Arnold, Coia, Saywell, Smith, Minick, & Laffler, 2002) and accounted for one third of biopharmaceuticals firms' revenues in 2001 (Kalamas, Pinkus, & Sachs, 2002).

Drugs developed under collaboration account for a significant percentage of the total drugs developed per development phase. For example, 33% (112) of drugs developed in Clinical Phase II are licensed (in and out) whilst 24% of drugs are licensed in Phase I (Rompas, 2005).

A typical collaborative agreement consists of upfront payments to the licensor (usually 5-25%) and milestone payments that are set according to the current development stage of the compound being licensed followed by royalties. An example of such collaboration is the licensing agreement between Endo Pharmaceuticals and Novartis AG. Specifically the press release states:

> "Pain drug developer Endo Pharmaceuticals Holdings Inc. [ ] gained licensing rights to Novartis AG's osteoarthritis pain treatment Voltaren Gel. Endo will make an upfront payment of $85 million to Novartis; along with possible future payments of $25 million in annual sales exceed $300 million. Novartis also will receive royalties on U.S. sales of the drug". – The Associated Press, March 4, 2008[6]

Biopharmaceuticals firms engage in collaborative agreements under various strategic intents. Given the risk and costs associated with preclinical and clinical drug development stages, biopharmaceuticals firms prefer to engage into collaborative agreements in a more risk-adverse stage such development Phase II (Kalamas & Pinkus, 2003). Given the intense competition to access

6 Accessed at http://www.businessweek.com/ap/financialnews/D8V6SM2O0.htm?campaign_id=alerts [14/03/08]

future innovative products, biopharmaceuticals firms are moving towards collaborations at an earlier stage of development. An example is the Idera Pharma – Merck KGaA research collaboration in the therapeutic area of cancer. The press release states as follows:

> "(RTTNews) - Idera Pharma announced that it has signed a worldwide licensing and collaboration deal with Merck KGaA of Darmstadt, Germany, for the research, development and commercialization of its Toll-like Receptor 9 agonists for the treatment of cancer. The company noted that as per the deal, it has decided to exclusively license the therapeutic oncology applications, excluding cancer vaccines, of its lead TLR9 agonists, IMO-2055 and IMO-2125. The company stated that both the companies have decided to engage in research collaboration to identify a specified number of novel, follow-on TLR9 agonists, which would be derived using its chemistry-based approach and for which Merck would have the exclusive right to use in oncology applications other than cancer vaccines." - RTTNews.com[7]

2.3 Review of empirical ERA related work

This section provides a review of empirical ERA related work. The review was conducted using the Business Source Premier (EBSCO) database. Following procedures used on meta-analytic studies (e.g., Newbert, 2007), I have used a number of keywords to identify relevant studies and their relevance. Relevance has been examined by investigating if keywords are present in the title, the abstract and the main body of the paper. While external resource acquisition

[7] Accessed at http://www.tradingmarkets.com/.site/news/BREAKING%20NEWS/927278/ [14/03/08]

has not been a widely applicable concept (yields only 1 result when focused on the title field), several other keywords were used such as resource acquisition, external resources, resource sourcing to identify relevant studies. The review yielded 75 empirical studies that are directly or indirectly concerned with one of the major literatures described above. In addition, I have tracked forward citations of major theoretical works concerned with the acquisition of external resources (Barney's (1986) seminal paper on strategic factor markets) and resources residing outside firm boundaries (Dyer and Singh's (1998) relational view seminal paper and Gulati's (2000) strategic networks paper). I have also drawn from recent reviews concerned with the RBV to identify empirical studies concerned with external resources (e.g., Newbert, 2007).

While few empirical studies are directly concerned with ERA and firm strategy, there is an important amount of empirical work focused on the antecedents and consequences of firms acquiring external resources. As I have argued above, empirical efforts thus far have been rooted to the theoretical premises of the RBV. Given the proliferation of the RBV as the major explanatory theoretical framework in the strategic management field (e.g., Hoopes et al., 2003), ERA related empirical studies span across several literatures. Most notably, empirical work in this context can be found in literatures concerned with: a) the organizational (performance) implications of strategic resources, b) interorganizational relationships, such as strategic alliances, as mechanisms of accessing strategic resources, and c) process characteristics of acquiring/accessing strategic resources. I synthesize empirical work from these literatures in order to provide a review of empirical work concerned, directly and indirectly, with ERA.

This section is organized as follows. First, I discuss how prior work relates ERA with organizational performance. While I do not empirically investigate performance implications of ERA, it is important to illustrate how ERA relates to performance and thus competitive advantage. Second, I review other important effects related to ERA. Most importantly, scholars have viewed ERA as the underlying mechanism of acquiring knowledge-based resources, and concerned with interorganizational knowledge transfer. Third, I briefly review interorganizational modes of ERA. Fourth, I provide a broader set of strategic motives that act as drivers of ERA. As it has been illustrated above, firms may engage in ERA to alter their technological trajectories, adapt to environmental changes, or respond to competitive pressures driven by technological change and industrial innovative activity.

2.3.1 ERA and organizational performance

In this section, I provide an extensive review of the relevant literature concerned with ERA and its consequences for organizational performance. As I have illustrated in chapter 3, management scholars have long investigated the antecedents of competitive advantage, and its relation with organizational performance. Through the theoretical lens of the RBV, an extensive amount of empirical research investigates the link between resources and organizational performance. While most of the empirical work has focused on resources that conceptually satisfy the VRIN conditions (strategic resources) proposed by Barney (1991), few empirical studies directly assess the theoretical premises of the RBV (Newbert, 2007). This empirical direction of the RBV holds also important implications for the empirical assessment of ERA. While external

resources have been of central theoretical importance on early RBV contributions (see section 3.2), most of the empirical work that aims to assess the impact of external resources to organizational performance does so in relation to the resource endowments of the firm.

Empirical contributions have primarily focused on two measures of organizational performance; financial performance and innovative performance. Both of these performance measures have been of central interest. Scholars in the strategic management field have long employed financial (or economic) performance as a proxy of competitive advantage (e.g., Wiggins & Ruefli, 2002). Given the proliferation of knowledge and innovation as central to economic activity, scholars have extensively concerned with innovative performance. In the theoretical sphere of the RBV, scholars concerned with the organizational implications of ERA have focused more on innovative rather than financial performance. There are at least two main reasons for this. First, innovative performance has been seen as crucial to firm survival when firms compete in new technological paradigms (e.g., Hitt, Hoskisson, Johnson, & Moesel, 1996; Rothaermel & Deeds, 2004). Second, it can be argued that innovative performance is operationally closer to resource development and deployment, as it usually operationalized through measuring patents or R&D expenditures.

As I have argued above, few studies have directly concerned with the link between ERA and organizational performance (e.g., Nicholls-Nixon & Woo, 2003). Rather, most empirical studies focus on intermediary (mostly moderating) firm-specific attributes that may affect such link. Primarily, the theoretical rationale of these studies lies on the RBV and is based in two basic

assumptions: a) firms will seek to acquire resources to enhance the value-generating potential of firm-specific idiosyncratic attributes (mostly resources and capabilities) (e.g., Ahuja & Katila, 2001), and b) firms seek to acquire resources to alleviate knowledge- or technology- constraints (e.g., Mitchell & Singh, 1996; Nicholls-Nixon & Woo, 2003). Table 2-1 provides a review[8] of such resource-based empirical studies that have been concerned with a number of issues relative to ERA that affect, directly or indirectly, firm performance**.** It is worthwhile noting that the range of these studies not only illustrate the complex and multidimensional nature of ERA but also serves as an illustration of the complex link between ERA and firm performance. I briefly discuss direct and indirect effects of ERA on firm performance.

As illustrated in Table 2-1, scholars have made significant research efforts to examine the link of ERA and firm innovative performance however providing inconsistent empirical findings. More specifically, on M&A and innovation, Prabhu et al. (2005) show that acquisitions can be a "tonic" to innovative performance whilst Ahuja and Katila (2001) find that technological acquisitions have a diverse impact on innovative performance depending on the relationship between the structural characteristics of knowledge bases of the acquiring and acquired firm. On the other hand, several studies have showed a negative effect of ERA on innovative performance. Mathews (2003) attributes such negative effect to the fact that firms are unable to realize potential benefits from the technology acquired due to lack of specific organizational capabilities. Empirically, Ernst and Vitt (2000) find that ERA

[8] The last column of the table illustrates which of the two assumptions presented above, the empirical study follows explicitly.

can heart innovation by reducing the post-acquisition inventive performance of key R&D personnel. In the empirical context of the manufacturing industry, Harrison, Hitt, Hoskisson, and Ireland (2001) support the negative effect of acquisitions on innovation by illustrating how acquisitions impede firm financial controls. However, they do find that strategic corporate controls positively affect internal innovation activities. Gans and Stern (2000) further suggest that dependency on external sources of acquiring resources could impede innovation.

Several empirical studies concerned with strategic alliances (as mode of ERA) and innovative performance have overall showed positive interaction effects based on a number of factors such as the size of partners (Stuart, 2000), complementary assets (Rothaermel, 2001b), relationships with customers and suppliers (Faems, Van Looy, & Debackere, 2005). Moreover, (Wuyts, Stremersch, and Dutta (2004) suggest that technological diversity and repeated partnering positively affects radical innovation. Fey and Birkinshaw (2005) find that external contracting has a negative impact on innovative performance whilst partnering with universities has a positive impact. In their study of the biopharmaceuticals industry, Nicholls-Nixon and Woo (2003) find that the introduction of new biotech products (as a measure of innovation) is positively associated with different types of technology sourcing. They further show that highly innovative firms exhibit a higher number of interfirm alliances. Jones, LanctotJr, and Teegen (2001) illustrate that ERA (in the case of technology) negatively affects firm performance.

Furthermore, a relevant stream of research has examined the existence of complementarity effects between internal and external resources. More

specifically, Cassiman and Veugelers (2006) illustrate a direct positive link of such complementarities to firm innovative performance in the empirical context of the Belgian manufacturing industry. Jones et al. (2001) provide further empirical support for the existence of a complementarity effect between ERA (focusing on technology) and internal resources. While these authors perceive ERA as a substitute of internal resource development, they argue that firms with greater level of internal resources will gain more from ERA, recognizing the positive moderating effect of absorptive capacity.Furthermore, in the empirical context of the biotechnology industry, Arora and Gambardella (1990) have empirically shown the existence of complementarities between various strategies of ERA.

Table 2-1. ERA related factors and organizational performance

ERA mode	Moderating Construct	Effects on Innovative performance	Effects on Financial performance	Representative Studies	
Direct effects					
multiple types of interfirm agreements		different types of sourcing(+); non-equity based linkages(+)		(Nicholls-Nixon & Woo, 2003)	(b)
interfirm agreements		internal information sources(mod); external information from competitors(+)		(Veugelers & Cassiman, 1999)	(b)
Strategic Alliances		+	collaboration with incumbents (+; sales)	(Rothaermel, 2001b)	(b)
Strategic Alliances			+	(Singh & Mitchell, 2005)	(a)
external technology acquisition			-	(Jones et al., 2001)	(a,b)
M&A/SA		M&A(-); SA(+)		(de Man & Duysters, 2005)	
		Indirect effects			
M&A	firm knowledge base (KB)	absolute and relevant size of KB(+,-) depth and breadth of KB(+) tech. similarity KB(U)		(Ahuja & Katila, 2001; Prabhu et al., 2005)	(a,b)

Strategic Alliances	partner-specific alliance experience	+		(Hoang & Rothaermel, 2005)	
M&A	patent behaviour of R&D personnel	-		(Ernst & Vitt, 2000)	
Strategic Alliances	firm patent intensity	+		(Hagedoorn & Schakenraad, 1994)	
M&A	post acquisition autonomy of acquired firm	+		(Schweizer, 2005)	(a)
Strategic Alliances (equity-based)	repeated partnering		-	(Goerzen, 2007)	(a)
Strategic Alliances	size of partners	Large and innovative (+) Small and unsophisticated (-)		(Stuart, 2000)	(a)
interfirm agreements	technological diversity	+	-	(Wuyts et al., 2004)	(a)
Strategic Alliances	knowledge flows		No effect	(DeCarolis & Deeds)	
external technology acquisition	internal resources		+	(Jones et al., 2001)	(a,b)
various sources	complementarity with internal resources	reliance on basic R&D (+) technology seeking (+)		(Cassiman & Veugelers, 2006)	
Strategic Alliances	partner technological diversity	+		(Sampson, 2007)	
external information sources	Openness to external sources	inv. U (search breadth and depth)		(Laursen & Salter, 2006)	(b)

		combination of internal and external learning		Innovators, Explorers (+); Loners, Exploiters (-)	(Bierly & Chakrabarti, 1996)	(a)
		imitation of competitors' knowledge		-	(DeCarolis & Deeds)	(a)
Strategic Alliances		asset interdependence	+ (drug discovery performance)		(Thomke & Kuemmerle, 2002)	(a,b)
Strategic Alliances		diverse alliance network	+		(Baum, Calabrese, & Silverman, 2000)	(a)
extraindustry sources knowledge	of	absorptive capacity	+		(Cohen & Levinthal, 1990)	

2.3.2 ERA and knowledge-based resources

In line with the theoretical assumptions of the RBV (and its extensions), strategic alliances have been treated as the main vehicle of acquiring knowledge-based resources (Eisenhardt & Schoonhoven, 1996). A large volume of studies in the strategic alliances literature have been concerned with the dynamics of alliance formation (for an excellent review on theories relevant to interfirm alliances see Grant & Baden-Fuller, 2004) identifying interorganizational knowledge transfer as the primary motive of alliance formation (Hagedoorn, 1993). For example, Eisenhardt and Schoonhoven (1996) find that difficult market conditions and risky firm strategies increase the rate of alliance formation. In similar fashion, Anand and Khanna (2000) find that firms create value through experience accumulation in R&D joint venturing whilst experience has no learning effects on licensing arrangements.

In their seminal study, Mowery et al. (1996) showed that equity joint ventures are a more efficient way of transferring knowledge than contract based strategic alliances. Furthermore, they illustrate that bilateral nonequity arrangements exhibit higher levels of knowledge transfer than unilateral contracts. However, they suggested that prealliance experience was a key factor on absorbing technological capabilities. Chen (2004) supports the findings of Mowery et al. (1996) by concluding that equity based alliances is a higher conduit of tacit knowledge than contract-based alliances whilst the opposite holds for explicit knowledge. Furthermore, Lane and Lubatkin (1998) suggest that knowledge transfer across organizations can be extremely difficult due to differences in corporate culture, processes and knowledge bases. Simonin (1999, 2004) has been concerned with the implications of knowledge

attributes on knowledge transfer. She generally suggests that knowledge ambiguity has a significant positive effect on knowledge transfer. More specifically, she argues that knowledge properties such learning intent and tacitness will impede knowledge transfer. She concludes that firms with greater collaborative know-how exhibit more efficient knowledge transfer by minimizing complexity and organizational distance.

In their field research of a Palestine NGO, Hardy *et al.* (2003) identify two dimensions, involvement and embeddedness, of interfirm collaborations that produce strategic, knowledge creation and political effects. They furthermore propose that high involvement will be associated with high strategic and knowledge creation effects whilst high embeddedness will result on high political effects (i.e. influence).

However, current studies on the interorganizational knowledge transfer literature fail to provide empirical evidence on possible mechanisms that may affect innovative performance.

2.3.3 Interorganizational modes as mechanisms of ERA

Firms engage in ERA using a number of interfirm modes such as mergers and acquisitions (M&A), joint ventures, licensing agreements, R&D collaborations and strategic alliances[9][10].The rationale behind these modes may

[9] Strategic alliances are defined as "those cooperative agreements which are aimed at improving the long term perspective of the product market combinations of companies involved" (Hagedoorn, 1993). Taking a more contractual view, Anand and Khanna (2000) define strategic alliances as "a complex organizational forms that are usually viewed as incomplete contracts". Strategic alliances can be categorized as horizontal and vertical. Alliances among competitors referred as horizontal alliances while vertical alliances refer to alliances between firms operating in adjacent stages of the value chain (Burgers, Hill, & Kim, 1993).

differ in terms of what is to be achieved and affects organizational outcomes, such as firm innovativeness, in various ways (Powell, White, Koput, & Owen-Smith, 2005). Briefly, motives for collaboration range from research-oriented objectives to market access (Hagedoorn, 1993: 374).

Relevant literature distinguishes interfirm collaboration modes into equity- and non-equity based. Such distinction is based on the organizational complexity of forming such collaborations and strategic objectives to be achieved. Differentiating between these two broad collaborative modes, (Hagedoorn, 1993)argues that equity-based collaborations as for example joint ventures focus on long term strategic objectives through a more complex organizational form resulting into a joint owned firm. On the other hand, non-equity based collaborations such as R&D agreements have short-term one dimensional goals such as technology achievement. In terms of organizational outcomes, scholars have shown that equity-based collaborations facilitate knowledge transfer (Mowery, Oxley, & Silverman, 1996) and learning (Anand & Khanna, 2000a) compare to non-equity based collaborations.

Taking a resource-based perspective [11], interfirm collaborations can be perceived as "devices that combine characteristics of markets and intrafirm organization" (Mowery, Oxley, & Silverman, 1998), thereby enabling firms to access valuable resources and capabilities (Das & Teng, 2000; Eisenhardt &

[10] Todeva and Knoke (2005) identify 13 organizational forms of interfirm collaboration namely hierarchical relations, joint ventures, equity investments, cooperatives, R&D consortia, strategic cooperative agreements, cartels, franchising, licensing, subcontractor networks, industry standards groups, action sets, and market relations.

[11] Scholars have viewed interfirm collaboration through different theoretical lenses. Other than the resource-based perspective, scholars have employed a transaction-costs (Williamson, 1975), social network (Gulati, 1998), and evolutionary (Doz, 1996) perspective.

Schoonhoven, 1996; Ireland, Hitt, & Vaidyanath, 2002). Strategic alliances can be further, viewed "as a firm's adaptive behaviour to maintain a match between firm strategy and resource endowment on the one hand and changing environmental conditions on the other" (Hoffmann, 2007: 829). Under such perspective, strategic alliances can be categorized in terms of resource contributions among partner firms. Following the scale-link typology, alliances where partner firms contribute similar resources termed as scale alliances, whilst alliances based on the combination of different resources termed as link alliances (Dussauge, Garrette, & Mitchell, 2004: 701). Specifically, strategic alliances may enable firms to access complementary resources (Rothaermel, 2001a) or reduce hazards associated with liability of newness and market entry (Baum et al., 2000).

It must be noted, however, that several ERA modes of can be viewed from a different theoretical perspective as for example the minimization of transaction costs (Williamson, 1975; Williamson, 1991). In such case, several scholars have drawn from transaction cost theory to explain governance choices on strategic alliances (e.g., Colombo, 2003; Oxley, 1997).

Whilst I acknowledge such contributions, my aim here is to provide further insights on empirical contributions that view ERA modes through resource-related motives (Das & Teng, 2000; Grant & Baden-Fuller, 2004; Mowery et al., 1998). Regardless of the theoretical views on strategic cooperation, Hagedoorn (1993) provides an extensive review on motives that drive strategic technology partnering. He identifies three major strategic motives: technology complementarity; reduction of the innovation time-span and influencing the market structure.

Going back to the case of the biopharmaceuticals industry, scholars have illustrated an overall positive impact of collaborations on organizational outcomes. For example, Danzon et al. (2005) showed that biopharmaceuticals indications developed under collaborations are significantly more likely to complete clinical drug development phases 2 and 3 than indications completed individually. Collaborations are also crucial for the survival of start-up biotechnology firms. As it has been illustrate above, the biotechnology paradigm enabled incumbent biopharmaceuticals firms to create value through economies of scale. Following this line of thought, (Henderson and Cockburn (1996) show that the success of research programs of biopharmaceuticals firms is directly associated with their size. However, firms exhibit a preferential tendency on joint R&D agreements over contractual forms (Roijakkers & Hagedoorn, 2006: 435). On the other hand, Anand and Khanna (2000a) argue that licensing agreements have been recognized as the preferred mode of cooperation and technology transfer in the biopharmaceuticals industry as they take less time to be negotiated and completed.

However, the engagement in such collaborations does not necessarily imply the realization of value especially in the case of equity based collaborations (Simonet, 2002). More specifically in the case of M&A, (Cartwright & Schoenberg (2006) found that 46-50% of M&A activities fail to provide value and firms can be caught up in integration hazards (Agarwal, Desai, Holcomb, & Oberoi, 2001). For example, in his study of post-acquisition integration in the biopharmaceuticals industry, Schweizer (2005)show that M&A fall short of expectations as the two partner firms involved in the M&A activity are still far from being a united entity. More specifically, he suggests that in order to

realize the pre-acquisition motives, non R&D related portions of the acquired business must be rapidly integrated whilst R&D acquired units must preserve a high degree autonomy. In addition, M&A involve the acquisition of entire knowledge bases thus knowledge that is not required is acquired as well (2005). Firms engaging into strategic alliances are faced with several risks such as appropriability hazards, opportunistic behaviour, and knowledge leakage (Oxley, 2002; Oxley & Sampson, 2004). For example, in their study of biotechnology start-ups, Baum et al. (2000) found that alliances with rivals may inhibit firm performance.

Furthermore, Hoang and Rothaermel (2005) conclude that partner specific alliance experience may decrease alliance performance in contradiction to general alliance experience which does not have any effect on alliance success. Oliver (2001) suggests that DBFs which are not actively engage into strategic alliances have a higher probability of organizational death whilst DBFs which increasingly form alliances will exhibit higher corporate growth.

2.3.4 Strategic motives for ERA

I have shown above empirical studies that are concerned with several dimensions of ERA. In this section, I summarize the strategic motives for ERA (see Table 2-2). Scholars have provided excellent reviews on different modes of ERA (for example Hagedoorn, 1993), thus there is no need for a similar review here. To this point, most empirical work in this context has treated ERA as primarily a strategic action driven by resource-related motives. This is particularly true for firms competing in environments where technological change and innovative activity shape the competitive advantage of firms and

thus their survival, the primary strategic motive for competing firms engaging in ERA is technological renewal (Nicholls-Nixon & Woo, 2003). Under this primary motive, firms engage in ERA under several resource-based motives such as to enhance their resource endowments (e.g., Burgers et al., 1993), alleviate their resource constraints (e.g., Combs & Ketchen, 1999; Nohria & Garcia-Pont, 1991), alter the path-dependent technological trajectories (e.g., Henderson & Cockburn, 1996), and acquire complementary resources in order to enhance the value generating potential of their resource endowments (e.g., Chung, Singh, & Lee, 2000).

Except for these resource-driven motives of ERA, there are several other motives that may drive a firm to engage in ERA. Empirical studies in this area have focused on identifying firm-specific characteristics as antecedents of ERA such as the reduction of risk and costs associated with the innovation process (Hagedoorn, 1993). (McEvily & Marcus, 2005: 1041), for example, highlight the importance of information-sharing, in the form of joint problem solving, as a major driver of ERA.

Firms may also engage in ERA to seize environmental opportunities and gain first-mover advantages (Combs & Ketchen, 1999: 871).Specifically, scholars have focused their efforts on identifying environmental characteristics that act as motives such as technological positioning (e.g., Stuart, 1998), environmental uncertainty [12] (e.g., Burgers et al., 1993; Eisenhardt &

[12] Burgers et al. (1993) distinguish between demand and competitive uncertainty. Demand uncertainty arises from unpredictable changes in consumer purchasing patterns whilst competitive uncertainty arises from competitive interdependence, which is the competitive action of a firm has a direct impact on the market position of its rivals.

Schoonhoven, 1996; Hoffmann, 2007), and competitive behaviour of rivals (Fey & Birkinshaw, 2005; Silverman & Baum, 2002).

Table 2-2. Motives for external resource acquisition

Motive/incentive for external resource acquisition	Level of analysis	Theoretical Perspective	Representative studies
reducing resource constraints/obtaining critical resources	firm-level; industry-level; network-level	RBV; Organizational economics; social network theory	(Ahuja, 2000; Combs & Ketchen, 1999; Nohria & Garcia-Pont, 1991; Powell et al., 1996)
Accessing complementary resources	Firm-level; dyad-level	RBV	(Chung et al., 2000; Rothaermel, 2001b; Rothaermel & Boeker, 2008)
reducing environmental uncertainty (demand; competitive; strategic)	industry-level	RBV; transactions costs; evolutionary economics (co-evolution)	(Burgers et al., 1993; Colombo, 2003; Eisenhardt & Schoonhoven, 1996; Hoffmann, 2007)
inducing joint problem solving & information sharing	network-level	RBV; social network analysis	(McEvily & Marcus, 2005)
conflict of internal capabilities	firm-level	RBV	(Capron & Mitchell, 2004)
advantageous technological positioning	industry-level	Social network theory	(Stuart, 1998)
reducing risks and costs associated with the innovation process	firm-level	transaction-costs	(Hagedoorn, 1993)
patent effectiveness	Industry-	Economics;	(Arora &

(moderated by complementary assets)	level	transaction-costs	Ceccagnoli, 2006)
seizing environmental opportunities	industry-level	RBV; IO economics	(Ahuja, 2000; Combs & Ketchen, 1999)
mimicking resource position of rivals (oligopolistic imitation)	SG-level	social network theory; Strategic groups; IO economics	(Garcia-Pont & Nohria, 2002)
responding to competitive pressures	Industry-level	Game-theory; RBV	(Fey & Birkinshaw, 2005; Silverman & Baum, 2002)

CHAPTER 3.

THEORETICAL PERSPECTIVES ON EXTERNAL RESOURCE ACQUISITION

3.1 Introduction

The aim of this chapter is to review and synthesize theoretical perspectives on ERA. In line with my overarching research question, I review theoretical perspectives that scholars have employed thus far to explain firm behaviour in the context of ERA. In line with theoretical developments in the strategy field, I draw from the RBV and theories of competitive dynamics to frame my thesis and later develop my conceptual framework. As i will illustrate throughout this chapter, theoretical perspectives on ERA has been developed independently and only recently scholars have tried to connect these theoretical perspectives (e.g., Capron & Chatain, 2008). Of course, my aim here is not to provide an

exhaustive review of different theoretical perspectives, but to illustrate how these perspectives treat firm in the context of ERA.

The acquisition of external resources has been a central theme in organizational and strategy research. In his seminal paper on competitive strategy, Barney (1986: 1235) suggests that "…*Most resources for implementing strategies must be acquired from a firm's environment at some point in a firm's history."* Barney goes on to argue that the acquisition of external resources is directly connected with a strategic factor market. Competition for resources in such markets assumes that competing firms exhibit a profit maximizing behaviour, and gain financial returns through implementing strategies that are based on competitive imperfections raised by asymmetric expectations of the future value of the resource to be acquired. Before I go into more details about the notion of strategic factor markets and its implications for ERA, it is important to note that other scholars have connected ERA with somewhat different firm strategic behaviour. For example scholars concerned with neoinstitutional explanations of competitive advantage have argued that competing firms may gain value through higher levels of legitimacy when acquiring resources (DiMaggio & Powell, 1983). In this theoretical rationale, a firm gains legitimacy through adopting strategies similar to that of its competitors. In contrast with the implicit notion of Barney's theory of strategic factor markets, firms acquire external resources not to differ but to conform to the strategies of their competitors.

This dissertation further addresses this theoretical discussion by investigating the question: "*What is the role of firm strategy in ERA?*" To address this question, I draw upon strategic choice theories to explain firm strategic

behaviour[13] in the context of ERA. Thus far, strategic management scholars have been very much concerned with the link between firm strategic behaviour and competitive advantage. Drawing from the main concept of strategic similarity, scholars have intensively investigated how competitive advantage is created when firms are different or when firms are the same (Deephouse, 1999: 147).

Of course, competing firms do not simply choose to differentiate or conform to the strategies of their competitors. These two extremes of strategic choice are used here as a theoretical device and do not provide a complete understanding of firm strategic behaviour. As Nelson (1991: 69) points out "… it is nonsense to presume that a firm can calculate an actual best strategy. The world is too complicated for a firm to comprehend."

As I will argue later on, these two extremes of strategic choice hold different theoretical implications for explaining patterns of ERA among competing firms. In the introduction chapter, I have briefly illustrated that scholars have viewed ERA as a resource-driven action. In this view, firm strategic behaviour is very much in line with the RBV's value-creation mechanism of differentiation. In contrast with this tradition, I will argue that ERA is not solely resource-driven but can be also competitor-driven. To build the competitor-driven view of ERA, I am also concerned with firms operate at the other extreme of strategic choice; that of imitation. In this sense, firms choose to strategically behave similarly with their competitors.

[13] Firm strategic behaviour reflects the strategy of competing firms. In this context, strategy refers to the firm's realized position in its competitive market (Deephouse, 1999: 148)

This chapter is organized as follows. I start by discussing the RBV. The RBV has been the predominant theoretical framework not only for ERA but also more broadly in the strategy field (Hoopes et al., 2003). It is thus necessary to discuss its basic theoretical premises and assumptions in relation to my resource-driven view of ERA. In relation to my competitor-driven view of ERA, I synthesize relevant literature of competitive dynamics that draw from theories of imitation to explain firm strategic behaviour. Imitative behaviour has been of central concern both at microeconomics and organizational sociology. My objective here is not to provide a complete review of the literature but illustrate how imitation connects with ERA (for two excellent recent reviews see Lieberman & Asaba, 2006; Ordanini, Rubera, & DeFillippi, 2008).

3.2 Resource-driven firm behaviour and RBV

This section illustrates the interplay and later transition between market positions and resources as sources of competitive advantage. I more specifically focus on the theoretical development of the RBV, which constitutes the theoretical foundation of my resource-driven view of ERA. I start by briefly discussing initial contributions to the RBV. I then discuss theoretical contributions that extend traditional RBV models, and illustrate how resources residing outside firm boundaries can lead to competitive advantage. By taking into account traditional and emerging work on the RBV, I provide the theoretical basis and fundamental assumptions for the resource-driven view of ERA.

3.2.1 Origins of the RBV: from competitive structures to advantageous resource positions

Understanding the source of superior economic rents has been a long research endeavour in industrial organization (IO) economics and strategy research. Scholars in this area have captured superior economic rents through the notion of competitive advantage. While several theories have been offered to explain the sources of competitive advantage, they mainly assume that competitive advantage stems from some short of interfirm heterogeneity. For example, scholars concerned with Bain type IO, assume that interfirm heterogeneity arises from differences in firm size (Conner, 1991: 125).

Other scholars in this tradition have suggested that firms outperform their rivals and thus gain competitive advantage by occupying specific market positions (e.g., Caves & Porter, 1977; Porter, 1979: 138). In their view, interfirm heterogeneity is a result of competitive structures. Hunt's (1972) seminal empirical observation[14] that a group of industry competitors employ similar strategies, suggests that firms with similar characteristics may employ similar strategies. Initially, Caves and Porter (1977: 250) argued that "… sellers within an industry are likely to differ systematically in traits other than size, so that industry contains subgroups of firms with differing structural characteristics". Strategic groups, such authors argue, will be generated as a response to raise barriers to entry to new entrants given structural similarities amongst competing firms. Such group of firms will exhibit mutual dependence in terms of their reactive strategy to new entrants thus raising mobility barriers.

[14] The primary goal of the "brewing studies" by Hunt, Hatten, Schendel and Cooper in the 1970's was to explore the proposition that performance was a function of strategy and environment. The studies revealed greater levels of interfirm heterogeneity than what was originally assumed by IO scholars, giving rise to the concepts of strategic groups and competitive advantage (Rumelt, Schendel, & Teece, 1994).

Later work revalidated the explanatory power of mobility barriers on the linkage between strategic group membership and competitive advantage (Mascarenhas & Aaker, 1989; McGee & Thomas, 1986). As Cool and Schendel (1988: 208) point out "it is not surprising that empirical evidence on the direct link between strategic group membership and performance are conflicting given the many intervening variables that arise since the formulation of the original [Caves and Porter] model".

Given conflicting empirical evidence of a direct link between strategic group membership and firm performance (Fiegenbaum, Sudharshan, & Thomas, 1990), scholars have shifted their focus on firm-specific attributes to explain inter-group performance variations. Most notably, Cool and Schendel (1988) highlighted the role of *asset endowments* (development of assets) and *execution ability* (strategy) during strategic investment decisions to account for variations on firm financial returns (profitability). In their longitudinal analysis of the U.S. biopharmaceuticals industry, Cool and Dierickx (1993) investigated between and within group rivalry as an intermediate link between strategic group membership and firm performance. They observed that while strategic distances between rival biopharmaceuticals firms remain stable over time, there was a repositioning of strategic groups (Cool & Dierickx, 1993: 57).

While competitive structures can be seen as a source of interfirm heterogeneity, empirical evidence thus far has suggested a weak link between such structures and competitive advantage. Drawing from the neoclassical view of the firm as input-combiner (Conner, 1991: 132), the RBV has been able to offer a stronger explanation of interfirm heterogeneity and competitive advantage (cf. Short, Ketchen, Palmer, & Hult, 2007). Moving away from

competitive barriers, the firm, in this case, is a seeker of costly-to-copy inputs (Conner, 1991: 132), and thus earns superior profits due to resource position barriers (Wernerfelt, 1984). I explore further the link between resources, strategy and competitive advantage in the next section.

3.2.2 Resources, firm strategy and competitive advantage

A central research program to the field of strategy is to answer the question of *why industry competitors vary systematically in performance over time* (Crook, Ketchen, Combs, & Todd, 2008; Hoopes et al., 2003). As I have briefly illustrated above, strategy scholars have suggested that firms outperform their competitors and thus gain competitive advantage by occupying advantageous market positions through raising barriers to entry for competitors, or self-organizing themselves in strategic groups[15](Caves & Porter, 1977; Hatten & Hatten, 1987; McGee & Thomas, 1986; Porter, 1979; Rumelt, 1991). However, some scholars have argued that competitive structures do not sufficiently explain interfirm heterogeneity[16], and thus provide an incomplete account of competitive advantage (and in turn above to normal economic rents). In contrast with the market-based explanation of competitive advantage, the RBV asserts that competitive advantage is a result of a strategy to acquire, combine and deploy firm-specific resources (Conner, 1991: 132).

15 Strategic groups are defined "as a subset of industry competitors that exhibit similar characteristics" (Porter, 1979).

16 In the RBV tradition, heterogeneity can be explained as an outcome of disequilibrium process of Schumpeterian competition (Mahoney & Pandian, 1992).

While economic theory has been long concerned with resources (as factors of production), the seminal work of Penrose (1959) was the first attempt[17] to provide a theory of the firm that is explicitly concerned with the concept of resources. In her theory, Penrose views firms as collections of productive resources organized in an administrative framework (Foss, 2000: 17). However, it wasn't until the theoretical contributions[18] by (Wernerfelt, 1984), (Barney, 1991), and (Peteraf, 1993) that have placed firm-specific resources at the epicentre of interfirm heterogeneity, and competitive advantage.

To provide some definitional clarity, resources are defined as "[those] tangible and intangible assets that are tied semi-permanently to the firm" (Wernerfelt, 1984: 172). Firm resources are converted into final products or services when combined with other firm assets and bonding mechanisms such as for example incentive systems (Amit & Schoemaker, 1993: 35). In turn, competitive advantage stems from "the successful implementation of a value creating strategy not simultaneously being implemented by any current or potential competitors" (Barney, 1991: 102).

I will now briefly review these three important contributions to the RBV. The seminal papers discussed here and the works of Barney (1986) and Dierickx and Cool (1989), which I review later, consist the initial core of the RBV. Acedo and colleagues devise the core of the RBV by employing an ad hoc

17 Wernerfelt (1984: 171) highlights this gap and argues that "…The reason, no doubt, is the unpleasant properties (for modelling purposes) of some key examples of resources, such as technological skills. The mathematics used by economists typically require that resources exhibit declining returns to scale, as in the traditional theory of factor demand".

18 Foss (2000: 19) has argued that these contributions utilize equilibrium constructs and build directly on price theory. He further suggests that these contributions primarily draw from the work of Harold Demsetz and the UCLA-Chicago tradition rather, as it is most often, assumed from Penrose's (1959) seminal theory of the growth of the firm.

heuristics method that "…starts from an initial reduced core, made up of the most basic works on theory…" (2006: 624). Acedo and colleagues have also identified and separated works on RBV, the knowledge-based view (KBV) and relational view. The relational view extends RBV to account for resources that are shared in interorganizational relationships. I discuss the relational view more extensively in the next section.

In his seminal paper, Wernerfelt was first to graphically argue that "resources and products are the sides of the same coin" (Wernerfelt, 1984: 172). His objective of course was to illustrate how resources can be a source of profitability for diversified firms. In doing so, he builds on Porter's work and his five forces framework, and identifies mechanisms where resources can provide advantages for diversified firms. Connecting back to the notion of entry market barriers, he perceives profitability as a result of resource position barriers. He however argues that "for a resource position barrier to be valuable it should translate into an entry barrier" (Wernerfelt, 1984: 173). Most importantly, Wernerfelt goes on and identifies classes of resources that can be used to raise such resource position barriers. He thus, even implicitly, introduces the idea of "strategic" resources (in his words attractive). Across his identified classes of resources, Wernerfelt's basic assumption is that such resources are idiosyncratic, in a sense that associated returns can only be earned by the firm that developed these resources. Wernerfelt clearly illustrate this point in his example of production experience (as an attractive resource). He argues that "late acquirers should pay more for the experience and expect lower returns from it" (Wernerfelt, 1984: 173). Wernerfelt extends this point further by discussing the trade of resources through mergers and acquisitions.

He highlights further the role of idiosyncratic resources and resource position barriers by arguing that "one's chance of maximizing market imperfection and perhaps getting a cheap buy would be greatest if one tried to build on one's most unusual resource or resource position" (Wernerfelt, 1984: 175).

Drawing from the early contribution of Wernerfelt, Barney provides a more comprehensive framework of how idiosyncratic resources can provide a firm with competitive advantage. He more specifically argues:

> "The resource-based view of the firm substitutes two alternate assumptions in analysing sources of competitive advantage. First, this model assumes that firms within an industry (or group) may be *heterogeneous with respect to the strategic resources* they control. Second, this model assumes that these resources may *not be perfect mobile across firms*, and thus heterogeneity can be lost lasting. The resource-based model of the firm examines the implications of these two assumptions for the analysis of sources of sustained competitive advantage." (:101; own emphasis)

Barney further argues that the heterogeneity of resources is important even when assumed that firms gain competitive advantage through advantageous market positions, resulting to the existence of mobility barriers. The same argument goes for the condition of immobility. Thus, it is explicitly assumed that mobility barriers are raised due to these heterogeneous and immobile resources. More specifically, there are four conditions that must be met for resources to constitute sources of competitive advantage. That is, resources must be *valuable, rare, imperfectly imitable and not substitutable* (VRIN) (Barney, 1991:106). Such resources have been further conceptualized as "strategic" (e.g., Barney, 1991; Crook et al., 2008) or "critical" (e.g., Peteraf & Bergen, 2003). More specifically, resources are valuable when enable the firm to conceive of or implement strategies that improve its efficiency or effectiveness (Barney, 1991: 106); rare when are scarce in quantity and

valuable; imperfectly imitable when firms that do not possess them cannot obtain them; and non-substitutable when there are no strategically equivalent valuable resources that are themselves not rare or imitable (Barney, 1991: 111)

Furthermore, Barney raises two important issues to complement his initial four conditions of the resource-based framework. First, he recognizes the path-dependency of resource accumulation. Put it differently, there is a time element where the development of specific resources meet the above initial conditions. Second, firms may able to sustain competitive advantage due to the existence of causal ambiguity to the resources they own as such resources could not be imitated by competitors.

In her seminal contribution, Peteraf (1993) provides a framework that connects resources to firm economic performance. While her framework is similar to the VRIN conditions proposed by Barney (1991), she is more concerned with how resources can generate economic rents. Building on the initial framework of Barney (1991), Peteraf argues that firms that possess superior *heterogeneous* resources will generate above to normal rents[19]. She identifies four conditions, which must be met in order for resources to contribute towards competitive advantage. Given the importance of resource heterogeneity, firms preserve long-term rent generation by limiting *ex post competition*. Such competition may inhibit firm performance by the supply of scarce resources. Dierickx and Cool (1989) argue that for resources to be a source of competitive advantage must be non-tradeable. At this point, Peteraf suggests that *tradeable* resources,

[19] More specifically, Peteraf distinguishes between Ricardian and monopoly rents. Ricardian rents are earned as firms with superior resources have lower average costs than other firms (Peteraf, 1993: 180). On the other hand, monopoly rents are earned by firms with heterogeneous resources resulting to product differentiation or spatial competition (Peteraf, 1993:181).

what she terms *imperfectly mobile*, can appropriate rents and thus positively affect firm performance. The underlying idea of imperfect mobility is that rents are jointly appropriated by the firm that originally develops the resource (factor firm) and the firm that employs the resource given an opportunity cost. However, Peteraf suggests that the firm employing the resource will be unable to appropriate higher value than what the factor could achieve**.** The last condition that must be met in order for firms to create competitive advantage is *ex ante limits to competition*.

Peteraf further argues that firms will appropriate above to normal returns in the case that possess superior resource positions compare to their rivals. However, such rents can only be generated if markets for resources do exist and are imperfect. That said, in the absence of such markets, firms could not acquire resources crucial to the implementation of their strategies and thus can only enjoy normal rents (Peteraf, 1993:184). Amit and Schoemaker (1993: 39) add to the conversation of resources and organizational rents[20] by illustrating three major reasons why VRIN resources will create more value than other resources. First, they argue, resources that they are in high demand and difficult to imitate will allow fewer firms to pursue market strategies based on such resources, while other firms not possessing such resources will find it too costly and time consuming to pursue a similar strategy. Second, firm-specificity and the presence of transaction costs affect the value potential of

[20] Mahoney and Pandian (1992: 364) distinguish between four types of organizational rents. First, Ricardian rents can be earned through owning resources that can be scarce. Second, monopoly rents can be earned through collusive arrangements. Third, entrepreneurial rents may be earned through risk taking and entrepreneurial insight in uncertain and complex environments. Fourth, quasi-rents (or Pareto) rents can be earned when resources are firm-specific.

resources. Third, the more durable the resources the smaller will be the investment to offset their depreciation.

The above theoretical contributions suggest that heterogeneously distributed resources among competing firms that are VRIN are a source of (sustainable) competitive advantage. Drawing from the core of the RBV, scholars have intensively directed their research efforts towards understanding the link of resources and firm performance (as a proxy of competitive advantage). In their meta analysis of RBV-related empirical work, Crook et al. (2008) provide empirical support[21] to the main theoretical predictions of the RBV. They also find that "strategic" resources exhibit a higher impact on organizational performance than resources that they do not meet the VRIN criteria.

3.2.3 Emerging RBV Models: Resources residing outside firm boundaries as source of sustained Competitive Advantage

As it was illustrated above, resources are of crucial importance on explaining sustained competitive advantage. Building on market barriers and entry theory, RBV scholars have initially provided a set of limiting conditions that resources must meet in order to contribute towards competitive advantage. Recently, scholars have challenged these limiting conditions by broadly suggesting that resources reside outside firm boundaries can also contribute towards competitive advantage. In contrast with traditional contributions on RBV, these scholars view firms as interconnected entities, and are thus concerned with resources shared or exchanged through interfirm relationships (e.g., Gulati,

[21] In another recent empirical assessment of RBV-related empirical research, Newbert (2007) finds that only 53% of empirical studies provide support for the basic RBV theoretical assumptions. Newbert also finds that capabilities have been found to explain firm performance than resources (Newbert, 2007: 137).

Nohria, & Zaheer, 2000). Scholars have been mostly concerned with two major mechanisms of accessing external resources; strategic alliances and inter-firm networks.

Taking a RBV perspective[22], scholars have viewed alliances as a medium of aggregating, sharing or exchanging valuable resources (Das & Teng, 2000: 37). Accordingly, firms enter strategic alliances with primarily two strategic motives; to either obtain resources essential to competitive advantage or retain resources for later effective use (e.g., Ireland et al., 2002). For example, competitive advantage can be gained through external resources by altering the firm's vulnerable strategic position (Eisenhardt & Schoonhoven, 1996) and overcoming resource constraints (Combs & Ketchen, 1999). In terms of the limiting conditions of resource heterogeneity and imperfect mobility, Das and Teng (2000) argue that alliances are formed as a response to the non-existence of resource markets. Put it differently, the existence of factor markets would allow firms to bid for needed resources eliminating the need for a strategic alliance. Hence, Das and Teng (2000:41) propose that the higher the imperfect mobility, imitability and substitutability of resources the more likely the firm to enter a strategic alliance. In terms of performance, the authors argue that the higher the contribution of resources to the alliance the higher the accumulation of new resources and thus the value appropriated by the alliance partners.

Drawing from the rapid proliferation of alliances, scholars have started to investigate the strategic importance of networks in terms of accessing

[22] Scholars in the alliance literature have also employed transaction cost theory to investigate differential performance implications of alliance governance forms (e.g., Colombo, 2003; Oxley, 1997) instead of focusing on the exchange of resources under the strategic motives of enhancing innovation or learning.

resources outside firm boundaries (Gulati et al., 2000). These scholars argue that focusing only at resources that are developed or owned by the firm, provides an incomplete understanding of competitive advantage. Rather, these scholars highlight that "the search for value-creating resources and capabilities should extend beyond the boundaries of the firm" (Gulati et al., 2000: 207). They further argue that a strategic network can be considered as an inimitable resource itself, and as a means for participating firms to access inimitable resources, (Gulati, 1999). In terms of the VRIN conditions, (Gulati et al., 2000) further suggest that network resources are heterogeneous (idiosyncratic) and non-imitable as they are unique to firms' participating in the network. They extend their argument that network structure and membership can be idiosyncratic and thus constitute a strategic resource.

Dyer and Singh (1998) further recognize that strategic resources can extend beyond firm boundaries and extend RBV by offering a *relational view* of competitive advantage. In their relational view, competing firms earn economic (relational [23] in this case) rents through network-specific routines/processes. In contrast with initial contributions that view resources as firm-level attributes, they focus at the dyad level of analysis.

More specifically, Dyer and Singh (1998) identify four specific rent-generating mechanisms. First, firms can generate relational rents through interfirm relation-specific assets. Interfirm relation-specific assets are basically strategic assets that are specialized in conjunction with assets owned by the alliance

[23] A relational rent is defined as "a supernormal profit jointly generated in an exchange relationship that cannot be generated by either firm in isolation and can only be created through the joint idiosyncratic contributions of the specific alliance partners" (Dyer & Singh, 1998: 662)

partners. Relational rents are generated through lower total value chain costs, greater product differentiation, fewer defects, and faster product development cycles (Dyer & Singh, 1998: 664). Second, firms can generate relational rents through knowledge sharing routines. Drawing from the importance of knowledge as the primary source of competitive advantage (e.g., Grant, 1996), Dyer and Singh (1998) argue that such routines are the most important sources of new ideas and information that result in the generation of relational rents through new technologies and innovation. Third, complementary resource endowments can be a source of relational rents. Complementary resource endowments are those resources of alliance partners that collectively generate greater rents than the sum of those obtained individually (Dyer & Singh, 1998: 666). Dyer and Singh further propose that the more synergistic the effect of these complementary resources the greater the potential of generating relational rents. Fourth, relational rents can be earned through the effective governance of the interfirm relationship. Effective governance can either minimize transaction costs among the alliance partners or provide incentives for value-creation initiatives (Dyer & Singh, 1998: 670).

To preserve such rents, several isolating mechanisms can be employed such as inter-organizational asset connectedness, partner scarcity, resource indivisibility, and the institutional environment. In contrast with the "core" RBV assumptions, the relational view suggests that firms gain competitive advantage by sharing rather than protecting firm-specific resources.

Extended the relational view offered by Dyer and Singh (1998), Lavie (2006) distinguishes between shared and non-shared resources and their relative contribution to firm competitive advantage. Shared (network-specific)

resources will appropriate relational rents for the partnering firms accrued by idiosyncratic resources committed to the alliance. Lavie suggests that firms participating in alliance networks facilitate asset flows thus leading to resource homogeneity (2006: 643). In terms of imperfect mobility, he suggests that alliances act as an isolating mechanism on accessing particular resources. Furthermore, Lavie identifies several factors that may affect the appropriation of relational rents. Of particular importance is the moderating role of absorptive capacity and scale and scope of resources. Lavie proposes that the higher the absorptive capacity of the focal firm and the smaller the overlapping between resource sets (scale and scope) the higher the relational rents accrued. I discuss further the important concept of absorptive capacity later on.

3.2.4 RBV Assumptions & ERA

In the two previous sections, I have provided an overview of theoretical contributions to the RBV. More specifically, I have illustrated mechanisms under which resources reside inside (section 3.2.2) and outside (section 3.2.3) the boundaries of the firm can constitute a source of competitive advantage, and thus create economic rents. Table 3-1 provides a summary of the mechanisms (and conditions) through which resources contribute to firm competitive advantage.

Table 3-1. Resource types and competitive advantage

Resource type	Level of analysis	Conditions/mechanisms of gaining competitive advantage	Representative Studies
Internal resources (owned and developed by the firm)	Firm-level	•Valuable and Rare •Heterogeneously distributed among rivals •Imperfectly mobile •Non-tradeable	Barney (1986, 1991); Peteraf (1993); Dierickx and Cool (1989); Wernerfelt, 1984; Amit and Schoemaker, 1993
Shared resources (shared through interfirm relationships)	Network-level Dyadic-level	•Partner scarcity •Effective governance •relation-specific knowledge sharing routines & emerging complementarities •Inter-partner resource alignments	Gulati, 1999; Eisenhardt and Schoonhoven, 1996 Dyer and Singh, 1998; Lavie, 2006; Das and Teng, 2000
External resources (acquired through strategic factor markets)	Firm-level	•Time compression advantages •External resource novelty •Asymmetric expectation on acquired resource value	Barney, 1986; Mathews, 2003; Capron and Chatain, 2008

In this section, I provide the theoretical foundations of the resource-driven view of ERA. While RBV has not been developed per se as a theory of ERA, it holds significant implications for the overarching question I have set out to answer. I more specifically discuss how external resources can contribute to competitive advantage. In so doing, I revisit some of the RBV's basic assumptions in relation to ERA.

Central to the view of ERA as a resource-driven action is the argument that external resources *can be a source* of sustainable competitive advantage. This argument is based on four major assumptions: *a) firms possessing Valuable, Rare, Inimitable and Non-substitutable (VRIN framework; Barney (1991)) resources enjoy competitive advantage, b) firms compete in environments where resources are central both to their strategy and competitive position, c)*

firms can acquire (external) resources in imperfect strategic factor markets, and d) external resources can lead to competitive advantage. These assumptions are directly relevant to the quest for competitive advantage. After all, the RBV is a theory of efficiency and as such it is concerned with how firms strategize based on their resources to gain an advantage over their competitors (Peteraf & Barney, 2003). The concept of competitive advantage, in the theoretical sphere of the RBV, holds important implications for firm strategic behaviour. One such implication is that firm strategic behaviour will be very much directed by the VRIN resources that a firm possesses. To this point I have discussed how VRIN resources can lead to competitive advantage (assumption (a)). Below, I discuss the rest of the assumptions that I have identified above.

The first important issue is that of strategic factor markets and the mechanisms where external resources can be a source of competitive advantage. In his seminal paper, Wernerfelt (1984) has raised the issue of acquired resources in relation to his concept of resource position barriers. He more specifically argued that:

> "Let us here focus on the purchase of resource bundles, taking as given the profitability of using different combinations. In this perspective, one's chance of maximizing market imperfection and perhaps getting a cheap buy would be greatest if one tried to build on one's most unusual resource or resource position. Doing so should make it possible to get into buying situations with relatively little competition, but also with relatively few targets. Although, in theory, it would be best to be the sole suitable buyer of a lot of identical targets, even a bilateral monopoly situation would be better than a game with several identical buyers and sellers. Especially since the latter situation will most likely lead one into heavier competition in the race to build resource position barriers after the acquisitions have taken place." (: 175)

The point that Wernerfelt is trying to make here is that markets for resources are highly imperfect and as such the value generating potential of acquired

resources depends on the resources that the acquirer already possess. This implied synergistic effect between targeted and already owned resources is of central importance to the RBV. Wernerfelt seems to suggest is that resources traded in such markets can be a source of competitive advantage *only* when combined with resources already controlled by the firm.

Barney (1986) develops this argument further by providing a framework on how competing firms gain value through strategic factor markets. Barney defines such markets as "a market where resources to implement a strategy are acquired" (Barney, 1986: 1231). Barney argues that a strategic factor market is developed whenever the implementation of a strategy requires the acquisition of resources (Barney, 1986: 1232). By understanding the underlying mechanisms of strategic factor markets, one can make inferences on the potential economic returns that a firm can accrue by acquiring resources. Barney makes this point very clear by arguing that the acquisition of resources can lead to greater than normal returns *only when* the firm exploits competitive imperfections[24]. Competitive imperfections arise when competing firms expect a different value for acquiring the target resource and implement a strategy. Put it differently, differences in (value) expectations constitute a strategic factor market imperfection (Barney, 1986: 1234).

Barney goes on and identify several strategic factor imperfections such as *lack of separation* (the firm owns all the necessary resources to implement their strategy), *uniqueness* (unique history of owned resources), *lack of entry (the*

24 In contrast, if competing firms, participating in the strategic factor market, hold the same information about the future value of the strategies to be implemented through the acquisition of resources, there are no arbitrage opportunities to be gained (Denrell et al., 2003).

firm chooses not to enter the market), profit maximizing (firm behaviour to maximize profits), *financial strength* (financial backing to enter the strategic factor market), *and luck of understanding* (firm does not understand the rent generating process underlying the strategy). Given these competitive imperfections, a firm can obtain above to normal returns when it holds more accurate expectations[25] about the value of the strategy to be implemented or simply by being lucky (Barney, 1986: 1238).

Taking away the element of luck, asymmetry on expectations about the future value of the targeted resource is then the most important factor that will determine the value generating potential of the resource to be acquired (and its potential to create a competitive advantage) (Makadok & Barney, 2001). Accurate expectations, Barney argues, are more probably to stem through an internal analysis of the skills (resources) that a firm already possess rather the information obtained from the firm's competitive environment. In their recent information model, Makadok and Barney (2001) argue that "the most fundamental asymmetry capable of generating competitive advantage are interfirm differences in skill at collecting, filtering, and interpreting information about the future value of resources" (Makadok & Barney, 2001: 1623). If a firm lacks such special resources then it can only rely to a sub-optimal strategy of imitating the strategy of its competitors (Barney, 1986: 1238).

This may be true when we assume that firms behave in a profit maximizing way and they can recognize the imperfections described above. While Barney

[25] Barney's argument of superior information and thus more accurate expectations is very much in line with the efficient market hypothesis (Denrell et al., 2003).

recognizes that sometimes firms act in a non profit maximizing manner, he fails to expand further on what other kind of firm behaviour is to be expected when firms engage in resource acquisition and thus choose to enter a strategic factor market.

Building their arguments on Barney's notion of strategic factor markets, (Dierickx & Cool, 1989) argue that product market positions are affected by the opportunity cost to build resources necessary to occupy such positions. If opportunity cost is not taken into account, the authors argue, measured returns of product market activities will be inflated. They extend the discussion of Barney (1986) on strategic factor markets by focusing on how and if resources can be traded and how such resources can be accumulated through time. Contrast to Barney, Dierickx and Cool propose that resources that can be acquired in the presence of strategic factor markets cannot be a source of competitive advantage. Rather, they suggest that such idiosyncratic (strategic) resources must be accumulated internally (Dierickx & Cool, 1989: 1506).

Dierickx and Cool clearly state that their main concern is with the sustainability of resource positions rather with the creation of competitive advantage. Building on their powerful proposition that strategic resources cannot be traded, they suggest that competing firms can either imitate (create their own) or substitute them. They identify several characteristics of the resource accumulation process such as *time compression diseconomies, asset mass efficiencies, interconnectedness of asset stocks, asset erosion, and causal ambiguity* that can protect a firm's internal resources by imitation or substitution. Briefly, time compression diseconomies refer to the time required for resource accumulation. Simply, the input required for such accumulation

cannot substitute for time. Asset mass efficiencies refer to the path-dependent nature of resource accumulation. Interconnectedness of asset stocks suggests that resource accumulation is connected with a number of resources not only to the resource to be accumulated. Asset erosion refers to the cost associated with the resource accumulation process of a particular resource. Causal ambiguity refers to the complex nature of resources as the resource accumulation process may be stochastic and discontinuous. Alternatively, competing firms may employ alternative stock of resources (substitute) given that these are available through markets. The threat in this case is that substitution may decrease the value of the substituted resource (Dierickx & Cool, 1989: 1509)

To this point, I have reviewed contributions that provide us with insights on how, and under what conditions, external resources can be a source of competitive advantage. While these contributions starting point is that firms are heterogeneous on the resources that they possess, Dierickx and Cool (1989) suggest that external resources *cannot* be a source of competitive advantage, if they can freely traded in strategic factor markets. In contrast with Barney's (1986) framework of strategic factor markets, Dierickx and Cool argue that if resources can be traded they cannot be VRIN. This suggests a tension between assumptions (a) and (d) that I have provided above. This tension does not only hold theoretical implications for ERA but has also directed empirical research in the context of the RBV.

Connecting back with the conversation on the traditional models of the RBV, scholars have implicitly assumed that only internally developed resources can contribute towards competitive advantage and thus have initially focused their empirical efforts on resources endogenous to the firm. Certain competitive

conditions, however, such as the proliferation of knowledge and innovation, has forced scholars to revalidate their initial views and account for mechanisms that resources residing outside the boundaries of the firm (shared or external) *can* contribute to firm competitive advantage (Mathews, 2003; Miller, Fern, & Cardinal, 2007). However, these contributions work under the assumption that such resources are a source of competitive advantage *only in* relation to the resources that the firm already owns. Put it differently, such resources can be heterogeneous (and in a sense VRIN) only when combined with the idiosyncratic resources of the firm.

While these contributions advance significantly our understanding on resources, firm strategy and competitive advantage, they fail to incorporate the environment of the firm. This is an important limitation that we must address if we are to better understand why firms are heterogeneous in the first place (Foss, 2000). In the next section, I review recent theoretical work that tries to incorporate the environment of the firm in the theoretical sphere of the RBV. This is important as scholars have shown that ERA can be central to firm survival when firms are faced with changing competitive conditions such as for example, the technological paradigm of biotechnologies(Nicholls-Nixon & Woo, 2003).

3.2.5 Towards a dynamic view of the RBV: competing through external resources in dynamic competitive environments

So far, I have provided an overview of the dominant theoretical framework on explaining intraindustry performance variations and sustained competitive advantage, namely the RBV. Taking into account initial contributions (Amit & Schoemaker, 1993; Barney, 1991; Barney, 1986; Conner, 1991; Dierickx &

Cool, 1989; Peteraf, 1993; Wernerfelt, 1984), I have highlighted limiting conditions for resources to be a source of sustained competitive advantage. Following Barney's original model (1991), resources can be a source of competitive advantage when they are valuable, rare, costly-to-copy, and hard to substitute (VRIN conditions). In turn, competitive advantage is sustained when resources are heterogeneously distributed among competing firms (resource heterogeneity) and non-tradeable into (perfect) strategic factor markets (purchased for a specific price).

As it has been illustrated above, scholars have significantly extended the theoretical basis of RBV by illustrating mechanisms where network- and alliance- specific resources can contribute to firm competitive advantage. Whilst these contributions shed important light to the applicability of the RBV in competitive environments where firms compete in an interconnected way, they fail to account for dynamic environment conditions that competing firms are faced with. It is under such competitive conditions, where understanding the interplay between external resources and sustained competitive advantage becomes even more important. Recently scholars have attempted to expand the theoretical boundaries of the RBV by taking into account environment conditions such as uncertainty, and munificence. A recent example is the study of Sirmon and colleagues (2007) which connects uncertainty and munificence (as environmental contingencies) with managing resources. Specifically, the authors focus on three environmental contingency factors that may produce uncertainty such as i*ndustry structure*, *the stability of market demand*, and *environmental shocks*. Under high uncertainty, the authors argue, firms will seek to acquire a broader set of resources in order to seize environmental

opportunities and increase their flexibility towards competitors' actions. Environmental uncertainty, in terms of resources, holds several implications for firm strategic behaviour. First, uncertainty can be seen as one dimension of perceived competitive action among rival firms. Second, uncertainty may affect the management of a firm's resources but also competitive actions towards the occupation of environmental opportunities. Third, resource uncertainty highlights the strategic importance of competitors' actions on the focal firms' strategic behaviour. The relationship between uncertainty and resources can be seen as an outcome of Schumpeterian competition. In his early attempt to provide theoretical implications of how firms strategize under Schumpeterian competition, Barney (1986) argued:

> "...certain firms in the industry may have the unique skills required to be the source of revolutionary changes in that industry... Other firms may have the unique ability to rapidly adapt to whatever evolutionary changes may occur ... However, as long as some irreducible uncertainty remains in the industry, firms will be unable to anticipate perfectly which particular changes in an industry will cause a revolution, or which firm or firms will be the sources of this change..."
>
> "If it were possible to anticipate a Schumpeterian revolution with certainty, then most firms will be able to respond accordingly by acquiring the appropriate resources and implementing the necessary strategies. However, Schumpeterian revolutions can only can be imperfectly anticipated, the effects of Schumpeterian revolutions of defining some organizations' abilities and assets as newly valuable, are partially stochastic in nature... Firms that have what turn out to be newly valuable skills *and* assets are, to some extent, lucky. These lucky firms may be able to retain their resource and skills advantages for a substantial period of time, thereby becoming dominant actors in their newly defined industry." (: 796-797)

Barney brings out some important implications for ERA that unfortunately does not fully incorporate in his theory of strategic factor markets. Such dynamic conditions, such as uncertainty, hold important implications specifically for the differential expectations that competing firms must build on if any value can be appropriated when acquiring resources in strategic factor

markets. More generally, in line with the argument of Dierickx and Cool (1989) on the (non)tradability of strategic resources, Denrell et al (2003: 985) suggest that competing firms can seize opportunities in strategic factor markets when the future value of the resource to be acquired is contingent to already owned resources. It is not hard to imagine that such strategic opportunities will be greater when competing firms are faced with high environmental [26] uncertainty.

It follows from the above discussion that resource uncertainty both enables and constrains strategic action. Competing firms can take strategic actions to seize opportunities in strategic factor markets. Such (resource) opportunities are created due to competitive imperfections that firms try to exploit (Alvarez & Barney, 2007). Of course, such imperfections suggest that some firms are more prepared to seize resource acquisition opportunities than others. Denrell and colleagues argue that internal resources (that are idiosyncratic) can either enable or constrain firms to capitalize on strategic factor market inefficiencies. Either way, they prescribe that internal resources "is a necessary component of a successful search of strategic opportunities" (Denrell et al., 2003: 989).

In terms of exploiting opportunities, internal resources may be of little help when firms are faced with high environmental uncertainty. One important factor that may hinder the value of internal resources is their path-dependent nature. Firms with a very rigid development trajectory may be unable to put such resources into use (develop value-creating strategies) to exploit resource

[26] The link between strategic opportunities and uncertainty in the context of the RBV has been also captured on the theory of the entrepreneurial firm (Langlois, 2007). To be consistent with previous sections, and my main concern with ERA, I do not extend my conversation to that literature.

opportunities. Another factor that may further hinder the value of internal resources is the causal ambiguity of putting such resources into new uses. As (Dierickx & Cool, 1989: 1508) point out, the accumulation of resources in dynamic environments can be described as stochastic and discontinuous. As such, high causal ambiguity will further hinder the value of internal resources to appropriate any opportunities.

Competing firms however, may act to acquire resources in strategic factor markets for other strategic reasons. As it has been illustrated earlier, one necessary condition for sustaining competitive advantage is the scarcity (rare condition) of resources. Resource imitation may eradicate the scarcity of resources (Peteraf & Barney, 2003: 1038). For firms to sustain competitive advantage must not only acquire superior resources faster than their competitors, to sustain scarcity, but also be able to deploy them. In the presence of uncertainty, firms may also seize opportunities to strategic factor markets to decrease the competitive positions of their competitors. For example, Makadok's (2001) resource-picking resource-deploying model suggests that competing firms may participate in strategic factor markets in order to pre-empt strategic resources. The pre-emption of strategic resources can lead competing firms to gain a first mover advantage (Lieberman & Montgomery, 1988) or decrease the value of competitors' resource profiles (Capron & Chatain, 2008).

3.3 Competitor-driven behaviour and theories of imitation

So far, I have reviewed the theoretical premises of the RBV and illustrated its connections with ERA. In this section, I build on a different set of theoretical perspectives in order to provide the theoretical grounds for my competitor-driven view of ERA. In doing so, I draw upon the competitive dynamics (hereafter CD) literature and theories of imitation to illustrate why firms will strategically behave to conform towards the actions of their competitors. In contrast with the resource-based rationale provided above, which perceives firm strategic behaviour as solely driven by the firm's idiosyncratic resources, firms may strategically act in similar ways (Gimeno, Hoskisson, Beal, & Wan, 2005: 297). Firms may exhibit a similar strategic behaviour for several reasons. Such firm behaviour is conceptually captured through the concepts of strategic similarity (deviation) and strategic interdependence. It is important to note, that strategic similarity does not necessarily mean that firms are in some way homogeneous. In line with the RBV, competing firms can still be heterogeneous but exhibit similar strategic behaviour. I return to this important point when I discuss CD research that examines the relationship between resource similarity and strategic behaviour. My objective in this section is not to be exhaustive[27] of relevant research but to provide sufficient theoretical grounds for my conceptual development later on.

3.3.1 Competitive explanations of strategic similarity and imitative behaviour

Scholars concerned with CD, have long argued that competing firms are strategically interdependent. Rooted primarily in the IO paradigm, scholars

[27] Recently, Lieberman and Asaba (2006) and Ordanini et al. (2008) have provided us with two excellent reviews on interorganizational imitation.

have concerned with such strategic interdependence by investigating the implications of strategic similarity and interfirm rivalry. *Strategic similarity*[28] is defined as "similarity in the general pattern of resource deployments and competitive orientations independent of the specific markets served by the firm" (Gimeno & Woo, 1996: 324). The concept of strategic similarity dates back to Bain-type IO research on competitive structures. From a structural perspective, Caves and Porter (1977) criticized neo-classical economic theory, and suggested that firms differ in traits other than size. Firms with structural similarities, Caves and Porter argue, "are likely to respond in the same way to disturbances from inside or outside the group, recognizing their interdependence closely and anticipating their reactions to another's move quite accurately" (Caves & Porter, 1977: 251). Such strategic interdependence suggests a collusive[29] strategic behaviour across the structural dimensions of a group of similar firms. The major rationale behind such strategic behaviour is the reduction of competitive intensity.

Caves and Porter (1977) suggest that higher levels of tacit coordination, among structurally similar firms, will lead to lower levels of competitive intensity (rivalry). Chen (1996) provides a similar rationale on how strategic similarity will affect interfirm rivalry. Focusing at the dyadic-level of analysis, he

[28] Deephouse (1999) offers a similar definition of strategic similarity. He defines strategic similarity as "the extent to which a firm's strategic position resembles the strategic positions of other firms competing in its market at a particular point in time" (Deephouse, 1999: 148). Gimeno and Woo's (1996) definition treats strategic similarity as independent of the markets that the firm and its competitors operate in. This is because these scholars distinguish between strategic similarity and multimarket contact, as two distinct dimensions of interfirm similarity. The concept of multimarket contact refers to the homogeneity of specific markets served by competing firms (Gimeno and Woo, 1996: 324).

[29] Collusion defers from imitation. Collusion is the ex ante coordination of strategic decisions where imitation is the ex post decision to copy the strategies of others.

suggests that the likelihood of the firm to take a strategic action against a competitor will be reduced if the two competing firms are strategically similar. However, Chen also suggests that a firm will be better able to respond to a competitors' action if it possesses similar resource endowments with that of its competitor. Chen's rationale lies on the fact that organizational requirements to respond to a competitors' action will be easier to manage when the focal (defending) firm has a similar resource base with its competitor (Chen, 1996: 115). In contrast with the Caves-Porter hypothesis, and Chen action-response framework, Gimeno and Woo (1996) provide empirical evidence that firms with high levels of strategic similarity compete more intensively. In a later study of multimarket contact and strategic similarity of the US computer software industry, Young, Smith, Grimm, and Simon (2000) find support for the Caves-Porter hypothesis by showing that lower levels of strategic similarity is associated with higher levels of competitive behaviour (frequency of competitive moves).

As I have briefly illustrated above, CD empirical research has provided us with conflicting findings on firm behaviour and the concept of strategic similarity. While CD scholars have suggested that further empirical evidence must be provided to this complex relationship (e.g., Fuentelsaz & Gómez, 2006), two conclusions seem to emerge. First, firms with high strategic similarity will exhibit less competitive behaviour. Second, firms with low strategic similarity will exhibit higher competitive behaviour through their efforts to differentiate (by exploiting their idiosyncratic resources).

When firms are faced with high levels of strategic similarity, they may choose not differentiate but to imitate[30] the strategic actions of their competitors in order to mitigate rivalry (Lieberman & Asaba, 2006). While the RBV suggests that, in this case, firms will be better off to differentiate, such strategic choice is highly risky and uncertain especially when firms compete under the dynamic conditions described above (Lieberman & Asaba, 2006: 374). Imitative behaviour will be more prevalent when competitors' actions are highly visible and easily to respond to (Chen & Miller, 1994: 97). Close (that exhibit high levels of strategic similarity) competitors will then be more likely to match their actions in order to preserve their status quo without escalating rivalry (Gimeno et al., 2005: 300).

3.3.2 Noncompetitive explanations of strategic similarity and imitative behaviour

In the previous section, I have briefly illustrated competitive explanations of imitative behaviour. More specifically, I have highlighted conditions whereby firms will imitate the strategic actions of their competitors. In this section, I expand the above conversation by focusing on noncompetitive explanations of firm imitative behaviour. Drawing from sociological and cognitive theories[31], contributions to this end have provided powerful explanations on why competing firms will strategically behave in similar ways.

[30] In rivalry-based explanations of imitative behaviour, competing firms avoid high levels of rivalry through tacit collusion (Lieberman & Asaba, 2006). As I have explained above, tacit collusion is a primary mechanism for the formation of strategic groups.

[31] In comparison with competitive explanations of imitative behaviour that stem from economic theories, sociological theories conceive firm behaviour as more stable and harder to change across time (Lieberman & Asaba, 2006).

In response to strategic group theory critiques, several scholars have taken a cognitive[32] approach on understanding strategic similarity and the existence of strategic groups (Reger & Huff, 1993). Under such perspective, (Fiegenbaum & Thomas, 1995: 462) have argued that strategic groups "may act as a reference point for group members when they make competitive strategy decisions". Furthermore, Peteraf and Shanley (1997) proposed that strategic groups may raise an *identity* based on the mutual understandings of managers of group member firms. Firms could also increase competitive interactions with their close rivals in order to develop the assets required to keep up with such technological change (Dranove et al., 1998). Nair and Filer (2003) illustrated that there is a co-integration of strategies amongst close rivals leading to the diminishing of intra-group variations over time. Overall, this cognitive approach suggests that strategic groups exist not due to the structural characteristics of similar firms but due to cognitive elaboration in terms of the competitive environment (Reger & Huff, 1993: 118).

Imitative behaviour can be also explained from a new institutional perspective. The basic argument in this perspective is that competing firms act in strategically similar ways in order to avoid legitimacy challenges in their organizational field[33]. Legitimacy is gained through isomorphic pressures that

32 Reger and Huff (1993) identify three mechanisms under which managers might focus on groups of firms rather to individual competitors; simplification, elaboration, and interaction. Through simplification, strategists simplify the complex cognitive problem of independently analysing a large number of competitors by grouping them. Elaboration refers to following a dominant design when strategists are faced with incomplete information. Interaction refers to the managers' shared perceptions of the competitive environment.

33 An organizational field is defined as "the collection of organizations, such as suppliers, resource and product consumers, regulatory agencies, and other organizations that produce similar products or services" DiMaggio, P., & Powell, W. 1983. The iron

drive firms to adopt similar strategies. This particular case of isomorphism, strategic isomorphism, is defined as "the similarity of a focal organization's strategy to the strategies of other organizations in its industry" (Deephouse, 1996: 1025). In their seminal paper on institutional isomorphism, DiMaggio and Powell (1983) provide a compelling explanation on how such firm behaviour, to adopt similar strategies, emerges in an organizational field. They specifically argue that "Strategies that are rational for individual organizations may not be rational if adopted by large numbers. Yet the very fact that they are normatively sanctioned increases the likelihood of their adoption" (DiMaggio & Powell, 1983: 148).

In relation to my discussion of dynamic competitive environments above, where competing firms faced with high levels of uncertainty, isomorphic pressures further drive imitative behaviour. In this situation, organizations will try to model their behaviour in organizations that are more legitimate or successful (DiMaggio & Powell, 1983: 152). In his study of diversification and market entry, Haveman (1993) provides some empirical support for the existence of imitative behaviour in a strategic context. He specifically found that firms will imitate the strategic actions of their successful (more profitable) peers. In contrast with early assumptions on institutional isomorphism, Haveman found that size had no effect on imitative behaviour of competing firms. Haunschild and Miner (1997), add to the empirical findings of Haveman, by distinguishing between three distinct modes of imitative behaviour. In the first mode, frequency-based imitation, firms engage in

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cage revisited: Institutional isomorphism and collective rationality in organizational fields. ***American sociological review***: 147-160..

actions employed by a large numbers of competitors. Trait-based imitation captures firm imitative behaviour driven by firm-specific similarities such as size. In the third mode, outcome-based imitation, firms imitate the actions of competitors that they perceived as successful. In relation to Haveman's findings, Haunschild and Miner (1997) provide empirical support for the existence of imitative behaviour (in all three distinct modes). Interestingly, their findings also reveal a strong correlation between environmental uncertainty and frequency-based imitation.

In relation to ERA, firms may exhibit imitative behaviour to eliminate legitimacy challenges with potential exchange partners. Deephouse (1999: 153) provides three reasons why legitimacy challenges may hinder the ERA efforts of competing firms. First, he argues that firms with low levels of legitimacy will be unable comprehend each other strategies. Second, less legitimate firms will be faced with less favourable acquisition terms. Third, such firms are faced with higher failure rates and lower performance potential.

CHAPTER 4.

CONCEPTUAL

FRAMEWORK

4.1 Introduction

This dissertation investigates an important yet challenging question in strategy research: *"What is the role of firm strategy in ERA?"* Scholars have paid significant attention to the antecedents and consequences of ERA. Drawing from the resource-based view of the firm, such contributions assume that ERA is a strategic action primarily driven by the firm's idiosyncratic attributes and more specifically its resource endowments. While these contributions advance understanding on how firm-specific idiosyncratic attributes relate to ERA, they exclude the competitive environment of the firm from their analysis. As such ERA is perceived as a resource-driven action, whereby value is created through the relation of externally acquired resources to the firm's idiosyncratic attributes. I argue that this is a serious limitation if we are to better understand the link between ERA and firm strategy. Recently, scholars have tried to address this gap by illustrating conditions where ERA can provide competitive advantage by not only improving the competitive position of the focal firm but also impeding the competitive positions of its rivals (Capron & Chatain, 2008).

Building on this recent effort, I propose that competing firms engage in ERA not only in relation to their idiosyncratic attributes but also in response to their competitors' ERA related actions. My conceptual development goes one step further by investigating this question not only in relation to the theoretical assumptions of the RBV but within a broader theoretical perspective of firm strategic behaviour.

In this chapter, I attempt to provide a conceptual framework where ERA can be seen both as a result of the firm's idiosyncratic attributes and its competitive environment. I define ERA as "*the strategic action of the firm to acquire critical resources residing outside the firm's boundaries"*. Previously scholars have conceptualized ERA as a process rather than a strategic action. For example, Sirmon et al. (2007: 277) define ERA as "the process of purchasing resources from strategic factor markets". In contrast with these previous conceptualizations, my definition allows for a direct empirical test of both firm- and competitor- specific explanations of ERA. While empirically investigating the process of ERA can yield some important insights on how firms search, acquire and assimilate external resources, viewing ERA as a strategic action can lead to important empirical insights by unravelling the extent to which firm- and competitor- specific factors drive patterns of ERA among competing firms. As I have argued in chapter 3, this definition of ERA assumes the existence of strategic factor markets in order to be in line with the early foundations of the RBV. Strategic factor markets are defined as "a market where there would be no arbitrage opportunities to be gained by acquiring some combination of resources and selling this combination for a

higher price than the cost of the individual resources" (Denrell et al., 2003: 980).

Instead of focusing solely on external resources per se and their value generating potential, I conceptualize ERA as a strategic action that a firm employs to gain competitive advantage over its competitors. In turn, a strategic action is defined as an externally directed, specific, and observable competitive move initiated by a firm to enhance its competitive position (Ferrier, 2001). While understanding the complex relationship of firm-level actions and competitive advantage has been an established research endeavour, we currently understand some strategic actions more than others (Young et al., 2000: 1218). Surprisingly, ERA has been an exception and no study exists to explicitly provide a theoretical framework of ERA actions among competing firms. As I will illustrate in more detail later, viewing ERA as a strategic action allows for an explicit inclusion of the firm's competitive environment, and as such provide us with an opportunity to progress our understanding in several fronts. Given my overarching theoretical question and my conceptualization of ERA, I address the following empirical questions: *"What patterns of ERA actions do we observe among competing firms? To what extent do firm-level idiosyncratic attributes explain firm ERA activity (resource-driven view)? To what extent do competitors' ERA actions explain firm ERA activity (competitor-driven view)? Is there an interaction effect between firm- and competitor- level explanations of ERA, and if so what kind?*

To answer these research questions, I develop a conceptual framework that incorporates the main constructs of my arguments. In so doing, I draw from the theoretical perspectives of the RBV and theories of interorganizational

imitation. While these different theoretical perspectives have been developed somewhat independently, scholars have provided us with several concepts that bridge these rather disjoint theoretical views of firm strategic behaviour. A central component to this theoretical effort is the concept of "strategic similarity". Its central question is why firms choose to be similar or different (Deephouse, 1999). Through my conceptual development I argue that by adopting such perspective we can advance understanding on the link between ERA and firm strategy. Whilst adopting a multi-theoretical perspective poses several challenges it also allows for a significant theoretical and empirical contribution in this research area. My aim here is not to provide an all-encompassing theory of ERA. Rather, I will argue that ERA is a product of both firm- and competitor- level explanations of firm strategic behaviour. Thus, my conceptual development aims at providing a direct test of both the resource- and competitor- view of ERA. In contrast with previous work in this area that focus primarily on either explanation, I argue that these two views are complementary. By investigating the question "*Is there an interaction effect between firm- and competitor- level explanations of ERA, and if so what kind?"* I aim to provide empirical support for my view of ERA. In summary, figure 4.1 provides a diagrammatic depiction of my conceptual development.

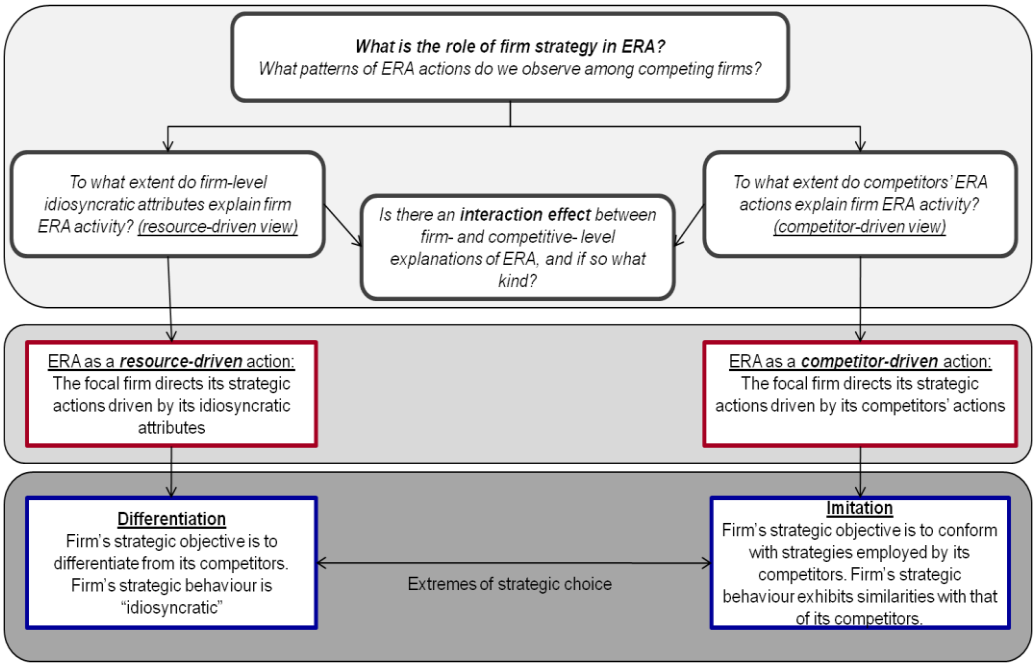


Figure 4-1. Research questions and theoretical "map"

This chapter is organized as follows. First, I provide the theoretical basis for my conceptual development. I then proceed with setting the boundaries of my conceptual framework and accordingly develop a set of testable hypotheses for each of my research questions.

4.2 Theoretical Background

Strategy scholars have long investigated the conditions under which firms strategically act to gain competitive advantage. While the quest for competitive advantage has been the major research agenda in the area of strategy (Hoopes et al., 2003), theories of strategic choice and firm behaviour have been very much developed independently. This is a serious limitation, if we are to better understand why firms engage in certain strategic actions and thus investigate patterns of strategic behaviour. Towards this end, I suggest that ERA is an excellent context of adopting a multi-theoretical perspective. I frame ERA in theories broadly concerned with strategic choice. I shall argue that firms

engage in ERA at the extremes of firm strategic behaviour; differentiation and imitation. As it has been illustrated earlier (chapter 3; section 2), the RBV suggests that the firm's optimal strategic goal is to differentiate from its competitors by obtaining unique product market positions. However, firms may choose not to differentiate but imitate the strategic actions of their competitors. In this broad theoretical framework, scholars have been very much concerned with the link of such strategic behaviour (in the context of these two extremes) and competitive advantage (Deephouse, 1999). I add to this discussion by focusing on the strategic action of ERA.

In the context of ERA, scholars thus far have adopted a resource-based perspective of firm behaviour. Under this dominant logic, competitive advantage is a function of firm-specific resources which can be hardly imitated by competitors or substituted (Barney, 1991; Conner, 1991; Wernerfelt, 1984). Initial theoretical work on the resource-based view of the firm (RBV) suggests that only resources developed inside organizational boundaries can be a source of competitive advantage as they are idiosyncratic and costly-to-copy (Barney, 1991; Dierickx & Cool, 1989). Some scholars extend this initial thought and suggest that share resources—resources that span organizational boundaries—can also be a source of competitive advantage (Dyer & Singh, 1998).

Scholars are still in disagreement to the extent which external resources can contribute to competitive advantage. Previous empirical efforts have focused on identifying mechanisms where a firm can improve its competitive position through the acquisition of external resources. Such contributions go one step further and identify several firm-specific factors that may further impact on the ability of external resources to improve organizational performance. For

example, one way that external resources can lead to superior organizational performance is through new combination of value-generating resources given the firm's ability to effectively acquire, assimilate, and utilize newly acquired resources (Cohen & Levinthal, 1990).

The acquisition of external resources, however, holds not only firm- but also competitor- specific implications. Focusing at the intra-industry level of analysis, scholars have illustrated several mechanisms where a firm can gain competitive advantage through ERA. A firm can gain competitive advantage through ERA by pre-empting critical resources (e.g., Lieberman & Montgomery, 1998). This is not to say however that resource pre-emption always leads to competitive advantage. Scholars have argued that often firms may acquire the "wrong" resources and as such suffer a disadvantage over their competitors (Lieberman & Montgomery, 1998: 1112). Furthermore, the focal firm may engage in ERA not necessarily under the incentive to improve its own resource position but to limit the competitive moves of other firms ("product space"; the notion of spatial pre-emption) (Lieberman & Montgomery, 1988: 44). More specifically, Capron and Chatain (2008) argue that the focal firm can gain competitive advantage by deploying strategies that decrease both the quantity and effectiveness of competitors' resources.

In line with the RBV, we would expect that patterns of ERA among competing firms are associated with the firms' idiosyncratic attributes. I develop a set of hypotheses in order to provide a direct empirical test of the RBV in the context of ERA. However, I expect that varying levels of firm-specific idiosyncratic attributes will be associated with differences in ERA patterns. I thus expect heterogeneous firm behaviour among competing firms engaging in ERA.

While engaging in ERA can provide the firm with opportunities to differentiate and move away from competition, it also increases competitive interaction. A firm's effort to either improve its competitive position or inhibit the competitive position of its competitors will be likely to draw significant attention, and as such increase rivalry by initiating countermoves from its competitors (Young et al., 2000). It is thus likely that a firm may engage in ERA to respond to its competitors. One immediate response would be for the firm to imitate the strategic action of its competitors. Scholars have provided us with several mechanisms where imitation can either create or limit a firm's competitive advantage in a number of contexts (Lieberman & Asaba, 2006). While imitative behaviour can increase competition for resources it can also be beneficial as it eliminates legitimacy[34] challenges that may hinder the firm's access to critical resources (Deephouse, 1999: 152). Scholars have paid significant attention on imitative behaviour in several empirical contexts such as international expansion (e.g., Delios, Gaur, & Makino, 2008), M&A activity (e.g., Haunschild, 1993; Yang & Hyland, 2006), strategic alliances (e.g., Garcia-Pont & Nohria, 2002) and international joint ventures (e.g., Xia, Tan, & Tan, 2008). In line with previous research in this area, I investigated whether firms engage in ERA in response to their competitors' actions. Thus, I argue that ERA can be seen as a competitor-driven action. I accordingly frame my arguments in the competitive dynamics (CD) literature and theories of interorganizational imitation.

[34] A legitimate firm obtains resources of higher quality and at more favourable terms than does a firm whose legitimacy is challenged (Deephouse, 1999: 152).

4.3 Conceptual development

4.3.1 Definitions and boundaries of the study

Before I proceed with my conceptual development, it is important to explicitly define the main concepts of my arguments, and set the boundaries of my study. First, in line with the theoretical premises of the RBV, I perceive the firm as an entity of heterogeneously distributed costly-to-copy resources. Firms compete under the assumption of Schumpeterian competition, where the economic rents derive by market opportunities that arise through innovative activity (Roberts & Amit, 2003). I am not concerned with the broader implications of competition rather I am interested in a set of firms competing in the same industry, offering similar products and thus targeting similar customers. In line with Baum and Korn (1996), I perceive competition as a firm-level property in contrast with classic economic theory where competition is a property of market structure and thus unrelated to firm strategic behaviour. This set of firms is defined as competing firms (Chen, 1996). If we are to study ERA and firm strategic behaviour, we need a set of firms that share the same resource space and strategic factor markets. Otherwise, ERA will be a strategic action unrelated to firm behaviour and the dynamics of competition among firms. The definition adopted here of "competing firms" includes this necessary condition in order to study ERA. In such competitive contexts, rivalry occurs when the strategic actions of one firm have noticeable effects on its competitors and thus increase the propensity of counter-actions (Young et al., 2000). Firm strategy is thus defined as a series of strategic actions with the objective of achieving competitive advantage. Based on its strategy, the firm gains competitive advantage when is able to create more economic value than its competitors (Peteraf & Barney, 2003).

Under the competitive conditions described above (Schumpeterian competition), competing firms are faced with high degree of environmental uncertainty and environmental munificence in terms of the resources they possess to achieve competitive advantage (Sirmon et al., 2007). As such, there is no "perfect" strategy that can lead the firm to enjoy sustained competitive advantage. Firm strategic behaviour is thus contingent on such environmental conditions and in a sense temporal. After all, if competing firms can simply deploy their internal resources and enjoy sustained competitive advantage, there is no need for ERA! Such simplistic strategic behaviour however is unrealistic for several reasons a) firms do not hold complete information about the value-generating potential of their resources that they own, and for resources exchanged in strategic factor markets, b) possessing valuable, rare, inimitable and non-substitutable resources is necessary but insufficient condition for value creation, c) competing firms are faced with constrained product/market space to be efficient and differentiate, d) firm strategy is constrained by the competitive environment that the firm operates in, and e) competing firms are strategically interdependent.

4.3.2 Basic assumptions & conceptual framework

As I have briefly illustrated above, I depart from studies that focus on the organizational implications of ERA. Instead, I conceptualize ERA as a strategic action and aim to provide new insights as to its link with firm strategy. In so doing, I connect with recent studies that conceptualize the competitive environment of the firm as an endogenous factor of firm action (Capron & Chatain, 2008). My conceptual development builds on this recent work, and offers two (complementary) views of ERA. Briefly, I propose that a)

Competing firms direct their ERA actions in relation to their idiosyncratic attributes (the *resource-driven* view), b) Competing firms direct their ERA actions in relation to their competitors' actions (the *competitor-driven* view), and c) patterns of ERA actions among competing firms are driven both by competitors' ERA activity and firm-specific idiosyncratic attributes.

Furthermore, I assume that a firm is faced with competitive pressures to act towards its external environment. If firms take strategic actions irrespective of their competitors, then it will not be possible to investigate my overarching research question. As I have argued in the previous section, in today's competitive environments the above scenario will be rarely true. Rather rapid technological change and industrial innovative activity force competing firms to intensively engage in ERA-related actions (Eisenhardt & Schoonhoven, 1996; Nicholls-Nixon & Woo, 2003). Hence, I develop my arguments by assuming that firms compete under the competitive dynamics described above.

Scholars thus far have tended to focus solely on one aspect of ERA rather than trying to examine both firm-specific and competitive factors simultaneously. On one hand, contributions, drawing from the theoretical proponents of the RBV, have ignored the external environment of the firm. On the other hand, contributions in the CD literature have provided us with theoretical insights but rather inconclusive empirical evidence on the competitive implications of ERA. To this end, I bridge these two rather independent streams of research by empirically showing how and whether competitor- and firm- level factors interact and consequently affect patterns of ERA behaviour among competing firms. My overall objective here is to provide a more complete understanding of ERA and its link with firm strategic behaviour. In doing so, I offer further

conceptual development in relation to these research streams. I do this by investigating the resource- and competitor- view of ERA. I then argue that these two views are complementary, and offer an interpretation of their interaction. Figure 5-2 illustrates my conceptual framework and more specifically the concepts that are involved in my conceptualization.

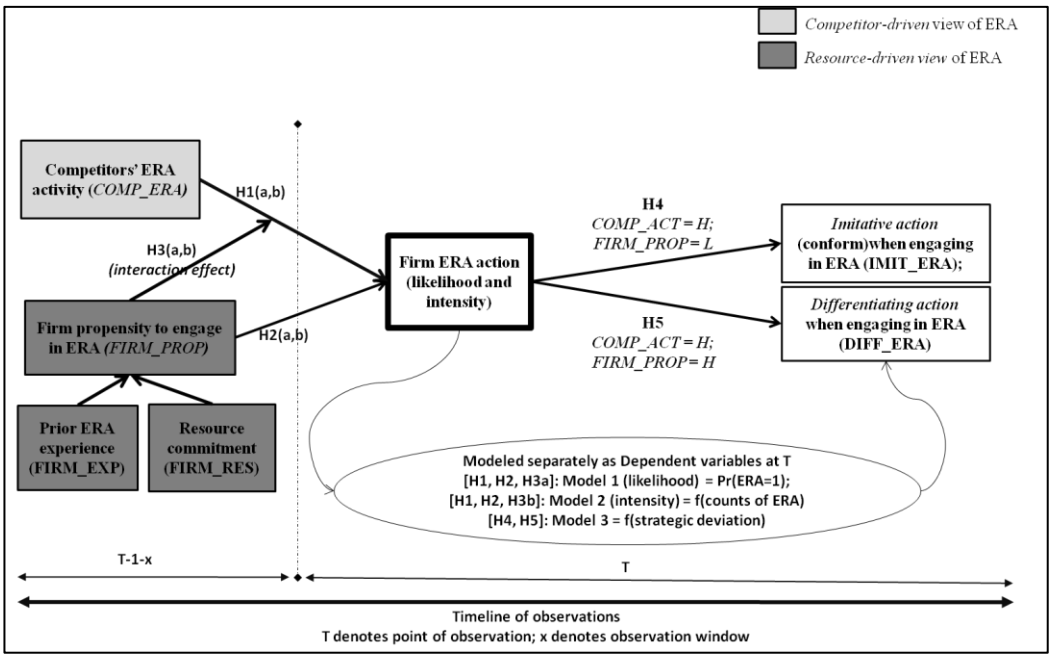


Figure 4-2 Conceptual framework

In relation to the above assumptions, I investigate these research questions: *To what extent do competitors' ERA actions explain firm ERA activity? To what extent do firm-level idiosyncratic attributes explain firm ERA activity? Is there an interaction effect between firm- and competitor- level explanations of ERA, and if so what kind?* To answer these questions, I develop a set of testable hypotheses that act as the basis for my empirical analysis. The main objective of the hypotheses presented below is to predict when a firm will be more likely to engage in ERA, and the intensity of its ERA actions. I am thus concerned with both the likelihood and intensity of firm ERA action. I argue that to better

assess the competitive implications of a strategic action, one must assess both the likelihood and the intensity of such action. In doing so, I aim to provide a more holistic understanding of the link between firm strategy and ERA. I expect a two stage strategic process of when firms engaging in ERA. I return to this important point later when I develop my hypotheses in relation to my research questions.

In a broader context, scholars have argued that competing firms must balance between differentiating and imitative strategic actions as in their extreme both activities may deter competitive advantage (Deephouse, 1999). I contend with this view of balancing between such actions, and aim to provide some further empirical evidence to this end. As I have argued earlier, ERA can be seen both as a resource- and competitor-driven strategic action. I have also suggested that these two views are not mutually exclusive and are both related to ERA patterns among competing firms. Actually I expect that ERA patterns among competing firms to be a by-product of both firm- and competitor- level factors. In contrast with the resource-driven view of ERA described above, I expect that emerging ERA patterns are significantly associated with strategic similarity among a set of competing firms (as described by hypotheses H4 and H5 below). Put it differently, I will argue that it is this "interplay" between firm- and competitor- level factors that drive strategic similarity (and may be strategic balance) among competing firms engaging in ERA. Empirical evidence to this end will aid on our understanding of how firm strategic behaviour in this broad theoretical context unfolds over time (Lieberman & Montgomery, 1998: 376). While scholars have provided us with several insights on how strategic similarity affects competitive behaviour (Fuentelsaz

& Gómez, 2006; Gimeno & Woo, 1996), no study so far have provided insights on how strategic similarity[35] emerges in the context of ERA. My conceptual framework addresses this important gap.

4.3.3 ERA as a competitor-driven action

I have argued so far that to gain a better understanding of ERA, and its link with firm strategy, the competitive environment of the firm must be explicitly treated as an endogenous factor. Recently, scholars have suggested that by incorporating the competitive environment of the firm to our analysis, we can gain a better understanding of firm strategic behaviour and competitive advantage (Capron & Chatain, 2008; Sirmon et al., 2007). In line with this recent critique, I explore further the predominant view of ERA as a resource-driven action. In contrast with RBV tradition in the context of ERA, I propose that the focal firm will be also likely to engage in ERA when it is faced with high levels of competitors' ERA activity. Put it differently, I suggest that the firm's ERA behaviour is contingent on that of its competitors. Competitors' ERA activity is conceptualized as the potential impact of competitors' ERA-related actions on the focal firm's strategic behaviour and survival (Ang, 2008; Barnett, 1997).

CD Scholars have long argued that competing firms strategically act in similar ways (in economic terms firms are strategically interdependent). As I have illustrated in chapter 3, scholars in the strategy field have captured such

[35] Insofar, strategic similarity has been treated as an explanatory variable of firm performance (e.g., Deephouse, 1999; Gimeno & Woo, 1996). Instead, I treat strategic similarity, in the context of ERA, as a dependent variable. I thank David Deephouse for his advice on this point.

strategic interdependence through the concept of strategic similarity. Strategic similarity refers to "the extent to which a firm's strategic position resembles the strategic position of competing firms at a particular point in time" (Deephouse, 1999: 148). Strategically similar firms are faced with high levels of rivalry as they depend on the same resources. The more similar the resource requirements of the focal firm to those of other firms the greater the degree of competition it is likely to experience (Baum & Korn, 1996: 258). In line with the RBV that perceives firms as "idiosyncratic", it will thus make sense for competing firms to aim their strategic efforts to differentiate and avoid intense levels of competition. However, competing firms may strategically choose to conform to the strategies of similar competitors. Strategic group scholars, for example, argue that strategic similarity may actually decrease rivalry among competing firms due to tacit coordination[36] (Gimeno & Woo, 1996). From a cognition point of view, strategic similarity may be the result of shared cognitive structures among strategists in competing firms and the adoption of widely adopted strategic recipes (Reger & Huff, 1993).

A firm may thus strategically act to imitate the strategies of its competitors. Interorganizational imitation refers to interdependent or mutually referential decision making in which strategic actions by some firms increase the likelihood of the focal firm taking the same strategic action (Gimeno et al., 2005; Haunschild, 1993). Firms may imitate the strategic actions of their competitors when faced with high levels of competitive activity (Lieberman & Asaba, 2006: 380). In this scenario, firms are more likely to engage in an

[36] The hypothesis that strategic similarity decreases interfirm rivalry has been also known as the Caves-Porter hypothesis.

immediate competitive response (Miller & Chen, 1994) in order to avoid a potential competitive disadvantage (Abrahamson & Rosenkopf, 1993). By taking under consideration other related competitive factors (i.e. multimarket contact), CD scholars have empirically illustrated that imitative behaviour intensifies rivalry among competing firms.

Apart from competitive pressures, competing firms may be faced with increased levels of institutional pressures to engage in a specific strategy in order to pursuit legitimacy. Some strategies (or strategic actions) can be more legitimate than others as they may be endorsed by a larger number of competing firms (DiMaggio & Powell, 1983). Scholars concerned with legitimacy and strategic behaviour have argued that not all competing firms exhume the same legitimacy pressures to their peers. Interorganizational imitation can be seen as one mechanism[37] to increase legitimacy (Haunschild, 1993). For example, in his study of market entry and diversification, Haveman (1993) finds that firms are more likely to imitate the strategic actions of their successful peers. He also observes a curvilinear effect of legitimacy and competition. While an increase in the number of successful firms engaging in the same strategic action, in this case market entry, increases legitimacy, it also increases competition. Thus, imitative behaviour[38] can be a result of the large number of competing firms engaging in a strategic action (adopting a strategy).

[37] Factors that lead organizations to adopt similar practices, strategies and processes are captured through the notion of "mimetic isomorphism". Specifically, strategic isomorphism refers "to the extent to which an organization's strategy resembles conventional normal strategies in its competitive environment" (Deephouse, 1996: 1029).

[38] Imitative behaviour is also captured through the notion of contagion. Contagion occurs between organizations when one organization's adoption of a practice increases the likelihood of that other organizations will adopt (Greeve, 1998: 970)

Such frequency-based[39] imitation suggests that the adoption of a specific strategy by a large number of firms enhances legitimacy and thus increase the likelihood of adoption by other firms (Haunschild & Miner, 1997). In relation to ERA, increased levels of legitimacy may be associated with more opportunities of obtaining critical resources. A firm with high legitimacy may be favoured both in terms of resource availability and exchange (Deephouse, 1999: 153).

Given the above competitive and institutional explanations, I expect that high levels of competitors' ERA activity will be associated with higher likelihood and intensity of the focal firm engaging in ERA. Hence, I hypothesize that:

H1a. The higher the competitors ERA activity that the focal firm faces, the higher the firm's likelihood of engaging in ERA.

H1b. The higher the competitors' ERA activity that the focal firm faces, the higher the firm's ERA intensity.

By testing hypotheses H1a and H1b, I aim to provide further empirical evidence on the link between competitors' actions and firm strategy in the context of ERA. To my knowledge, this is the first attempt to assess the relationship between competitors' ERA related actions and the focal firm's ERA behaviour. Furthermore, this is a direct test of both competitive and institutional explanations of firm strategic behaviour in the context of ERA.

[39] In the case of frequency-based imitation, firm strategy may not be always a direct result of rational managerial decision making in terms of strategic objectives and outcomes. In contrast with this rational assumption adopted by Deephouse (1999) in his strategic balance theory, Haunschild and Miner (1997: 494) suggest that firms may adopt a strategy without having a specific intent but as a response for that strategy been taken-as-granted among competing firms.

Through the empirical test of the hypotheses proposed above, I also aim to identify other factors that may affect firm ERA behaviour over time. For example, I have assumed above that firms compete under both high environmental munificence and uncertainty[40]. As such, I expect that patterns of firm ERA behaviour evolve over time.

4.3.4 ERA as a resource-driven action

In this section, I investigate further the conditions where ERA, as a strategic action of seizing opportunities in relation to the firm's resource environment. In so doing, I identify several firm-specific propensity factors that affect the firm's strategic response to opportunities raised to acquire resources. Without trying to be exhaustive, I focus on two major propensity factors: *a) firm prior experience with ERA, and b) firm resource commitment.* Extensive empirical research has focused on the interplay between internal and external resources and more specifically on its performance implications. My aim here is not to further contribute to this stream. Rather, I am concerned on how these propensity factors may *relate to firms engaging in ERA* in relation to its environment.

I have argued above that ERA can be seen as a competitor-driven action. Insofar, scholars in the RBV tradition have suggested that firms engage in ERA driven by their idiosyncratic attributes. While ERA has been perceived as a strategic action to alleviate resource constraints (Combs & Ketchen, 1999),

40 Uncertainty affects the amount and type of the resources needed in the resource portfolio, the capabilities necessary to outperform rivals, and the leveraging strategies required to gain and maintain competitive advantage (Sirmon et al., 2007: 275).

empirical research has shown that firms with a larger resource base (in terms of both breadth and depth) gain more from ERA than firms with a constrained resource base. Relative to the empirical context of this study, the global biopharmaceuticals industry, recent studies have shown a positive association between ERA and resource base structural characteristics in terms of organizational outcomes and more specifically innovation performance (Ahuja & Katila, 2001; Prabhu et al., 2005). Paradoxically, scholars argue that resource constrained firms are faced with lower value generating potential when engaging in ERA. One rationale is that such firms will exhibit a lower capacity to absorb and utilize newly acquired resources, as such capacity is a by-product of the firm's commitment to internal resource development (Cohen & Levinthal, 1990). For the sake of simplicity, I henceforth use the term *resource commitment* to refer to the firm's commitment to the development of internal resources. Remember that internal resources are defined as those resources solely developed by the firm. In contrast with resource constrained firms, firms with high levels of resource commitment may enjoy complementarities between internal and external resources as resource commitment may reduce inefficiencies and problems associated with ERA (Veugelers, 1997). In the case of the biopharmaceuticals industry for example, Rothaermel (2001a: 695) shows that incumbent biopharmaceuticals firms that exploit such complementarities, in this case with their start-ups counterparts, experience improved new product development and superior performance.

Resource commitment however, is accumulated through time and is inherently path-dependent. Except from the structural characteristics of the firm's resource base, resource commitment and its relation to ERA is very much

related to firm-specific experience with ERA. It is expected that historical conditions on how firms develop their resources play a crucial role on future ERA activity. For example, scholars have illustrated that firms with a broader experience with ERA, through strategic alliances or networks, will be overall more effective with future ERA related actions (e.g., Goerzen & Beamish, 2005) by for example minimizing strategic uncertainty associated with ERA (e.g., Hoffmann, 2007:). Furthermore, a firm intensively engaging in ERA will accumulate experiential-based knowledge and thus be very likely to consequently engage in ERA. Higher levels of accumulated experience may lead to the development of ERA specific capabilities and thus positively reinforce consequent ERA actions. A higher experience with ERA may also enable the firm to search for critical resources more efficiently than its competitors (Katila & Ahuja, 2002). As such I expect that ERA experience is path-dependent[41] and be positively related with consequent ERA actions.

I formally hypothesize that:

H2a. The likelihood of the focal firm engaging in ERA is positively associated with its prior ERA experience and resource commitment.

H2b. The intensity of the focal firm to engage in ERA is positively associated with its prior ERA experience and resource commitment.

Scholars thus far have highlighted the importance of these two firm-specific factors when investigating the acquisition of external resources (e.g., Ahuja, 2000; Combs & Ketchen, 1999). I build on these studies but, instead of treating

[41] Path dependency refers to "the tendency for what a firm is currently doing to persist in the future" (Kogut and Zander, 1992: 392).

them as moderating factors to organizational performance, I conceptualize them as ERA-related propensity factors. As I am concerned with firm strategic behaviour, I would like to investigate further how varying levels of resource commitment and prior ERA experience are associated with ERA patterns among competing firms. While I have argued above that firms with higher resource commitment will be more likely to engage in ERA (and with higher intensity), some scholars have perceived ERA as a substitute of internal resource development (e.g., Hitt, Hoskisson, & Ireland, 1990). Furthermore, other scholars have shown a non-linear relationship between resource commitment and ERA. For example, in their study of the U.S. medical sector, Karim and Mitchell (2000: 1079) found that firms engage in acquisitions either for close reinforcement of existing skills or for substantial jumps into new skill sets. By testing the above hypotheses, I aim to provide additional empirical evidence to the ongoing discussion between the external sourcing of resources and internal resource development.

4.3.5 The interaction effect between firm- and competitor- level views of ERA

Up to this point, I have offered two views of firm ERA behaviour; the resource- and competitor-driven. In the resource-driven view, I argue that competing firms will engage in ERA as a response to their idiosyncratic attributes. More specifically, I expect that firms with high levels of resource commitment and prior experience with ERA will be more likely to engage in ERA and they will do so with higher intensity. This argument is very much in line with the theoretical premises of the RBV which perceives firm strategic behaviour as a function of firm-specific idiosyncratic attributes. In the competitor-driven view, I argue that competing firms will engage in ERA as a

response to their competitive environment. I thus expect a positive association between competitors' ERA activity and the likelihood and intensity of the focal firm engaging in ERA.

In this section, I argue that these two views are not mutually exclusive but complementary. To build my arguments, and test this important proposition, I draw from both the RBV and CD literatures. Surprisingly, these two research streams have largely developed independently[42]. Through my conceptual development and consequently my empirical analysis, I aim to provide a more holistic treatment of firm behaviour at least in the context of ERA. My conceptual and empirical efforts complement recent research in other contexts such as for example the study of Park and Zhou (2005) on alliance formation motives. More specifically they argue that "firms not only form alliances to differentiate themselves from others but also as a competitive response to prevent others from gaining a competitive edge by accumulating more capabilities" (Park & Zhou, 2005: 533)[43]. I build a similar argument here but offer a broader theoretical rationale that incorporates interorganizational imitation as mechanism of such firm behaviour. Earlier work of Park and colleagues has provided us with novel empirical evidence on the interplay between internal resource conditions and market changes in the context of alliance formation (Park, Chen, & Gallagher, 2002). In contrast with their

[42] Scholars have provided us with several theoretical contributions on how these two streams can be combined. For example, Lieberman and Montgomery (1998) provide insights on how RBV can be combined with FMA theory.

43 Park and Zhou (2005: 545) conclude that "along with the classic cost-benefit analysis, it is the competitive dynamics in a given market that trigger competitors' alliance decisions. Despite no substantial benefits from an alliance, it is often a rational choice to form an alliance, primarily to prevent potential losses as a firm's competitors strengthen their competitive positions through cooperative alliances."

study, I am not concerned with market dynamics but rather with dynamics between competing firms engaging in ERA.

As I have argued above, I expect a positive association between competitor-level factors (competitors' ERA activity) and firm-specific factors (resource commitment and ERA experience) with firm ERA likelihood and intensity. I propose that there is a significant moderation effect between the firm-specific factors identified and competitive pressures to engage in ERA. More specifically, I expect that firms with higher resource commitment and experience with ERA will be less prone to react to the actions of their competitors. On the other hand, firms with lower levels of resource commitment and ERA experience will be more sensitive to competitive pressures.

From a RBV perspective, firms with limited resource commitment and experience will be better off not engaging in ERA. However, such firms will choose to engage in ERA not necessarily to improve their own competitive position but avoid competitive disadvantage (Abrahamson & Rosenkopf, 1993). In this scenario, firms will engage in ERA in order not be disadvantaged in the race of obtaining critical resources with its competitors. This would be particularly true in a competitive environment where firms are intensively compete in a limited resource space with high resource scarcity (Park et al., 2002), as for example in the empirical context of this study; the biopharmaceuticals industry. Of course, such constrained firms are faced with several challenges as they engage in ERA. In this case, the firm's probability of engaging in ERA is inhibited due to a misalignment between the firm's

current strategic configuration and the external environment (Bingham & Eisenhardt, 2007).

From a neo-institutional perspective, firms with a limited set of resources and experience will be faced with low levels of legitimacy among their peers. As such they will be less favoured when searching for ERA opportunities in their resource environment (Deephouse, 1999). While these firms may gain less when engaging in ERA, I expect that these firms will intensively engage in ERA in order to respond to their competitive environment. In a positive spirit, even as a matter of strategic luck, these firms may pre-empt resources that are critical to other competitors, or can be recombined in innovative ways not yet conceived. In line with my competitor-view of ERA, I expect that these firms will respond to their competitive environment by intensively imitating the ERA-related actions of their competitors. While there are several types of interorganizational imitation (Haunschild & Miner, 1997), I expect that these firms will not imitate specifically targeted resources with their competitors, as they are unable to assess the value-generating potential of such resources. Rather, such firms will try to imitate the actions of their competitors as a broader strategic response. This is not to say that imitation is an erratic strategic behaviour. Rather imitator firms are driven by a growing awareness of the benefits of the new practice, in this case ERA, adopted by other competing firms (Garcia-Pont & Nohria, 2002).

In contrast with the scenario described above, I expect that firms with high levels of resource commitment and experience with ERA will be less prone to respond to competitive pressures. I believe that these firms develop their own view of the competitive environment, and are more likely to direct their ERA-

related actions in line with their idiosyncratic attributes. While these firms may be better able to gain value from ERA (as predicted by the resource-driven view), they may be also faced with inertial forces driven by the path-dependent nature of their idiosyncratic attributes. Inertia may be particularly present when competing firms are faced with a newly developed resource space, as for example when incumbent biopharmaceuticals firms were faced with the introduction of biotechnology. Path-dependencies may result in firms being more selective on what kind of resources they target and be less prone to competitive pressures to widely engage in ERA. Such selective behaviour may also be the result of tacit coordination amongst strategically similar firms (Garcia-Pont & Nohria, 2002). These firms will be insulated by competitive pressures to engage in ERA in order to preserve the status quo in the competitive environment. Furthermore, such firms may be able to seize opportunities in strategic factor markets. High levels of resource commitment and prior experience with ERA may enable these firms to "appraise resource combinations and carry out commercial ventures that correspond to specific combinations of resources" (Foss & Ishikawa, 2007: 756). Thus, highly "idiosyncratic" firms will be able to isolate themselves from competitors' ERA actions even when competing firms can acquire resources that can be put to similar uses. One may argue that such isolation stems from the complex relations between resource combinations (Foss & Ishikawa, 2007).

Taking together the above arguments, I hypothesize that:

H3a. The positive impact of competitors' ERA activity on the focal firm's likelihood to engage in ERA is moderated by the firm's prior ERA experience and resource commitment.

H3b. The positive impact of competitors' ERA activity on the focal firm's ERA intensity is moderated by the firm's prior ERA experience and resource commitment.

While firm resource endowments and prior experience have been identified as important factors related to ERA, few empirical evidence exist on the interaction effect between competitors' ERA activity and these firm-level attributes. Instead, scholars have assumed thus far that firms which wish to imitate their competitors' actions must possess similar resources (Chen, 1996; Lieberman & Asaba, 2006). However, we know little on how varying levels of such idiosyncratic attributes relate to the competitive pressures that the firm experiences in its competitive environment. By testing hypotheses H3a and H3b, I aim to provide further empirical evidence on this interplay between competitors' actions and firm-level idiosyncratic attributes that direct ERA. In their empirical study of the financial services industry, Yang and Hyland (2006) found that both prior experience with M&A and the number of M&A initiated by competing firms in the same product market positively affects the focal firm's likelihood of consequent M&A activity. They however suggested that further empirical work on the dynamics of imitation must investigate the interplay between competitors' activity and firm-level attributes (Yang & Hyland, 2006: 396). My empirical analysis addresses this point.

4.3.6 Firm ERA behaviour and the two extremes of strategic choice

So far I have developed the resource- and competitor-view of ERA. I have also argued in the previous section, that these two views are not mutually exclusive but rather complementary. More specifically, I expect a significant interaction effect between competitors' ERA activity and two firm-specific attributes—

resource commitment and prior ERA experience—when predicting the likelihood and intensity of the focal firm engaging in ERA. In this section, I conceptualize further this interaction effect in the context of strategic choice at its two extremes; differentiation and imitation. While the benefits of both differentiation and imitation have been well established (see section 5.2), it still remains unclear how firm- and competitor- specific factors will simultaneously drive firms to choose either of these two extremes of strategic choice. Previous research has provided arguments in favour of both differentiation and imitation. Empirical evidence thus far suggests that competing firms can gain competitive advantage at both extremes. Other scholars have suggested that firms that balance[44] between these two extremes are better performing and thus more likely to enjoy competitive advantage (Deephouse, 1999). While we have a clear idea about the value implications of being different or the same, we know little on how firm strategic behaviour shapes strategic choice. This gap is most evident when examining the dynamics of ERA. To address this gap, I derive a set of hypotheses (H4 and H5 below) that aim to predict strategic similarity as a proxy of strategic choice given varying levels of competitors' ERA activity that the focal firm is faced with and its levels of resource commitment and prior ERA experience. To be clear, I am not concerned with how competing firms make such choices but with their strategic behaviour retrospectively, in the two extremes of strategic choice.

Up to this point, CD scholars have largely provided contradictory views of how strategic similarity emerges among competing firms (Gimeno & Woo,

44 More specifically, the strategic balance hypothesis states that "moderately differentiated firms have higher performance than either highly conforming or highly differentiated firms" (Deephouse, 1999).

1996). Some scholars have argued that strategic similarity will be associated with low levels of rivalry (Chen, 1996). For example, in their empirical study of the U.S. software industry, Young et al. (2000) show that as resource dissimilarity (inverse of strategic similarity) increases, competing firms will engage in more strategic actions.

Let's first assume a scenario where a focal firm has low propensity to engage in ERA. In this case, I propose that the firm will engage in ERA in order to imitate the resource positions of its competitors. Based on the proponents of the RBV, firm-level studies have shown that a firm in this scenario will be better off not to engage in ERA as it may not benefit from favourable firm-level conditions such as extensive prior experience (Hoang & Rothaermel, 2005), broad resource base (Ahuja & Katila, 2001; Prabhu et al., 2005) or resource complementarities (Cassiman & Veugelers, 2006). However, when the firm is faced with high competitive pressures (competitors' ERA activity), staying inert may not be the best strategic action. Instead, I argue that the focal firm will engage on ERA in order to reduce the likelihood being disadvantaged over its competitors.

Given a competitive environment with the characteristics described above, the focal firm will be highly dependent on its external environment for critical resources (Park & Zhou, 2005: 534). As such, a firm with low propensity to acquire such resources will be forced to imitate its competitors. CD scholars make a similar argument by suggesting that a firm will engage in an imitative action in order to stay abreast with close competitors (Garcia-Pont & Nohria, 2002). In the case of alliance formation, Park and Zhou (2005: 545) suggest

that a firm will engage in an "alliance race" in order to prevent losses occurring from the strengthening of its competitors' positioning.

In line with the above argument, I hypothesize that:

H4 (strategic similarity is high). When faced with high competitors' ERA activity, firms with low levels of resource commitment and prior experience will differentiate from the ERA-related actions of their competitors.

Let's now assume a scenario where the firm exhibits high propensity to engage in ERA. Under this scenario the firm has several incentives to obtain a differentiated resource position through ERA. One incentive for example would be to pre-empt critical resources (Lieberman & Montgomery, 1988) and further reduce resource competition (Deephouse, 1999). In contrast with the previous scenario, a firm with high propensity to ERA will be less dependent to its external environment. While the firm is faced with intense competitive activity, it will be able to employ a resource differentiation strategy by acquiring first critical resources. In line with the VRIN conditions proposed by Barney (1991), the scarcer the resources being acquired the higher the benefits from resource differentiation. In their economic theory of strategic opportunity, Denrell et al. (2003) provide a similar argument. They argue that "the view of each firm is shaped by its own existing resources and information, including the ability to assess the resources of other firms, and is to that extent unique. The more distinctive the firm's own view, the more likely that such view can encompass valuable opportunities not similarly visible to other firms" (Denrell et al., 2003: 978). Accordingly, I propose that:

H5 (strategic similarity is low). When faced with high competitors' ERA activity, firms with high levels of resource commitment and prior experience will imitate the ERA-related actions of their competitors.

While it has been assumed that imitative behaviour is directly dependent on firm resource endowments, and more specifically, to the extent which firms' resource endowments are similar, this assumption (Caves-Porter hypothesis) is somewhat in contradiction to the theoretical premises of rivalry-based competition. By testing the interaction effect of competitors' ERA activity and firm-level ERA propensity in predicting strategic similarity, I aim to provide further empirical evidence to this end.

CHAPTER 5.

METHODOLOGY

5.1 Introduction

In the previous chapter, I have provided a conceptual framework that aims to test both the resource- and competitor- driven views of ERA. More specifically, I have offered two sets of hypotheses.

The first set of hypotheses (H1-H3) predicts the focal firm's ERA activity as a function of the ERA actions of its competitors and its idiosyncratic attributes, and their interaction. Overall, I expect that: a) competitors' ERA activity is positively associated with focal firm ERA activity, b) firm-specific idiosyncratic attributes (resource commitment and prior experience with ERA) are positively associated with focal firm ERA activity, and c) the positive impact of competitors' ERA activity on focal firm ERA activity is negatively moderated by the firm's idiosyncratic attributes.

The second set of hypotheses (H4 & H5) predicts patterns of ERA behaviour in the two extremes of strategic choice (through strategic similarity). In summary, I expect that: a) strategic similarity can be explained by competitors' ERA activity and firm-specific idiosyncratic attributes, and b) strategic similarity is positively associated with competitors' ERA activity, but such positive effect decreases for firms with high levels of idiosyncratic attributes.

To empirically test my hypotheses, I need to make several methodological choices in terms of sample selection, operationalization of constructs, and measurement. This chapter is concerned with such methodological issues. First, I briefly discuss my research design and its appropriateness in answering my research questions. Second, I offer a rationale on sample selection. I more specifically illustrate why the biopharmaceuticals industry is an appropriate context on testing my hypotheses, and more broadly investigating firm ERA behaviour. Third, I illustrate issues with operationalization and measurement of my constructs. Fourth, I am concerned with econometric modelling and estimation procedures on assessing my hypothesized relationships.

5.2 Research design

In the previous chapter, I have proposed a conceptual framework that provides two distinct views of ERA. In relation to my research questions, I would empirically investigate the competitor- and resource- driven views of ERA offered above, and thus assess my empirical questions. Remember, there are three empirical research questions that I am concerned with. These questions are: *To what extent do firm-level idiosyncratic attributes explain firm ERA activity? To what extent do competitors' ERA actions explain firm ERA activity? Is there an interaction effect between these firm- and competitor-specific factors on the focal firm's ERA activity, and if so what kind?*

Through these questions, I aim to provide an assessment of alternative theoretical explanations of firm behaviour in the context of ERA. In doing so, I adopt a hypothetico-deductive methodological approach. While my aim is not

to provide a super theory of firm ERA behaviour, a (deductive) test of alternative theoretical explanations of ERA behaviour during the biotechnology paradigm in the biopharmaceuticals industry will allow for a better theoretical description of a complex strategic action (phenomenon) such as ERA (e.g., Christensen, 2006; Colquitt & Zapata-Phelan, 2007). Strategy scholars have long adopted a hypothesis testing paradigm to investigate complex phenomena by adopting multiple theoretical perspectives (for a set of examples, see Hitt, Gimeno, & Hoskisson, 1998). I have argued above for example, that firms engage in ERA in response to their idiosyncratic resources. While it is empirically impossible to observe such idiosyncratic resources (Godfrey & Hill, 1995), a hypothesis testing approach based on a population of firms will allow for a direct observation of how theoretical predictions, in this case resource-driven ERA, can be assessed through measurable proxies (variables) in the context of a real world phenomenon (the biotechnology paradigm).

I expect that firms (as part of a population) differ in their ERA behaviour across time. In relation to my empirical questions, I propose that these differences, leading to patterns of ERA behaviour among competing firms, can be at a certain degree explained by firm- and competitor-specific factors, which I have identified in my conceptual framework. From a method's point of view, to identify patterns of ERA behaviour and assess how these patterns are driven by the factors (parameters) identified above, we must use methods that model parameter variation across firms and over time (Bowen & Wiersema, 1999). In section 5.6, I explain in greater detail appropriate statistical methods for my research design.

5.3 Empirical context

To empirically investigate firm ERA activity and emerging patterns of ERA behaviour, I need a population of firms that engage in ERA across time. Such population must allow for some degree of variability of ERA activity at the firm-year level. In line with these methodological requirements, I draw my population of firms from the global biopharmaceuticals industry. While a multi-industry sample could increase the generalizability and the statistical power of my empirical results, I focus on one industry for at least three main reasons. First, my population of firms must satisfy the theoretical assumptions that my conceptual development is based on (see section 4.3.2). In line with my theoretical assumptions, firms within a single industry compete for similar resources (and thus share strategic factor markets), face similar industry conditions that collectively affect business decisions, and exhibit similarities in organizational factors such as culture (Hitt et al., 1998; Rouse & J. Daellenbach, 1999). Second, by focusing on one single industry, I aim to avoid variable definition problems and consequent comparability of competing firms (Pangarkar and Klein, 1998: 61). Remember, that competing firms are defined as those firms offering similar products and thus targeting similar customers. As such, competing firms target similar resources and exhibit a degree of multimarket contact. While it could be possible to statistically control for industry variance (by introducing industry-level dummies), such a design would inhibit the conceptual definitions of variables of interest such as competitors' ERA activity and the conceptual mechanisms underlying its hypothesized impact on focal firm ERA activity. I have previously offered several theoretical explanations for this hypothesized relationship. One

explanation (see section 4.3.3) for example is that the focal firm will engage in ERA as a competitive response to similar competitors. It would be empirically very difficult to assess this mechanism across multiple industries as firm strategic behaviour is contingent on several industry-specific effects such as market structure and size distribution (Anand & Khanna, 2000b). Thus, in line with previous relevant empirical research, I control for industry variance by drawing my sample of firms from a single industry (e.g., Shan, 1990). Third, by focusing on the global biopharmaceuticals industry, my empirical analysis can provide further insights in how patterns of ERA behaviour unfold over time. This is important not only for understanding firm ERA behaviour but also for commenting on the evolution of competitive dynamics in the biopharmaceuticals industry in relation to the biotechnology paradigm.

Based on a single industry design, the biopharmaceuticals industry is an excellent context for studying ERA and firm strategic behaviour. In section 2.2, I have illustrated the dynamics of the biopharmaceuticals industry, and the emergence of the biotechnology paradigm. In relation to these emerging dynamics, ERA has been an integral part of firm strategy. At the industry level, competition is very much driven by innovation. In contrast to other industries, the biopharmaceuticals industry is less prone to external factors such as challenges in the economy and exchange rates (Bierly & Chakrabarti, 1996: 126). Biopharmaceuticals firms must exhibit high levels of research productivity if they are to gain an advantage over their competitors (Henderson & Cockburn, 1994). With the emergence of the biotechnology paradigm, however, biopharmaceuticals firms must look outside their boundaries and rely on external resources in order to innovate (Gambardella, 1992). Thus, ERA is

an important strategic action in this competitive context. ERA activity (through several interorganizational arrangements) has seen an exponential growth since the very early stages of the biotechnology paradigm. For example, in comparison to the volume of initial public offerings in the biopharmaceuticals industry, ERA activity provided eight times more capital to fund R&D (Wuyts et al., 2004).

From a practical point of view, ERA activity in the biopharmaceuticals industry is well documented both in the press and specialized databases. As such, several secondary sources capture ERA activity and allow for data validity checks and high comparability with prior empirical work. The biopharmaceuticals industry is highly regulated from governmental agencies such as the Food and Drug Administration (FDA) in the U.S. The FDA has closely documented the biopharmaceuticals industry and offers long term historical data which is publicly accessible (Sorescu, Chandy, & Prabhu, 2003: 88).

5.4 Sample and data collection

I have illustrated above my rationale for choosing the biopharmaceuticals industry as the empirical context of my study. To empirically test my hypotheses, I construct a panel data set on the biggest 50 biopharmaceutical firms with global operations between 1987 and 2006. ERA is a complex strategic action given its resource requirements, and as such, a panel data design allows for observations across a long time window. Before I illustrate in

more detail the data sources that I have drawn from to collect my data, I discuss further some characteristics of my sample firms and the selected time frame.

I started constructing my sample by focusing on biopharmaceutical firms with global operations that have been historically focused on drug discovery and development across several therapeutic areas (firms with SIC codes #2834, #2836, #2800)[45]. I focus on the biggest biopharmaceutical firms as ERA is a resource intensive and risky strategic action associated with firm size[46]. Firms outside my sample rarely engage in ERA (sample captures almost 93% of total ERA activity). Furthermore, in order to empirically assess my hypotheses, it is important for the sample firms to exhibit some multimarket contact (serving similar markets) and without exhibit large differences in size and financial strength. Wide differences on these two firm-specific dimensions could significantly affect ERA behaviour (for a similar design see Nicholls-Nixon & Woo, 2003). As I have also illustrated above, ERA can be seen as an adaptive strategic response of established biopharmaceuticals firms in the biotechnology paradigm. I have drawn my sample firms from the *Biopharmaceuticals executive "Pharm Exec 50" annual report* (Biopharmaceuticals Executive Biopharmaceuticals Report, 2005). The Biopharmaceuticals Executive[47] is a well established practitioner's magazine focusing on a range of business issues in the biopharmaceuticals industry. In 2005 in which the data were collected,

[45] SIC codes #2834, #2836, #2800 correspond to biological products, biopharmaceuticals preparations, and chemical products respectively.

[46] In the next chapter, I provide some empirical insights in the important effect of firm size on firm ERA activity.

[47] The biopharmaceuticals executive magazine can be accessed electronically at http://pharmexec.findpharma.com/pharmexec [date last accessed: 26/04/2009]

the top 50 biopharmaceuticals firms had a total of $387bn on ethical sales and $76bn total R&D expenditures. Table 5-1 illustrates the top 50 biopharmaceutical firms of my initial sample.

Table 5-1. Top 50 biopharmaceutical firms *(Pharm Exec 2005)*

Firm	Ethical Sales (US $bn)	R&D expenditure (US $bn)
Abbott	13.756	1.69
Aisai	5.006	0.724
Akzo Nobei	2.37	0.642
Alcon Labs	1.542	0.4
Allergan	1.842	0.35
Altana	2.23	0.504
Amgen	10.6	1.996
AstraZeneca	21.426	3.803
Baxter International	3.504	0.517
Bayer	5.44	1.527
Biogen Idec	1.486	0.686
BMS	15.482	2.5
Boehringer-Ingelheim	8.698	1.527
Chugai	2.62	0.454
Forest Labs	2.65	0.246
Fujisawa	3.201	0.695
Genentech	3.749	0.948
Genzyme	1.976	0.391
GSK	31.377	5.195
Ivax Corporation	1.577	0.162
J&J	22.128	5.203
King Pharmaceuticals	1.304	0.679
Lilly	13.059	2.69
Lundbeck	1.518	0.295
Merck	21.493	4.01
Merck KGaA	3.845	0.597
Mitsubishi	1.812	0.476
Mylan Labs	1.374	0.101
Novartis	18.5	3.48
Novo Nordisk	3.51	0.664
Ono	1.31	0.25
Otsuka	3.719	0.5
Pfizer	46.133	7.52
Purdue Pharma	1.34	0.294
Roche	17.322	5.4
Sankyo	2.908	0.661
Sanofi-Aventis	30.919	9.31

Schering AG	6.085	0.745
Schering-Plough	6.417	1.607
Serono	2.177	0.595
Shionogi Seiyaku	1.641	0.281
Shire	1.363	0.196
Solvay	2.163	0.358
Takeda	8.274	1.223
Tanabe Seiyaku	1.296	0.232
Teva	4.276	0.338
UCB	2.08	n/a
Watson	1.641	0.134
Wyeth	13.964	2.46
Yamanouchi	3.73	0.661

Most of the biopharmaceutical firms in Table 5-1 such as Pfizer, GSK, AstraZeneca and Novartis were established under the technological paradigm of chemical screening (Hoang & Rothaermel, 2005: 335). However, there are other biopharmaceutical firms such as Genentech and Biogen which were established at the early stages of the biotechnology paradigm.

As my interest lies with ERA and firm strategy, I collect relevant data on these 50 biopharmaceutical firms between 1987 and 2006. While the Genentech IPO in the early 1980's marked the beginning of extensive ERA activity in the biopharmaceuticals industry (Hoang & Rothaermel, 2005), according to my data few firms have engaged in any collaborations prior to 1987. Post 1987, overall ERA activity has exponentially increased. Figure 5-1 illustrates overall ERA activity across the observed time frame. As it is illustrated by the four-year moving average, in the first 10 years of the time frame, we observe an exponential increase in ERA activity (~six fold increase). After 1996, however, total ERA activity follows a lower rate of increase (~one fold increase). I unpack this interesting effect further in the discussion chapter.

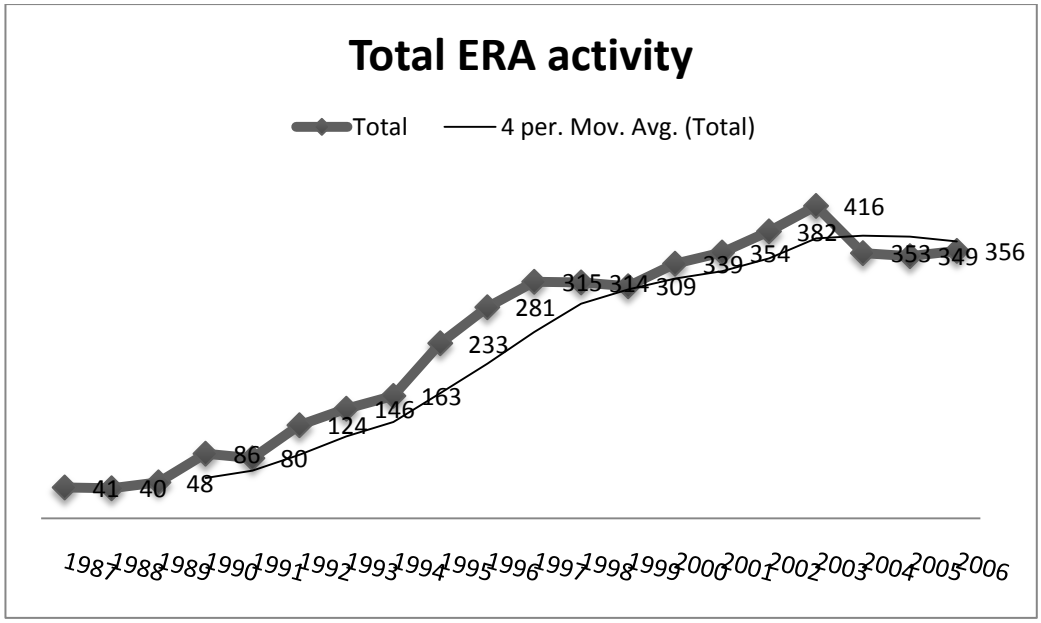


Figure 5-1. Overall ERA activity (1987-2006)

I draw data from 3 secondary sources. To measure my ERA related variables, I draw from the Recombinant Capital Alliances database. Recombinant Capital[48] (RECAP) is a private consulting firm specializing in the biopharmaceuticals industry. The Alliances database holds extensive information[49] on more than 20,000 interfirm agreements between biopharmaceutical firms. In her study of

[48] I would like to thank Recombinant Capital for granting me complementary access in order to collect data for this study. Complementary access was granted in the basis of not-for-profit use of the data collected.

[49] RECAP describes the Alliance database as follows: "RECAP Alliance Database contains high-level summaries of more than 13,500 alliances in the life sciences which have been formed since 1973. These high level summaries are derived by RECAP from one or more of three principal public sources: (1) biotechnology and biopharmaceuticals company press releases and other literature; (2) U.S. Securities and Exchange Commission (SEC) filings; and (3) company presentations made at investment conferences and other public meetings. The Alliance Database is principally concerned with biotechnology alliances - where a biotechnology company partners with a major drug company (drug/biotech), with a university (university/biotech), or with another biotechnology company (biotech/biotech). In addition, the Database contains many, although by no means all, high level summaries of alliances of non-biotechnology alliances in the life sciences. Agreements involving medical device companies, two major drug companies (drug/drug), or a university partnering with a major drug company (university/drug) are among the non-biotechnology alliances included in the Database." [www.recap.com; date last accessed: 16/04/07]

alliance databases, Schilling (2009) provides a direct comparison of RECAP with other multi-sector and specialized in biopharmaceuticals industry databases such as BioScan. Schilling identifies some advantages and disadvantages for using each of the reviewed databases. The two major advantages of RECAP are the extensive coverage of agreement types and the great depth of information on individual alliance agreements (Schilling, 2009: 239). For example, in comparison with BioScan, RECAP holds 6 times the number of agreements. Overall, Schilling finds high consistency of alliance patterns over time among the five databases examined.

To measure my financial related variables, I draw from Standard & Poor's COMPUSTAT database and DATASTREAM. Unfortunately, I was unable to collect data for all 50 firms in my initial sample. Three of these biopharmaceutical firms, Alcon, Purdue Pharma and Ono are private and as such no available financial data were available in the COMPUSTAT database. For other firms such as Lundbeck and Boehringer-Ingelheim, more than 90% of the required financial data were missing. Furthermore, some firms in my initial sample (Table 5-1) have been merged or acquired. For example, Yamanouchi and Fujisawa were merged to Astellas Pharma in 2005. Following (Hoang & Rothaermel, 2005), I include the newly formed firm in my final sample by combining interfirm agreements data of both firms prior to the merger.

My final sample consists of 37 firms. 17 firms are incorporated in the U.S., 14 firms are European, and 5 firms are Japanese. 1 firm in the sample, Teva Pharmaceuticals, is incorporated in Israel. Table 5-2 illustrates my final sample of firms as described in the COMPUSTAT database. The "ticker symbol" and

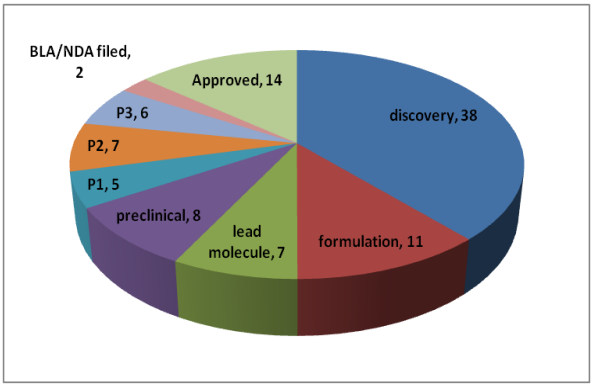
"Gvkey" variables were used to query the database in order to collect relevant financial data. In cases where minor data were missing, I draw additional data from the DATASTREAM database and in some cases specific Security and Exchange Committee (SEC) filings. Correcting for missing data is an important part of the empirical analysis. I explain this further when I discuss the econometric models employed to test my hypotheses.

Table 5-2. Final Sample of 37 firms

Company name	Ticker Symbol	Gvkey	Details
Abbott Laboratories	ABT	1078	
Akzo Nobel Nv	AKZOY	15334	
Allergan Inc	AGN	15708	
Altana Ag	AAAGY	100004	
Amgen Inc	AMGN	1602	
Astrazeneca Plc	AZN	28272	
Baxter International Inc	BAX	2086	
Bayer Ag	BAYRY	100080	
Bayer Schering Pharma Ag	SHRGY	101076	PREVIOUSLY SHERCING AG. ACQUIRED FROM BAYER
Biogen Inc	BGEN	2226	
Bristol-Myers Squibb Co	BMY	2403	
Chugai Biopharmaceuticals Co Ltd	JP4519	100441	
Forest Laboratories -Cl A	FRX	4843	
Fujisawa Biopharmaceuticals Co	JP4511	100412	
Genentech Inc	DNA	5020	
Genzyme Corp	GENZ	12233	
Glaxosmithkline Plc	GSK	5180	
Ivax Corp	IVX.	14446	
Johnson & Johnson	JNJ	6266	
Lilly (Eli) & Co	LLY	6730	
Merck & Co	MRK	7257	
Merck Kgaa		220301	
Merck Serono Sa	SRA	102045	PREVIOUSLY SERONO
Mylan Inc	MYL	7637	

Novartis Ag	NVS	101310
Novo Nordisk A/S	NVO	8020
Pfizer Inc	PFE	8530
Daichi Sankyo	JP4568	205509
Sanofi-Aventis		101204
Schering-Plough	SGP	9459
Shionogi & Co Ltd	JP4507	100707
Solvay Sa		101394
Takeda Biopharmaceuticals Co	JP4502	100718
Teva Pharmaceuticals	TEVA	14538
Ucb Sa-Nv		100751
Watson Pharmaceuticals Inc	WPI	27845
Wyeth	WYE	1478

The average firm in the final sample has revenues of US$24641 (000) and R&D expenditures of US$ 2796 (000) per financial year. In terms of ERA activity, the average firm performed 99 agreements between 1987 and 2006.



Overall, the average firm performed 98 ERA actions across the 9 distinct stages of the drug discovery and development process. More specifically, 65 ERA actions were performed in preclinical phases (discovery, formulation, lead molecule & preclinical), 17 in clinical phases (Phases I, II & III), and 16 in approval phases (BLA/NDA filed & Approved). More than 1/3 of the total ERA actions have performed during the discovery phase.

5.5 Operationalization and measurement

In this section, I provide a detailed description of the operationalization and measurement of variables of interest. I start by discussing the dependent variables involved in hypotheses H1-H5; firm ERA likelihood (ERA_BIN), firm ERA intensity (ERA_COUNT), and strategic similarity (STRAT_DEV). I then discuss the independent and control variables. Table 5-5 provides a summary of operationalization and measurement.

Scholars thus far have operationalized ERA by focusing on a broad set of interorganizational relationships. Interorganizational relationships have been treated as the main mechanism of acquiring strategic resources (Eisenhardt & Schoonhoven, 1996). Scholars have shown that some modes of interorganizational relationships are more effective than others depending on the strategic intent underlying such relationships (Mowery et al., 1996). It is thus common for researchers, concerned with interorganizational relationships, to distinguish[50] between equity and non-equity relationships (Nicholls-Nixon & Woo, 2003). In line with previous empirical research, and to be more restrictive in hypothesis testing, I exclude agreements that do not incorporate the acquisition of a particular resource (such as assets, copyrights, marketing rights, technologies, compounds, and molecules). As my interest lies with ERA and not with interorganizational relationships per se, I need to distinguish between agreements that do not satisfy my theoretical assumptions. In the next section, I explain in more detail how I distinguish ERA actions.

[50] In their empirical study of the biopharmaceuticals industry, Arora and Gambardella (1990) find that different interorganizational linkages (research agreements, equity stakes in biotech firms, and acquisitions of firms) are complementary strategies.

5.5.1 Coding ERA actions using the RECAP Alliances database

As I have illustrated above, several empirical studies have used interfirm collaborative agreements as a proxy of ERA (e.g., Eisenhardt & Schoonhoven, 1996). To be restrictive on hypothesis testing, and consistent with my theoretical assumptions (see section 4.3.2), I measure ERA related variables by focusing on nonequity-based interfirm agreements, and thus excluding equity-based agreements. Furthermore, I exclude agreements that do not incorporate the acquisition of a particular resource (such as assets, copyrights, marketing rights, technologies, compounds, molecules). In doing so, I exclude agreements with types Acq, CoM, CoP, Col, D, Di, E, JV, LoI, Lo, Man, Mrg, Sec, Set, Ter, War (see Table 5.4). In the case where an agreement is described with more than one of the above types, I include it in the sample only if its TYPE description contains "License". As I am interested on the acquisition of resources for my sample firms, I also exclude all outward (out-licensing) agreements, thus focusing only on agreements in which the sample firm is the "R&D Company". Table 5-3 illustrates an example of an agreement that is coded as an ERA action (Client firm: ABBOTT).

Table 5-3. Example of an agreement coded as ERA action

ID	RND	CLIENT	DATE	PARTIES	TYPE	SUBJECT
D70	Genaera	Abbott	1994	Drug / Biotech	Research Development, Option, License	Screening of food additives

SIZE	DISEASE	TECHNOLOGY
$0.9M	Nutritionals/Vitamins	Screening

In this example, the biopharmaceuticals firm Abbott Labs acquired a screening technology in the therapeutic area of nutritionals from biotech firm Genaera. During the data collection process, I assign a unique ID to every agreement categorized ERA action. The letter assigned to the ID denotes the discovery and development stage that the agreement was signed (stage at signing; see Appendix A). In this case, the agreement is signed at the discovery phase.

Table 5-4. RECAP interfirm agreements codes

Abbreviation	Type	Description (RECAP)
Acq	Acquisition	In an Acquisition agreement, the Client Company acquires legal control (greater than 50% of voting shares) of the R&D Company, including both assets and liabilities.
Ast	Asset Purchase	An Asset Purchase is an agreement in which the Client Company acquires legal control of one or more physical assets, such as manufacturing plants or business units, from the R&D Company.
Asn	Assignment	In an Assignment agreement, the R&D company transfers title or legal interest in an intellectual property asset to the Client company.
CoD	Co-Development	In a Co-Development agreement, both parties participate to some degree in the clinical development of a compound or project within a licensed territory and the Client company does not fully reimburse development expenses incurred by the R&D company.
CoM	Co-Market	A Co-Market agreement defines a commercialization venture whereby two or more parties promote and sell a single product with each party obtaining sales revenues and/or net profits only from its own sales of the product.
CoP	Co-Promotion	A Co-Promotion agreement defines a commercialization venture in which two or more parties promote and sell a single product, with each party obtaining sales revenues and/or net profits from either party's sales of the product.
Col	Collaboration	In a Collaboration agreement, two or more parties perform research and/or development activities in a single R&D program.
CrL	Cross-license	In a Cross-License agreement, one party obtains a license to an intellectual property asset (e.g. a patent) in at least partial exchange for granting a license to its own intellectual property asset.

D	Development	In a Development agreement a sponsoring party engages another party to perform R&D services beyond the stage of lead generation.
Di	Distribution	In a Distribution agreement one party is engaged to promote or sell a product in final manufactured form as supplied by the originating party
E	Equity	An Equity agreement describes the issuance of a minority share (<50%) of legal ownership interest in an entity.
JV	Joint Venture	A Joint Venture agreement concerns the legal creation of a separate entity (i.e. corporation, partnership, or limited liability corporation) by two or more parties.
LoI	Letter of Intent	A Letter of Intent is a written description of economic terms and any other principle elements of an agreement between two parties. It may be binding or non-binding.
L	License	A License is a written agreement whereby one party obtains permission to make, have made, use, sell, or have sold an intellectual property asset (e.g. a patent or compound) from another party
Lo	Loan	A Loan is a payment or promise of future payment from one party to another whereby such payment is repayable (either with cash, equity, or a combination of the two) at a future time.
Man	Manufacturing	In a Manufacturing agreement, the Client company will make or have made a product for use or sale by the R&D company.
Mkt	Marketing	In a Marketing agreement, the Client company obtains certain rights to a product not otherwise disclosed or classified. A Marketing agreement is a commercialization designation that does not meet the criteria of either a License or a Distribution agreement.
Mrg	Merger	In a Merger agreement legal control (50%+) of two entities passes to a third entity from which the business of the two will be conducted on an ongoing basis.
O	Option	An Option is a legal right, acquired for some consideration, for a party to gain access or license to an asset at some future time for fixed economic terms.
R	Research	In a Research agreement, a sponsoring party engages another party to perform R&D services in the discovery and/or lead stages of an R&D project.
Sec	Security	A Security is a legal interest in an asset given by one party to another as a pledge of repayment of a loan or other obligation.

Set	Settlement	A Settlement is a written agreement following litigation or another dispute between two or more parties.
Sub	Sublicense	A Sublicense concerns the conveyance of a license from one party to another, wherein that license was earlier granted to the conveyor by a third party.
S	Supply	In a Supply agreement, the R&D company will make or have made a product for use or sale by the Client company.
Ter	Termination	A Termination agreement concludes or dissolves an earlier arrangement between two companies.
War	Warrant	A Warrant is the issuance of a future share of legal ownership interest in an entity whereby the acquirer has the option, but not the obligation, to purchase such ownership interest for a designated period of time for fixed economic terms.

Overall, the 37 biopharmaceutical firms in the final sample engaged in ***4,729*** ERA actions between 1987 and 2006 (across 592 firm-year observations).

5.5.2 Dependent Variables

Firm ERA activity

I have illustrated in the previous section, the procedure of coding ERA actions through different type of inward nonequity-based interfirm agreements. The first three hypotheses (H1-H3) presented in the conceptual chapter aim to provide a direct empirical test of the competitor- and resource- driven views of ERA. To predict the focal firm's ERA activity, I am concerned with two variables. The first dependent variable is concerned with the *likelihood* of the firm engaging in ERA (ERA_BIN). ERA_BIN is measured as a binary variable that takes 1 when firm *i* engages to 1 or more ERA actions at year *t*

and 0 if firm *i* does not engage in any ERA action at year *t*. Scholars concerned with firm strategic behaviour have widely employed a similar operationalization in several empirical contexts. In their study of the automotive industry, (Garcia-Pont & Nohria, 2002) employ a binary measure to predict alliance activity between a pair of firms. Other scholars employ a similar measure to capture the event of a firm entering a technological field (e.g., Mitchell, 1989) or a new geographical market (e.g., Delios et al., 2008).

Table 5-5. Operationalization and measurement of constructs

Theoretical Construct	Operational Construct	Hypotheses (pred.)	Measure (firm-year)	Data Source	Relevant Studies (context/method)
Dependent Variables					
Firm behaviour when engaging in External Resource Acquisition (ERA)	Firm ERA activity	H1 H2 H3	• Intensity (ERA_COUNT): Number of interfirm inward nonequity-based agreements for firm *i* in year *t*.	RECAP alliances database	Cassiman and Veugelers, 2006; Stuart, 1998; Chen and Miller, 1994 (index); Haunschild, 1993
			• Likelihood (ERA_BIN): 1 if firm *i* engaged on 1 or interfirm inward nonequity-based agreements at year *t*; 0 otherwise.		Garcia-Pont and Nohria, 2002 (alliance); Mitchell, 1989 (entry timing)
Firm ERA behaviour in the two extremes of strategic choice	*Imitative action* (conform) when engaging on ERA (IMIT_ERA); *Differentiating action* when engaging on ERA (DIFF_ERA)	H4 H5	Strategic similarity (STRAT_DEV): Comparison of number of interfirm inward nonequity-based agreements of firm *i* in year *t* to the industry mean expressed as standard deviation (strategic deviation measure) at year *t* for *N* competing firms.	RECAP alliances database	Deephouse, 1999; Gimeno et al., 2005 (Euclidean distance); Gimeno and Woo, 1996 (Euclidean distance); Gulati, 1995 (strategic interdependence)

Independent Variables

Impact of competitors' ERA-related actions to the focal firm's activity to engage in ERA	Competitors' ERA activity (COMP_ACT)	H1(+) H3(+) H4 H5	Number of interfirm inward nonequity-based agreements for competing firms *N* of firm *i* at *t-2* prior to firm's *i* ERA action at year *t*.	RECAP alliances database	Delios et al., 2008 (nat. log.); Garcia-Pont and Nohria, 2002 (density); Gimeno et al., 2005 (centred to the population mean); Mitchell, 1989; Ferrier et al., 1999
Firm's propensity to engage in ERA depends on firm-specific idiosyncratic attributes	Firm ERA propensity (FIRM_PROP) = prior ERA experience (FIRM_EXP) X resource commitment (FIRM_RES)	H2(+) H3(U) H4 H5	• FIRM_EXP: total number of interfirm inward nonequity-based agreements for firm *i* at *t-2*. • FIRM_RES: R&D intensity of firm *i* measured as R&D exp. divided by total sales at *t-2*.	RECAP alliances database COMPUSTAT EDGAR online (SEC)	Anand and Khanna, 2000; Delios et al., 2008; Yang and Hyland, 2006; Miller and Chen, 1994 (count); Nerkar and Roberts, 2004 Schoenecker and Cooper, 1998; Heeley et al., 2006; Miller, 2004; Fiegenbaum et al., 1990; Nicholls-Nixon and Woo, 2003; DeCarolis, 1999 (3yrs average); Hitt et al.,

Control Variables

Firm size$_{i,t-1}$	Number of employees (natural logarithm)	• COMPUSTAT • EDGAR online (SEC) • DATASTREAM	Ahuja and Katila, 2001; Rothaermel and Boeker, 2008; Chen and Miller, 1994;
Country of origin	Boolean variable for distinguishing between US, European and Asian firms	RECAP alliances database	Pangarkar and Klein, 1998
Financial strength $_{i,t-1}$	• Return on Assets (ROA) • Return on Equity (ROE) • Debt-to-equity ratio (D-E)	• COMPUSTAT • EDGAR online (SEC) • DATASTREAM	Stuart,1998; Wiggins and Ruefli, 2002; Haunschild, 1993

The second dependent variable that I am concerned with is the focal firm's *intensity* when engaging in ERA. To measure the intensity of the focal firm's ERA actions, I employ a count variable expressed as the total number of inward nonequity-based agreements of firm *i* at year *t* (ERA_COUNT). ERA_COUNT simply captures the frequency of firm ERA action at any given point in time. Scholars concerned with similar strategic actions have employed a frequency measure to capture the intensity of firm action. For example, Haunschild (1993) employs a similar measure to examine the impact of corporate ties on the focal firm's acquisition activity.

While scholars have employed likelihood and intensity measures to operationalize strategic action, few studies have been empirically concerned with both measures. A recent exception is the recent study of Park et al. (2002) which examines the competitive dynamics of alliance formation. In line with Park and colleagues (2002), I believe that we can gain a better understanding of firm strategic behaviour by examining both likelihood and intensity in a single empirical study. I expect that the independent variables employed to explain ERA will exhibit a varying effect on these two dependent variables.

Strategic similarity

The third dependent variable that I am concerned with is *strategic similarity*. Recall that hypotheses H4 and H5 try to predict firm ERA behaviour at the two extremes of strategic choice. Thus far, scholars concerned with competitive dynamics have conceptualized strategic similarity as an independent variable. While I employ a similar operationalization with previous empirical studies, I treat

strategic similarity as a dependent variable[51]. To measure strategic similarity, I draw from the concept of strategic deviation (Deephouse, 1999). Strategic deviation is measured as the "distance" between the focal firm's strategy and that of its competitors. Firm strategy can be captured along a set of dimensions. In this case, I use two distinct ERA strategies; R&D-oriented ERA actions and marketing-focused ERA actions. In a similar fashion with (Deephouse, 1999), strategic deviation (STRAT_DEV) for firm *i* at year *t* is calculated by the following equation:

$$STRAT\_DEV_{it} = \sum_{a=1}^{2} ABS\left(\frac{P_{ait} - M(P_{at})}{SD(P_{at})}\right)$$

where: $\boldsymbol{P_{ait}}$ = the proportion of ERA strategy *a* for firm *i* at year *t*;

$\boldsymbol{M(P_{at})}$ = the mean of ERA strategy *a* in year *t* for the firms in the sample;

$\boldsymbol{SD(P_{at})}$ = the standard deviation of ERA strategy *a* in year *t* for the firm sample;

***ABS* =** absolute value function

STRAT_DEV is a firm-level property and can take any non-negative continuous value, including 0. A STRAT_DEV of 0 suggests that the strategy of firm *i* in year *t* is perfectly aligned with the strategies of its competitors. The higher the value of STRAT_DEV (above 0), the more differentiated the strategy of firm *i* in year *t*.

[51] I would like to thank David Deephouse for his valuable input on how to operationalize and measure strategic similarity in the context of ERA.

The more the value of STRAT_DEV approaches zero, the more firm *i* conforms to the strategy of its competitors in year *t*.

Strategy scholars concerned with the concept of strategic similarity have employed similar measures, mostly drawing from strategic group research. For example, scholars have employed a strategic similarity measure based on Euclidean distances at the dyad-level (Fuentelsaz & Gómez, 2006; Gimeno & Woo, 1996; Young et al., 2000). Similarly to the strategic deviation measure described above, these scholars start their calculation of strategic similarity by choosing a set of strategies that best reflect the strategic position of the firm in its competitive context. In contrast with my conceptualization of strategic similarity as a dependent variable, these studies employ strategic similarity as a predictor of either intensity of rivalry[52] (Gimeno & Woo, 1996; Young et al., 2000) or market entry (Fuentelsaz & Gómez, 2006). Another notable difference is that these studies choose a set of strategies to provide a generic strategic profile of competing firms.

My concern however is not to generically describe the strategic profile (strategy) of the biopharmaceutical firms in my sample, but to choose strategic dimensions relevant to ERA. I thus distinguish between *R&D-oriented ERA actions* and *market-oriented ERA actions* as two distinct strategies in my empirical context. To distinguish between these two types of ERA actions, I use the New Drug Application submission decision making point in the drug discovery and development process. I operationalize R&D-oriented ERA actions as those interfirm inward nonequity-based agreements that take place at the preclinical

[52] In contrast with Young and colleagues' (2000) study of firm competitive behaviour, Gimeno and Woo (1996) employ a price-cost margin profitability measure to investigate the interfirm rivalry across markets.

stages of the drug discovery and development process. In line with the RECAP categorization, such agreements can take the following values at the "stage at signing" field: discovery, formulation, lead molecule & preclinical. One recent example of a R&D-oriented ERA action is the agreement between Pharmagene and GlaxoSmithKline:

> *"Royston, UK, 24 July 2002 - Pharmagene announced today that it has signed a further agreement with GSK to assist in the characterisation of the metabolism of a number of development compounds in human tissues prior to beginning full clinical development. Under the terms of the agreement, GSK will gain access to specific Pharmagene capabilities in the area of compound validation with an option to extend the scope of the agreement if required. Pharmagene's unique human tissue-based approach can assist in identifying clinical trial errors early and thus help reduce the high attrition rates and costs associated with drug discovery and development"*

In turn, market-oriented ERA actions are those interfirm inward nonequity-based agreements completed at later stages of the D&D process such as clinical phases (I, II & III) and approval stages (BLA/NDA filed & Approved). An example of collaboration market-oriented ERA action is the licensing agreement between Aventis (now Sanofi-Aventis) and Danippon:

> *"Strasbourg, France – Aventis announced* today *that it is has entered into an agreement with Dainippon to license its novel antidementia agent AC-3933, currently under development in Europe by Dainippon. Under this agreement, Aventis has received exclusive worldwide development and marketing rights (excluding Japan) for AC-3933, with option rights for China, Taiwan and South Korea. AC-3933 is a potential cognitive enhancer with a novel mechanism of action. IAC-3933 acts as a partial inverse agonist at the GABA-benzodiazepine receptor complex, enhancing cholinergic function. Because of these properties, it is anticipated that AC-3933 will demonstrate better efficacy for improving memory deficit than currently marketed treatments."*

Scholars investigating, alliance activity and formation in the biopharmaceuticals industry, have highlighted differences along these two distinct strategies. For example, Rothaermel and Deeds (2004: 202) build on the exploration-exploitation model of organizational learning and argue that biopharmaceutical firms form exploratory alliances (early stage) to search for new technological knowledge, and exploitation alliances (late stage) to commercialize developed knowledge. These scholars further argue that while there are distinct strategic motives underlying these two different types of alliances, they are interlinked (exploitation alliances depend on exploration alliances) throughout the new product development process. At an earlier conversation of the exploration-exploitation model as a framework of firm adaptation to its environment, Koza and Lewin (1998: 256) argue that "the firm's choice to enter into an alliance can be distinguished in terms of its motivation to exploit an existing capability or to explore new opportunities. This dichotomy applies equally to any strategy of the firm".

The point that I am trying to bring across here is that there is good theoretical reasoning for distinguishing between R&D-oriented ERA actions and marketing-oriented ERA actions as two distinct strategies serving different value chain functions (Lavie & Rosenkopf, 2006: 798). Another methodological option would be to not distinguish between these two types of ERA actions, but treat ERA at one dimension. However, given the above discussion, and the plethora of empirical work on the application of the exploration-exploitation model on interorganizational relationships, I believe that such a distinction could lead to a more insightful empirical analysis by taking full advantage of my extensive dataset of ERA actions in the biopharmaceuticals industry.

5.5.3 Independent Variables

Competitors' ERA activity

The first independent variable of interest is *competitors' ERA activity* (COMP_ACT). COMP_ACT captures the impact of competitors' ERA related actions to the likelihood (ERA_BIN) and intensity (ERA_COUNT) of the focal firm's subsequent ERA actions (H1 & H3). COMP_ACT also acts as a predictor variable of strategic similarity (H4 & H5).

Scholars concerned with firm competitive behaviour have employed similar measures to describe competitors' activity. Ferrier, Smith, and Grimm (1999: 378) define competitors' activity (in their word total competitive activity) as "the total number of newly created competitive actions…" Scholars have widely applied aggregate count measures to investigate imitative behaviour (operationalized as the impact of competitors' strategic actions on the probability of the focal firm engaging in the same action). Haunschild and Miner (1997) use the term *frequency-based imitation* to describe the increased probability of the focal firm to engage in a strategic action when a large number of competitors engage in the same action. Haunschild and Miner (1997) measure frequency-based imitation as the aggregate number of prior competitors adopting a specific action (in their case the use of a specific investment banking firm). In their study of firm imitative behaviour and the dynamics of alliance formation, Garcia-Pont and Nohria (2002) employ a similar measure to capture the impact of global mimetism (the larger the aggregate number of prior alliances in an industry, the more likely any two firms enter an alliance) on alliance formation. They employ a measure based on the density of the alliances formed between two competing firms at a particular point

in time. To study interorganizational mimetic behaviour in the context of market entry, Delios et al. (2008) construct a similar density measure based on the natural algorithm of the count of competitors' previous entries.

Through my conceptualization of COMP_ACT, I aim to investigate the existence of imitative behaviour in the context of ERA. As illustrated above, scholars have predominantly employed aggregate based measures to investigate imitative behaviour. The problem is however, that competing firms may engage in several modes of mimetic behaviour (Haunschild & Miner, 1997). Aggregate measures could be more appropriate when competing firms engage in a strategic action as a response to a large number of competitors (frequency-based imitation). (Garcia-Pont & Nohria, 2002), however, argue that firms don't just imitate any other firm in their competitive environment but focus on those firms that are strategically similar (local mimetism). In contrast with Garcia-Pont and Nohria's study (2002), I am not concerned with strategic groups as a theoretical anchor of imitative behaviour, and I do not therefore empirically identify strategic groups as an identifier of strategically similar firms. While my theoretical interest lies with frequency-based imitation, given my focus on a well defined set of competitors, I do contend with Garcia-Pont and Nohria (2002) that competing firms may differ in the way they view their competitors' actions.

In line with these studies, I provide alternative measures of COMP_ACT. The first measure is simply the cumulative count of ERA actions that sample firms N engage at *t-2* minus the ERA actions of the focal firm's *i* at the same period. For example, if GlaxoSmithKline has engaged in 10 ERA actions in 1995 and all the other firms in my sample cumulatively engaged in 100 ERA actions then COMP_ACT for GlaxoSmithKline in 1997 is equal to 90.

I draw from empirical work on resource niches in order to develop the second measure of COMP_ACT. Organizational ecology scholars have argued that firms competing in the same market segments tend to draw from similar resources and compete more intensively (e.g., Dobrev, 2007). Competitive dynamics scholars have provided a similar argument by showing that firms in the same markets are more aware of their respective strategic actions (e.g., Chen, 1996). Thus, one way to construct a more specific measure of COMP_ACT would be to distinguish between firms that directly compete in the same markets (market overlap). In line with these argument, COMP_ACT is calculated as the aggregate number of interfirm inward nonequity-based agreements that *competing firms C* (C is a subset of N) of firm *i* engage in *t-2*, prior to the firm's *i* ERA actions in year *t*. Competing firms, of firm *i*, are defined as those firms that engage in ERA actions in the same markets *m* as firm *i*. For example, if firm *i* faces competitors C_1 and C_2 with total ERA actions at year *t-2* c_1 and c_2 respectively in market M_1, and competitors C_3 and C_4 with total ERA actions at year *t-2* c_3 and c_4 respectively in market M2 then COMP_ACT for firm *i* at year *t* is simply the cumulative count equal to $\boldsymbol{c_1+c_2+c_3+c_4}$. As in the first measure of COMP_ACT, I employ a 2-year lag to account for the time required for the focal firm to be aware of the ERA actions of its competitors.

It is important to note that both measures yield similar results for my sample of biopharmaceutical firms (significance and direction). One reason for this may be that firms in my sample serve very similar markets (high market overlap). I discuss this further in the next chapter where I illustrate my empirical results and the discussion chapter.

Firm-specific attributes

Apart from competitors' ERA activity, I see two firm-specific (idiosyncratic) attributes driving firm ERA behaviour; prior experience with ERA and resource commitment. Scholars thus far have provided us with extensive empirical efforts on understanding how these two firm-specific attributes are associated with the focal firm's propensity to engage in a specific strategic action. As I have illustrated in the previous chapter, these two firm-specific attributes hold important theoretical implications in the resource-driven view of ERA (section 4.3.4). Strategy scholars, especially within the RBV tradition, have provided us with several measures of these two important firm-specific attributes. As I will illustrate below, measuring prior experience is a much easier task than measuring resource commitment.

Prior experience with ERA. Scholars have long argued that firm action is a function of historical events (e.g., Mir & Watson, 2000). Empirical studies in the strategy field have predominantly measured firm experience as the aggregate number of prior actions (usually at *t-1* or *t-2*) that the focal firm engages in (e.g., Delios et al., 2008; Yang & Hyland, 2006). Scholars concerned with firm experience in other contexts have employed similar count based measures. For example, in their empirical study of the biopharmaceuticals industry, Nerkar and Roberts (2004) measure firm technological experience as the aggregate count of patents granted in 10 years prior to launch of a new product. In line with these empirical studies, I measure firm's prior experience with ERA (ERA_EXP) as the total number of interfirm inward nonequity-based agreements for firm *i* at *t-2*.

Resource commitment. Strategy scholars have long argued that internal resources direct firm strategic action. As I have discussed in chapter 2, the concept of internal resources has been of particular empirical concern within the theoretical premises of the RBV. As I have illustrated above, competing firms engage in ERA in response to their resource endowments. While internal resources has been of high theoretical importance, their operationalization and measurement remains problematic (e.g., Priem & Butler, 2001). The problem primarily lies with the theoretical premises of the RBV, and more specifically, the VRIN conditions that resources must satisfy in order to be a source of competitive advantage. These very limiting conditions however, make strategic resources hard to measure[53]. Scholars concerned with the dynamics of interorganizational relationships have used several different measures to operationalize firm resource endowments. Most notably, scholars have measured firm resource endowments through R&D intensity. In this case, internal resources express the commitment that a firm makes to R&D (Goerzen, 2007; Schoenecker & Cooper, 1998).

In their empirical study of the biotechnology industry, Nicholls-Nixon and Woo (2003) show that higher levels of commitment in internal R&D are positively associated with the technological output of the firm. In line with this prior empirical research, I measure *resource commitment* (FIRM_RES) by R&D intensity of the focal firm *i* at *t-2*. R&D intensity is defined as R&D expenditures divided by total sales (Chang, 2003; Goerzen, 2007; Schoenecker & Cooper, 1998). Some other scholars have defined R&D intensity as R&D expenditures

[53] Godfrey and Hill (1995: 523) highlight this point by arguing that "the power of the [RBV] theory to explain performance persistence over time is based upon the assumption that certain resources are by their nature unobservable, and hence give rise to high barriers to imitation".

divided by total assets (Miller, 2004). I use the former measurement of R&D intensity. Recently, scholars have criticized the use of R&D intensity as a measure of internal resources. Crook et al. (2008: 1144) argue, for example, that "R&D intensity appears to be a distant proxy for an organization's underlying R&D resources because investment levels say little about the quality of the outputs from those investments". Armstrong and Shimizu (2007: 966) further argue that "…using readily measurable variables is certainly legitimate, but in our opinion, it offers limited contributions towards understanding the real value of the resource-based theory". My operationalization of resource commitment through R&D intensity does not aim on a direct test of RBV per se but a resource-driven view of ERA. As such, R&D intensity is used as a proxy of the commitment of the focal firm to internal resource development, rather than a direct measure of internal resources (for a similar application see Young et al., 2000).

5.5.4 Control Variables

I use three set of variables to control for other effects that may drive firm ERA behaviour. First, I control for *firm size*. Scholars have argued that firm size is positively associated with firm age, and thus controlling for firm size can isolate age related effects and reduce unobserved heterogeneity (Rothaermel & Boeker, 2008). Furthermore, scholars have argued that larger firms exhibit a higher propensity of engaging in collaborative activity than smaller firms (Pangarkar & Klein, 1998). Furthermore, larger firms have a wider range of industry contacts, and more extensive personnel networks (Stuart, 1998). Firm size is measured by the natural logarithm of number of employees for firm *i* at year *t-1* (e.g., Ahuja & Katila, 2001).

Second, I employ a Boolean variable to distinguish between firms incorporated in different *country of origin*. Scholars concerned with alliance behaviour in the biopharmaceuticals industry have found that firms from different countries have different propensities to collaborate due to country-specific characteristics such as culture (Pangarkar & Klein, 1998). As I have illustrated above, my sample firms are predominantly incorporated in the U.S., Europe, and Japan. I employ three distinct Boolean variables for each of these origins of incorporation.

Third, I control for the *financial strength* of the firm. I expect that firms with high levels of financial strength will be more prepared to engage in ERA. I have argued above, that ERA is a strategically complex and risky strategic action. It is not hard to assume that firms with stronger financial ground will be more likely to engage in ERA and more intensively. This could be particularly true when firms are faced with high environmental uncertainty. Furthermore, strong financial performance may be associated with slack resources. I employ three accounting measures to measure financial strength for firm *i* at *t-1*: Return on Assets, Return on Equity, and Debt-to-Equity ratio. These accounting measures have been extensively used in strategic management research as proxies of financial performance (e.g., Wiggins & Ruefli, 2002).

The control variables described above, hold important effects for firm behaviour in the context of ERA. As I have illustrated above, scholars have long identified firm size and financial strength as important firm-specific effects of firm strategic behaviour. While these variables are not of central importance to my conceptual development, I discuss their effects on the hypothesized relationships proposed in the next chapter where I present my empirical results.

5.6 Econometric modelling of dependent variables

I have discussed above the operationalization and measurement of the dependent and independent variables involved in my conceptual framework. In this section, I illustrate appropriate econometric models to test my hypotheses. More specifically, I am concerned with three dependent variables. The first dependent variable ERA_BIN is a binary measure of capturing whether a firm engages in ERA at a specific point in time. The second dependent variable that I am concerned with, ERA_COUNT is a count measure that captures the focal firm's intensity of ERA actions. The third dependent variable, STRAT_DEV, aims to measure strategic similarity among my sample firms over time. As illustrated above, STRAT_DEV can take non-negative continuous values.

To empirically estimate these three dependent variables given my set of independent and control variables discussed above, I need to employ a set of econometric models. Given the nature of my dependent variables, the widely applied linear regression model and the basic Ordinary Least Square (OLS) solution provide an insufficient estimation technique. In my efforts to model firm ERA activity (ERA_BIN and ERA_COUNT), I employ a set of nonlinear regression models specifically designed to address the particular nature of my dependent variables. In the case of strategic similarity, I employ the linear regression model but apply a Generalized Least Square (GLS) estimator rather than OLS.

Recall, that my concern lies with the ERA actions of a set of competing firms over time. These pooling of observations across cross-sectional units (firms) over time (years) is defined as *panel data* (Baltagi, 1995: 1). Panel data offers several advantages over other possible designs (such as time series and cross-sectional

designs[54]), but it also raises certain challenges, especially in the case where the researcher's focus lies with dependent variables that cannot be modelled by the linear regression model. Management scholars have argued that panel data can be employed to demonstrate causality among a set of constructs (Echambadi, Campbell, & Agarwal, 2006). While claiming causality can be an adventurous endeavour, which I do not fully engage, I take under consideration suggestions from these scholars in order to improve the strength of my empirical analysis. In line with (Echambadi et al., 2006: 1804)[55], I employ alternative econometric models as robustness checks to ensure that the correlations among the variables involved in the hypothesized relationships proposed above, are robust across different specifications. Scholars in the strategy literature have highlighted the importance of applying alternative models to avoid biased results when faced with panel data designs (Bowen & Wiersema, 1999).

Furthermore, I employ alternative measures of my constructs to eliminate measurement error and increase the validity of my empirical analysis (Echambadi et al., 2006). More specifically, I employ two sets of measures. The first set is the two lagged year single term for the independent variables described above. The second set is concerned with the natural logarithm values (log) of the two year lagged single term. As I illustrate in more detail in the next chapter where I present my results, these alternative model specifications yield similar results (in terms of direction and significance). The Log models however, perform slightly better. One

[54] For a critique on cross-sectional designs see Bowen and Wiersema (1999).

[55] Echambadi et al. (2006) raise some excellent points on the (mis)treatment of interaction effects. I provide an in-depth discussion of modelling interaction effects in the next chapter.

reason for this slightly better performance, in terms of overall model fit, may be that the log values standardize the single terms of the independent variables.

My aim here is not to be exhaustive of the application of these econometric models, but illustrate the rationale behind choosing these models for estimating my dependent variables, and testing the hypothesized relationships that I am concerned with. To complement my discussion of such rationale, I briefly illustrate how these models are derived. As my interest lies with ERA and firm strategy, I also briefly discuss the application of these econometric models in strategy related empirical work.

5.6.1 Modelling the likelihood of a firm engaging in ERA (ERA_BIN)

ERA_BIN predicts whether firm *i* engages in ERA at time *t*. Put it differently, ERA_BIN captures the probability that ERA (as an event) takes place or not. ERA_BIN is thus coded as a dichotomous (binary) variable. ERA_BIN equals 1 if firm *i* at year *t* engages in 1 or more ERA actions (event occurs) and 0 otherwise (event does not occur). ERA_BIN can be characterized as a limited dependent variable (LDV) as it can only take a limited range of values (in this case 1 or 0). ERA_BIN, as a LDV variable, cannot be estimated by estimators employed for continuous variables such as the OLS model which has been widely applied in strategy research (Wiersema & Bowen, 2009). In contrast with the more straight forward application of linear regression models and the OLS estimator, LDV models are inherently more complex to apply and have been largely misinterpreted by strategy scholars (Hoetker, 2007). I discuss in detail this point in the next chapter where I illustrate my empirical results and steps taken towards a best practice of applying LDV models. Suffice to say here, that there two fundamental

differences between LDV and OLS models. First, LDV models do not satisfy the linearity assumption of the OLS estimated linear regression models and are thus characterized as nonlinear. Second, LDV models are estimated through maximum likelihood, and as such there is no single measure that can describe the "fit" (as is the F-test in the OLS case) of the model to the data (Wiersema & Bowen, 2009).

Given the above, I estimate ERA_BIN through a logistic regression[56] (Logit) model. A Logit model is a specific type of a regression model focusing at binary outcomes (Long, 1997). More specifically to estimate the probability of ERA_BIN equals 1, given a set of independent variables, I need to estimate $P(y=1|x) = F(a+bx)$ [1] where F is the logistic cumulative density function (cdf): $\Lambda(\varepsilon)=\exp(\varepsilon) / 1 + \exp(\varepsilon)$. In my case, I can rewrite [1] as:

$$Pr(ERA\_BIN_{i,t}=1)=F(\beta_0+\beta_1 COMP\_ACT_{i,t-2}+\beta_2 FIRM\_EXP_{i,t-2}+\beta_3 FIRM\_RES_{i,t-2}+\beta_4 FIRM\_EXP_{i,t-2}*FIRM\_RES_{i,t-2}+\beta_5 COMP\_ACT*FIRM\_RES*FIRM\_EXP_{i,t-2}+\beta_6 CONTROLS_{i,t-2}).$$

(Equation 2)

Strategy scholars have employed LDV models (mostly Logit) to predict various strategic actions such as alliance activity (Chung et al., 2000; Park et al., 2002), entry to a new technological subfields (Mitchell, 1989), innovator-imitator race (Ethiraj & Zhu, 2008), and location strategies (Alcácer & Chung, 2007).

[56] For a full proof of the Logit model see (Long, 1997: 40).

5.6.2 Modelling the intensity of a firm engaging in ERA (ERA_COUNT)

I model the second dependent variable of interest, ERA_COUNT, as a count variable that takes non-negative and integer values. A count variable is best modelled by count specific regression models rather than linear regression models (Hausman, Hall, & Griliches, 1984; Long & Freese, 2006). Count regression models assume that variables of interest follow a Poisson distribution as described in equation 3.

$$Pr(y|\square) = \frac{e^{-\square}\square^{y}}{y!} \qquad \text{for y = 0, 1, 2, ...} \qquad \text{(Equation 3)}$$

In the Poisson distribution, the mean and variance equals to μ, and as such the distribution assumes equidispersion. Looking closer at the distribution of ERA_COUNT (figure 5-2), however, I observe an overdispersion[57] of ERA actions towards larger firms (statistically overdispersion is common for count models).

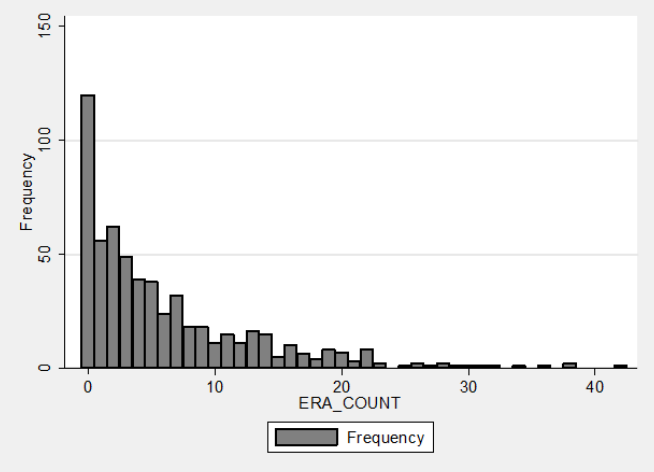


Figure 5-2. Frequency distribution of ERA_COUNT

[57] In the presence of overdispersion, estimates based on the Poisson regression models yield inefficient results (downward biased standard errors). (Long and Freese, 2006: 376).

To account for such overdispersion, I employ a negative binomial regression model as described in equation 4. The negative binomial model accounts for overdispersion among observations by adding a parameter ***a*** that reflects unobserved heterogeneity (Long & Freese, 2006: 243). In my case,

$$\mu = \exp(\beta_0+\beta_1 COMP\_ACT_{i,t-2}+\beta_2 FIRM\_EXP_{i,t-2}+\beta_3 FIRM\_RES_{i,t-2}+\beta_4 FIRM\_EXP_{i,t-2}*FIRM\_RES_{i,t-2}+\beta_5 COMP\_ACT*FIRM\_RES*FIRM\_EXP_{i,t-2}+\beta_6 CONTROLS_{i,t-2} + \varepsilon_i)$$ [58]

where ε_i is the parameter *a*, and assumed to be uncorrelated with the independent variables as in the case of the linear regression model. Given the above calculation of μ, the (Poisson) distribution of observation *i* is calculated by equation 4.

$$Pr(y_i|x_i, \delta_i) = \frac{e^{-\mu_i}\mu_i^{y_i}}{y_i!} \qquad \text{(Equation 4)}$$

If the parameter *a* is equal to zero, then the negative binomial regression model reduces to the Poisson regression model. Following (Long & Freese, 2006), I further test for overdispersion by testing the hypothesis that the parameter *a* equals to zero (H_0: a = 0). To test this hypothesis, I run the full Poisson and negative binomial regression models (including all explanatory variables) and then compare them with an LR test (G^2 $x^2(01)$ test in STATA). More specifically, I find significant evidence of overdispersion (G^2 = 350.943; $p < .01$)[59], and thus the negative binomial regression model is preferred.

[58] From basic algebra E(exp(ε_i)) = 1, which corresponds to the strong exogeneity assumption of the linear regression model.

[59] $G^2 = 2(\ln L_{NBRM} - \ln L_{PRM}) = 2$ (-1437.085 – (-1612.5565)) = 350.943, where L_{NBRM} and LPRM is the Log likelihood for the negative binomial regression model (NBRM) and the Poisson regression model (PRM) respectively (Long and Freese, 2006: 246).

Count models have been extensively applied in strategy research. Most notably, scholars have employed such models to predict organizational performance (e.g., Ahuja & Katila, 2004; Baum et al., 2000; Stuart, 2000), market entry (e.g., Baum & Korn, 1999), competitive actions (e.g., Chen, Su, & Tsai, 2007; Derfus, Maggitti, Grimm, & Smith, 2008), entry in technological fields (George, Kotha, & Zheng, 2008), alliance activity (Park et al., 2002), and boundary spanning search (Rosenkopf & Nerkar, 2001). In line with these studies, I take additional steps to account for unobserved heterogeneity in relation to my panel data design. I discuss this in more detail in section 5.8.4.

5.6.3 Modelling strategic similarity (STRAT_DEV)

As I have illustrated above, I operationalize strategic similarity through the STRAT_DEV measure. STRAT_DEV is a continuous variable (takes continuous values between 0.258 and 4.659) and thus can be estimated through linear least square estimators such as OLS. However, when faced with a panel data design, the OLS assumption of homoscedastic disturbances across time is often violated[60]. Simply, the linear regression model assumption of homoscedastic disturbances suggests that there is no additional information in the regressors about the variances of the disturbances (Baum, 2006: 133). It is thus expected that cross-sectional units (firms) exhibit different variances across time, suggesting the existence of heteroskedasticity (Baltagi, 1995). Another common problem arising with panel data is that estimated errors are not independently distributed (correlated with each other). To account for heteroskedastic disturbances across

[60] Put it differently, this violation implies that estimated errors are either not identically distributed or not independently distributed (non- i.i.d errors). There two general ways to deal with non-i.i.d errors (Baum, 2006).

panels, I employ a Generalized Least Squares (GLS) estimator. In strategy research, (Rothaermel, Hitt, & Jobe, 2006) offer a similar application of GLS estimation to investigate the impact of vertical integration and strategic outsourcing on product success.

5.6.4 Implementation of econometric models using STATA 10.0

As I have illustrated above, there are three dependent variables that I am concerned with. These dependent variables are measured differently and as such are estimated through different econometric models. To employ these econometric models, I use the STATA 10.0 statistical package. STATA is a powerful statistical software with a wide range of features and applications. In contrast with other statistical software packages, STATA offers a command based interface which allows the execution of multiple commands through STATA-specific command files (DO files). This is a powerful feature when dealing with a wide range of models. In addition to STATA basic features, I have employed three additional packages for post-estimation analysis. I have used the *SPost* library developed by Scott Long and colleagues for estimation and graphical analysis of the Logit and count models (Long & Freese, 2006: 9). Recall that hypotheses H3a and H3b are concerned with the interaction effect of COMP_ACT and firm-specific variables FIRM_RES and FIRM_EXP. To estimate and graphically represent this interaction effect, and its impact on the focal firm's ERA activity (likelihood and intensity), I employ the *inteff* command developed by Norton and colleagues (Norton, Wang, & Ai, 2004). Finally, I employed the *estout* package for creating the model tables presented in the next chapter.

As I have illustrated above, my panel data design offers several strengths but also raises several econometric challenges. One such challenge is the existence of

unobserved heterogeneity across panels (firms). To account for the existence of unobserved heterogeneity across firms, I employ the STATA cluster-robust-variance/covariance estimator (VCE)[61]. This estimator accounts for non-i.i.d errors across panels (for a proof of this estimator see Baum, 2006: 139). The VCE estimator is employed through the *cluster*() option available in all three econometric models employed. To run the cluster() option, I develop a firm-specific variable that indicates the structure of within-cluster observations (observations for the same firm). When the cluster() option is included to the regression command, STATA reports standard errors calculated by the VCE estimator (robust standard errors).

Given my panel design, it is very likely that my data are exposed to firm specific effects that are unobserved. To account for such effects, and increase the robustness of my empirical analysis, I employ the fixed-effects[62] counterparts for the models described above. This must be treated as an alternative analytical strategy than the VCE estimator described above. I employ a Hausman-type test (Hausman, 1978) to test the appropriateness of fixed effects models in comparison with alternative models. In the case of the STRAT_DEV estimation through GLS[63], the Hausman test suggests that fixed effects models are more efficient than random effects for my dataset. In the case of the LDV (Logit and negative

[61] The basic idea underlying the VCE estimator is that the estimated logistic probabilities for observations of the outcome (in this case ERA_BIN and ERA_COUNT) in a cluster are more highly correlated than across clusters (Hosmer & Lemeshow, 2004). Practically, the VCE estimator returns larger P values (overstated in the simple versions of the models) for the z statistic for each independent variable in the LDV models.

[62] β coefficients in the fixed-effects Logit models are calculated through Chamberlain's (1980) conditional likelihood function due to the presence of the incidental parameters problem (Baltagi, 1995: 210).

[63] For similar applications in strategy research, the reader can refer to the studies of Gimeno and Woo (1996) and Moliterno and Wiersema (2007).

binomial) models described above, the VCE estimator based models (*logit* and *nbreg* with cluster() option) are more efficient than the fixed-effects models. It is important to note here that these alternative models yield similar results (in terms of estimated β coefficients and standard errors).

Unfortunately, in the case of the nonlinear models presented above (modelling ERA_BIN and ERA_COUNT), the SPost post-estimation library does not support fixed-effects models (in STATA these models are represented by the commands *xtreg* and *xtlogit*). This is an important limitation, given the complexity of interpreting nonlinear LDV models (Hoetker, 2007). As I will illustrate further in the next chapter, the SPost library provides some excellent tools for the graphical representation of the hypothesized relationships tested.

CHAPTER 6.

RESULTS

6.1 Introduction

The main objective of this dissertation is to investigate firm strategic behaviour in the context of ERA. In chapter 4, I have offered a conceptual framework that provides two views of ERA behaviour. First, the competitor-driven view suggests that the focal firm engages in ERA when faced with high levels of competitors' ERA activity (COMP_ACT). I thus expect a positive association between competitors' ERA activity and the focal firm's subsequent ERA actions (H1a,b). Second, the resource-driven view suggests that firms engage in ERA in relation to their idiosyncratic attributes. Empirically, I expect that firm resource commitment (FIRM_RES) and prior experience with ERA (FIRM_EXP) to be positively correlated with the likelihood and intensity of the firm's ERA actions (H2a,b). Finally, I propose that these two views of ERA are complementary. More specifically, hypotheses H3a and H3b investigate how FIRM_RES and FIRM_EXP relate (expected moderating effect) with COMP_ACT.

Overall, my empirical analysis provides support for this first set of hypotheses. Given however the application of non-linear econometric models to test my hypotheses, I interpret the results by not only focusing on the significance and direction of the estimated coefficients, but also I provide graphical representations and marginal effects of the hypothesized relationships. In so doing, I respond to

recent critiques on the application of non-linear models in strategy research (e.g., Hoetker, 2007)

In the second part of my conceptual development, I am concerned with firm ERA behaviour and strategic similarity (H4 and H5). More specifically, I provide empirical evidence on how COMP_ACT, FIRM_EXP and FIRM_RES are associated with strategic similarity (measured through the strategic deviation concept) in the context of ERA (Deephouse, 1999).

This chapter is structured as follows. Section 6.2 provides descriptive statistics and briefly discusses model fit. Sections 6.3 and 6.4 focus on the first set of hypotheses concerned with the likelihood and intensity of the firm engaging in ERA respectively. Section 6.5 extends the empirical findings in predicting firm ERA activity by discussing the marginal effects of the independent variables presented above. Section 6.6 presents empirical results on the second part of the conceptual framework which associates ERA drivers and strategic deviation. Section 6.7 briefly discusses additional effects from my empirical analysis which are not directly relevant to my conceptual framework and hypotheses tested, but have a significant effect on predicting ERA behaviour.

6.2 Descriptive statistics and model fit

Table 6.1 presents summary statistics. In terms of the dependent variables, I observe a significant and positive correlation among ERA likelihood and ERA intensity (0.4413). The mean value of ERA likelihood of 0.797 suggests that sample firms intensively engage in ERA across time. However, the large standard deviations observed indicate an overdispersion of ERA actions across the observed

time frame. I furthermore observe a significant and positive correlation between R&D- and marketing- oriented ERA actions (0.6754). Such correlation confirms (Rothaermel & Deeds, 2004)'s finding on the complementary nature of R&D and marketing related collaborating activities. In addition, strategic deviation is negatively correlated with ERA likelihood and ERA intensity suggesting that across sample firms ERA activity is associated with conformity.

With respect to my independent variables, I do not generally observe high correlations. An exception is the high correlation observed between FIRM_EXP and firm ERA intensity. Recall that ERA intensity is measured as the number of inward collaborative agreements for firm *i* at time *t*. On the other hand, FIRM_EXP is operationalized as the number of inward collaborative agreements for firm *i* at time *t-2*. The significant and high correlation (0.8471) suggests the existence of an important effect between FIRM_EXP and ERA intensity. As I will illustrate below, firm ERA experience is a strong predictor of both the likelihood and intensity of firm's ERA actions. Furthermore, the financial related control variables, Return on Assets (ROA) and Return on Equity (ROE) appear to be highly correlated (0.7492). This is somewhat expected as both of these accounting variables contain net income as part of their calculation. Their positive and significant correlation suggests an expected positive relationship between high levels of total assets and equity as reported in the firm annual reports. I also observe a relatively high correlation between size and the dependent variables ERA_BIN and ERA_COUNT. I discuss further the effect of firm size on ERA_BIN and ERA_COUNT in section 6.7.

Table 6-1 Descriptive Statistics

	Mean	Std. Dev.	Min.	Max.	1	2	3	4	5	6	7
1 ERA intensity	6.128378	7.008605	0	42	1						
2 ERA likelihood	0.7972973	0.4023528	0	1	0.4413*	1					
3 R&D ERA actions	4.141892	5.049682	0	29	0.9640*	0.4139*	1				
4 Marketing ERA actions	1.986486	2.526975	0	16	0.8471*	0.3967*	0.6754*	1			
5 Strategic Deviation	1.625183	0.9753496	0.258988	4.65939	-0.4880*	-0.2240*	-0.4799*	-0.3946*	1		
6 Competitors' ERA activity	190.7027	93.28727	34	348	0.2546*	0.2892*	0.2184*	0.2697*	-0.0075	1	
7 ERA experience	5.297297	6.602783	0	42	0.8190*	0.3616*	0.7794*	0.7141*	-0.4222*	0.3309*	1
8 Resource commitment	0.1511328	0.2374016	0.0049	3.4471	-0.052	-0.0083	-0.0463	-0.0516	0.0135	-0.005	-0.0342
9 Size	4.15612	0.6368739	2	5.2154	0.5442*	0.3862*	0.5050*	0.4998*	-0.3024*	0.1503*	0.5243*
10 Return on Assets	0.0833553	0.0792111	-0.524	0.2689	0.3300*	0.1784*	0.3185*	0.2786*	-0.1152*	0.0821*	0.2935*
11 Return on Equity	0.1773419	0.1937005	-0.7102	2.5317	0.4057*	0.1942*	0.3903*	0.3449*	-0.1792*	0.0333	0.3638*
12 Debt to Equity	1.109995	0.854773	0.0615	6.4847	0.1400*	0.0629	0.1373*	0.1139*	-0.1116*	-0.0187	0.1261*
13 Is American	0.4594595	0.4987752	0	1	0.0131	0.0433	-0.0091	0.0546	0.1341*	-0.002	0.0278
14 Is European	0.3783784	0.4853928	0	1	0.1762*	0.0902*	0.2003*	0.0883*	-0.2164*	-0.0106	0.1496*
15 Is Asian	0.1351351	0.342157	0	1	-0.2232*	-0.1817*	-0.2285*	-0.1623*	0.0927*	0.0149	-0.2110*
16 ERA experience*Resource commitment	0.7524369	1.0598	0	9.4164	0.6366*	0.3216*	0.5976*	0.5709*	-0.3403*	0.3378*	0.8447*
17 Competitors' ERA activity*ERA experience*Resource commitment	177.4016	287.6936	0	2636.592	0.5718*	0.2819*	0.5302*	0.5260*	-0.2951*	0.4497*	0.7894*

	8	9	10	11	12	13	14	15	16	17
8 Resource commitment	1									
9 Size	-0.3723*	1								
10 Return on Assets	-0.3985*	0.3392*	1							
11 Return on Equity	-0.2753*	0.4213*	0.7492*	1						
12 Debt to Equity	-0.1796*	0.4595*	-0.0388	0.2953*	1					
13 Is American	0.1461*	-0.1172*	0.1141*	0.0522	-0.1410*	1				
14 Is European	-0.0894*	0.2931*	0.026	0.1017*	0.2645*	-0.7193*	1			
15 Is Asian	-0.0545	-0.1985*	-0.1966*	-0.2141*	-0.1718*	-0.3644*	-0.3084*	1		
16 ERA experience*Resource commitment	0.1456*	0.3304*	0.1952*	0.2456*	0.0036	0.0405	0.1273*	-0.1903*	1	
17 Competitors' ERA activity*ERA experience*Resource commitment	0.1498*	0.3025*	0.1493*	0.1694*	-0.0032	0.0241	0.1120*	-0.1520*	0.9585*	1

*significant at $p<0.05$; N = 592

The statistical models employed to test hypotheses H1-H5 exhibit a good fit in terms of overall model significance and variance explained (as reported by R^2). Let's first consider the fit of the models predicting firm ERA activity. The alternative models presented in tables 2 and 3 are estimated through maximum likelihood (ML). Assessing the fit of ML-based models is more complicated than linear regression models. While in the case of linear regression models researchers assess model fit through the observed R^2, such approach is inadequate for ML-based models. In line with recent critiques of misinterpreting ML-based models (Hoetker, 2007), I provide 3 different criteria[64] to assess model fit; 1) the LR test; 2) alternative pseudo R^2 measures[65] (McFadden Adjusted R^2 and Cragg-Uhler R^2); and 3) the Bayesian Information Criterion (BIC).

As illustrated in tables 6.2 and 6.3, the LR test[66] for all alternative models is significant at $p < 0.001$ indicating that I can safely reject the null hypothesis H_0: $\beta_0 = ... = \beta_k = 0$, for K predictor variables. I furthermore observe a significant increase over the control only model (LR = 116.942) when explanatory variables are included. The pseudo R^2's, presented here, further reflect the LR test for alternative models[67]. In terms of the McFadden's adjusted R^2, I observe a significant increase over the controls model when COMP_ACT, FIRM_EXP and

64 I use the fitstat command in STATA developed, as part of the SPost library, by Long and Freese (2006) to estimate these criteria.

65 Pseudo R2 measures reported here must not be interpreted as directly equivalent to the OLS R2 (Hoetker, 2007: 339).

66 For a complete proof of calculating the LR test see Long (1997:103).

67 In addition, I have calculated the adjusted count R2 for all the alternative models. The adjusted count R^2 captures the proportion of correct predictions for Pr(ERA_BIN)=1 beyond the number that would be correctly predicted by choosing the largest marginal (Long, 1997: 108). The controls only model exhibits an adj. Count R^2 of 0.042 compared to 0.256 for the full model. In line with the pseudo R2 measures presented above, the full model significantly outperforms the controls only model in terms of goodness of fit.

FIRM_RES are included both individually and simultaneously ranging between 0.198

Table 6-2 Alternative Logit models for predicting firm ERA likelihood (ERA_BIN)

		H1a			H2a			H2a: Interaction of FIRM_EXP*FIRM_RES			
	Controls	**M1.2.2**	**M1.2.7**	**M1.3.8**	**M1.3.7**	**M1.4.2**	**M1.4.8**	**M1.5.1**	**M1.5.1i**	**M1.5.5**	**M1.5.5i**
$COMP\_ACT_{i,t-2}$		0.00708**									
		(0.003)									
$COMP\_ACT_{i,t-2}$			1.09036***								
			(0.313)								
$FIRM\_EXP_{i,t-2}$				0.95226***				0.67491***	0.37440*		
				(0.170)				(0.157)	(0.180)		
FIRM _EXPi,t-2 (log)					1.69116***					1.34611***	0.73805
					(0.224)					(0.232)	(0.967)
$FIRM\_RES_{i,t-2}$						2.00761		0.43612	0.34199		
						(1.800)		(0.547)	(0.467)		
FIRM_RESi,t-2 (log)							1.90857***			1.52007***	1.62265***
							(0.300)			(0.403)	(0.483)
$FIRM\_EXP*FIRM\_RES_{i,t-2}$									2.11837+		
									(1.316)		
FIRM_EXP*FIRM_RESi,t-2 (log)											-0.25939
											(0.369)
Sizei, $_{t-1}$	1.99777***	1.72179***	1.75744***	0.71070**	0.51879	2.31036***	2.85019***	1.11852***	1.25329***	1.45548***	1.50869***
	(0.380)	(0.347)	(0.346)	(0.247)	(0.322)	(0.443)	(0.395)	(0.308)	(0.297)	(0.397)	(0.441)
ROA $_{i,t-1}$	-8.29641	-9.88227	-10.50201	-8.17893	-15.33286**	-2.50710	2.17155	-10.70926**	-10.85423**	-8.97450	-8.10964
	(6.336)	(6.269)	(6.578)	(5.432)	(5.020)	(6.179)	(4.091)	(3.923)	(4.103)	(6.053)	(6.653)
ROE $_{i,t-1}$	4.74169	5.47042	5.74378	3.81252	6.97245**	2.82284	1.10902	5.74648*	5.74591*	4.86763	4.55445
	(3.818)	(3.742)	(3.936)	(3.512)	(2.650)	(2.907)	(1.998)	(2.248)	(2.370)	(3.158)	(3.352)
D-E $_{i,t-1}$	-0.81215*	-0.73204*	-0.75754*	-0.44843+	-0.48883**	-0.67774*	-0.42802*	-0.67456**	-0.63677**	-0.36522+	-0.36381+
	(0.36)	(0.342)	(0.346)	(0.247)	(0.156)	(0.287)	(0.210)	(0.210)	(0.211)	(0.201)	(0.197)
Is US firm	0.16768	0.11242	0.12336	-0.10291	0.27631	-0.12429	-1.28536**	-0.24319	-0.37766	-0.80318*	-0.85408*
	(0.446)	(0.454)	(0.466)	(0.266)	(0.331)	(0.534)	(0.427)	(0.359)	(0.364)	(0.406)	(0.432)
Is Japanese firm	-0.94573**	-1.06037**	-1.08328**	-0.17857	0.61916+	-0.48753	-1.85832***	-0.34382	-0.52386*	-0.65976	-0.70644
	(0.329)	(0.384)	(0.389)	(0.236)	(0.324)	(0.425)	(0.564)	(0.251)	(0.263)	(0.430)	(0.459)
Is European firm	-0.16671	-0.10283	-0.09047	-0.59577*	-0.34855	-1.04462**	-2.32558***	-0.81030**	-0.95327**	-1.55488**	-1.60333**
	(0.352)	(0.407)	(0.421)	(0.294)	(0.313)	(0.346)	(0.404)	(0.301)	(0.326)	(0.480)	(0.516)
Constant	-5.62156***	-5.82843***	-10.12673***	-2.44977***	-0.83942	-7.17968***	-3.88322***	-3.26559**	-3.63911***	-0.15255	-0.08178
	(1.307)	(1.185)	(1.805)	(0.715)	(1.153)	(1.741)	(1.018)	(1.044)	(0.960)	(0.811)	(0.781)
Log Likelihood	-236.5433	-222.2826	-218.8899	-174.4226	-120.5021	-230.2508	-203.1268	-187.8151	-185.5127	-114.0534	
McFadden's Adj. R^2	0.198	0.216	0.228	0.378	0.34	0.185	0.277	0.326	0.33	0.367	0.363
Cragg-Uhler R^2	0.285	0.346	0.36	0.531	0.479	0.306	0.419	0.478	0.487	0.513	0.514
LR test: x^2	116.942***	145.463***	152.248***	241.183***	151.134***	126.304***	180.552***	211.176***	215.781***	164.031	164.408
BIC	517.736	495.593	488.807	399.873	290.832	511.515	457.267	433.021	434.793	284.163	290.015

					H3a: COMP_ACT*FIRM_EXP*FIRM_RES							
	M1.6.1		**M1.6.1.i**		**M1.6.2**		**M1.6.2i**		**M1.6.3**		**M1.6.3i**	
$COMP\_ACTi_{,t-2}$					0.00333	(0.002)	0.00503+	(0.003)				
$COMP\_ACT_{i,t-2}$ (log)	0.41057+	(0.300)	0.40705+	(0.302)					0.42587	(0.262)	0.70710+	(0.362)
$FIRM\_RES_{i,t-2}$ *$FIRM\_EXP_{i,t-2}$					0.04197***	(0.013)	0.08373**	(0.027)				
$FIRM\_RES_{i,t-2}$ *$FIRM\_EXP_{i,t-2}$ (log)									6.00640***	(1.537)	23.06058*	(10.535)
$FIRM\_RES_{i,t-2}$*****$FIRM\_EXP_{i,t-2}$ (log)	-0.70040***	(0.111)	-0.63504	(0.709)								
$COMP\_ACT_{i,t-2}$*$FIRM\_RES_{i,t-2}$*$FIRM\_EXP_{i,t-2}$ (log)											-3.25408+	(1.999)
$COMP\_ACT_{i,t-2}$ *$FIRM\_RES_{i,t-2}$ *$FIRM\_EXP_{i,t-2}$							-0.00019+	(0.000)				
$COMP\_ACT_{i,t-2}$*****$FIRM\_RES_{i,t-2}$***** $FIRM\_EXP_{i,t-2}$ (log)			-0.01309	(0.144)								
Size $_{i,t-1}$	0.57694+	(0.336)	0.57616+	(0.335)	1.31028***	(0.259)	1.27077***	(0.254)	1.16934***	(0.245)	1.10639***	(0.241)
Return on Assets (ROA) $_{i,t-1}$	-14.38749*	(5.660)	-14.44633**	(5.483)	-13.78441***	(3.236)	-13.33556***	(3.293)	-10.78795*	(4.843)	-10.26318*	(4.974)
Returns on Equity (ROE) $_{i,t-1}$	6.67678*	(2.957)	6.72436*	(2.818)	7.01175***	(2.077)	6.40038**	(2.146)	5.18619+	(3.141)	4.51977	(3.142)
Debt-to-Equity (D-E) $_{i\,,\,t-1}$	-0.53045***	(0.153)	-0.53183***	(0.158)	-0.67237***	(0.173)	-0.64321***	(0.176)	-0.45120*	(0.205)	-0.41922*	(0.212)
Is US firm	0.44673	(0.358)	0.45665	(0.376)	-0.46813	(0.368)	-0.56644	(0.370)	-0.58929+	(0.341)	-0.71843*	(0.350)
Is European firm	0.83743*	(0.371)	0.83880*	(0.372)	-0.5679+	(0.3)	-0.57585*	(0.291)	-0.78615**	(0.287)	-0.80078**	(0.278)
Is Japanese firm	-0.33271	(0.316)	-0.32819	(0.304)	-1.16148***	(0.331)	-1.18741***	(0.331)	-1.26442***	(0.335)	-1.29121***	(0.329)
Constant	-3.08794	(1.947)	-3.07810	(1.951)	-4.04281***	(0.909)	-4.13475***	(0.933)	-5.45613***	(1.613)	-6.54633**	(2.001)
Log Likelihood	-123.1779		-123.1742		-185.5346		-183.2144		-170.6853		-168.9844	
McFadden's Adj. R^2	0.321		0.316		0.334		0.338		0.384		0.387	
Cragg-Uhler R^2	0.464		0.464		0.486		0.495		0.54		0.547	
LR test: x^2	145.782***		145.790***		215.737***		220.377***		245.435***		248.837***	
BIC	302.412		308.633		428.46		430.196		398.761		401.736	

Notes:

N = 592 across 37 firms

Models have been estimated by taking into account intragroup correlation across panels (in STATA, through the cluster() option)

Standard errors in parentheses; significant at: $^{+}$ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 6-3 Alternative negative binomial regression models for predicting ERA intensity (ERA_COUNT)

		H1b				H2b	
	Controls	**M1.2.2**	**M1.2.7**	**M1.3.8**	**M1.3.7**	**M1.4.2**	**M1.4.8**
$COMP\_ACTi_{,t-2}$		0.00321***					
		(0.001)					
$COMP\_ACT_{i,t-2}$ (log)			0.54539***				
			(0.095)				
$FIRM\ \_EXP_{i,t-2}$				0.08718***			
				(0.013)			
$FIRM\ \_EXP_{i,t-2}$ (log)					0.68863***		
					(0.037)		
$FIRM\_RES_{i,t-2}$						1.55714+	
						(1.076)	
$FIRM\_RES_{i,t-2}$ (log)							0.88172***
							(0.161)
Size $_{i,t-1}$	1.18472***	1.16093***	1.16620***	0.60644***	0.29740***	1.36242***	1.48820***
	(0.171)	(0.178)	(0.176)	(0.129)	(0.071)	(0.199)	(0.165)
Return on Assets (ROA) $_{i,t-1}$	2.57583+	0.26549	0.31562	0.76676	0.54761	1.93378	2.20621**
	(1.427)	(1.848)	(1.849)	(0.908)	(0.522)	(1.377)	(0.837)
Returns on Equity (ROE) $_{i,t-1}$	0.49275**	0.91272	0.87178	0.18845	0.17925+	0.48155	0.25920
	(0.178)	(0.606)	(0.585)	(0.206)	(0.105)	(0.440)	(0.272)
Debt-to-Equity (D-E) $_{i\ ,\ t-1}$	-0.16907	-0.24258	-0.25069+	-0.12597+	-0.03531	-0.19464	-0.09949
	(0.126)	(0.154)	(0.152)	(0.075)	(0.035)	(0.134)	(0.090)
Is US firm	0.33435	0.50371*	0.50362*	0.23089+	0.24863***	0.18790	-0.39385+
	(0.205)	(0.196)	(0.196)	(0.136)	(0.067)	(0.257)	(0.215)
Is Japanese firm	0.50591**	0.54521**	-0.11545	0.05633	0.33064***	-0.16252	-0.67384***
	(0.174)	(0.175)	(0.150)	(0.122)	(0.062)	(0.146)	(0.165)
Is European firm	0.01243	0.54521**	0.54551**	0.23393*	0.12149+	0.26153	-0.33672
	(0.130)	(0.175)	(0.175)	(0.116)	(0.071)	(0.237)	(0.270)
Constant	-3.90739***	-0.72564***	-0.7759***	-1.72451***	-0.91841***	-4.61720***	-2.60024***
	(0.695)	(0.205)	(0.213)	(0.482)	(0.272)	(0.835)	(0.413)
Log Likelihood	-1936.326	-1506.709	-1498.212	-1430.15	-1236.373	-1518.104	-1472.781
LR test: x^2	325.466***	382.174***	399.169***	535.293***	588.589***	355.990***	446.636***
McFadden's Adj. R^2	0.091	0.107	0.112	0.152	0.186	0.099	0.126
Cragg-Uhler R^2	0.426	0.479	0.494	0.599	0.688	0.456	0.534
BIC	3127.531	3077.202	3060.207	2924.083	2535.031	3099.975	3009.33

	H2b: FIRM_EXP*FIRM_RES				H3b: COMP_ACT*FIRM_EXP*FIRM_RES			
	M1.5.3	**M1.5.3i**	**M1.5.5**	**M1.5.5i**	**M1.6.1**	**M1.6.1i**	**M1.6.4**	**M1.6.4i**
$COMP\_ACT_{i,t-2}$							0.00181** (0.001)	0.00392*** (0.001)
$COMP\_ACT_{i,t-2}$ (log)					0.15600** (0.054)	0.22141* (0.104)		
$FIRM\_EXP_{i,t-2}$	0.08159*** (0.012)	0.07890*** (0.018)						
$FIRM\_RES_{i,t-2}$	0.87290+ (0.545)	0.85242+ (0.578)						
FIRM $\_EXP_{i,t-2}$ (log)			0.64926*** (0.047)	0.10373 (0.095)				
$FIRM\_RES_{i,t-2}$ (log)			0.16193+ (0.099)	0.55619*** (0.097)				
$FIRM\_EXP_{i,t-2}$*$FIRM\_RES_{i,t-2}$ (log)				-0.24266*** (0.042)	-0.28193*** (0.025)	-0.38771** (0.129)		
$FIRM\_EXP_{i,t-2}$*$FIRM\_RES_{i,t-2}$		0.01961 (0.119)					0.35249*** (0.065)	1.20026*** (0.200)
$FIRM\_EXP_{i,t-2}$*$FIRM\_RES_{i,t-2}$ *$COMP\_ACT_{i,t-2}$ (log)						0.02071 (0.026)		
$FIRM\_EXP_{i,t-2}$*$FIRM\_RES_{i,t-2}$ *$COMP\_ACT_{i,t-2}$								-0.00350*** (0.001)
$Size_{i,t-1}$	0.71469*** (0.152)	0.71914*** (0.149)	0.39847*** (0.106)	0.45606*** (0.097)	0.26174* (0.129)	0.27160* (0.131)	0.97907*** (0.126)	1.00783*** (0.126)
Return on Assets (ROA) $_{i,t-1}$	1.55488+ (0.912)	1.55979+ (0.899)	0.76767+ (0.447)	0.91824* (0.448)	0.02591 (0.990)	0.03833 (0.998)	0.89274 (1.225)	1.46293^ (1.100)

(continued in the next page)

Returns on Equity (ROE) $_{i,t-1}$	0.08741	0.08371	0.13325	0.13288	0.47015*	0.46425*	0.41258	0.04213
	(0.200)	(0.199)	(0.095)	(0.082)	(0.215)	(0.214)	(0.340)	(0.309)
Debt-to-Equity (D-E) $_{i\,,\,t-1}$	0.10276	-0.10162	-0.01889	-0.01173	-0.11862	-0.11718	-0.15725^	-0.14084+
	(0.074)	(0.074)	(0.032)	(0.034)	(0.073)	(0.073)	(0.096)	(0.083)
Is US firm	0.10265	0.09963	0.11203	0.04767	0.55100***	0.54809***	0.25902+	0.24492^
	(0.169)	(0.165)	(0.111)	(0.094)	(0.120)	(0.121)	(0.154)	(0.153)
Is Japanese firm	0.09500	-0.09675	0.01154	-0.12608	0.25987**	0.25395**	-0.13155	-0.11854
	(0.121)	(0.121)	(0.104)	(0.106)	(0.083)	(0.083)	(0.125)	(0.131)
Is European firm	0.13133	0.12715	0.19739+	0.07332	0.65863***	0.65528***	0.26152^	0.23111^
	(0.144)	(0.147)	(0.114)	(0.100)	(0.094)	(0.095)	(0.159)	(0.158)
Constant	-2.25254***	-2.26651***	-2.19756***	-2.29827***	-1.59038*	-1.96009*	-1.15412***	-1.18217***
	(0.619)	(0.603)	(0.230)	(0.220)	(0.618)	(0.847)	(0.219)	(0.206)
Log likelihood	-1422.649	-1422.603	-1233.492	-1224.071	-1270.127	-1269.75	-1437.31	-1404.262
LR test: x^2	546.900***	546.992***	594.352***	613.194***	521.081	521.835	517.578***	583.675***
McFadden Adj. R^2	0.155	0.154	0.187	0.192	0.163	0.163	0.146	0.165
Cragg-Uhler R^2	0.607	0.607	0.692	0.703	0.644	0.644	0.587	0.631
BIC	2915.443	2921.727	2535.497	2522.884	2608.769	2614.243	2944.764	2885.044

Notes:

N = 592 across 37 firms

Models have been estimated by taking into account intragroup correlation across panels (in STATA, through the cluster() option)

Standard errors in parentheses; significant at: $^{+}$ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001

(controls) and 0.387 (full model). Similarly for the Cragg-Uhler R^2, I observe a significant increase on fit between the controls only model (0.285) and the full model (0.547). While I cannot comment on the magnitude of R^2 observed, this significant increase in magnitude indicates that the explanatory variables of interest outperform the controls only model in terms of variance explained. To further assess the goodness of fit of the models presented, I employ the Bayesian Information Criterion (BIC). The BIC measure is used to compare nested and non-nested alternative models (Long, 1997: 110). Referring back to tables 6.2 and 6.3, the smaller the BIC value the better the fit with the data observed. In support with the other measures of fit, I observe a significantly lower value of models including the explanatory variables of interest compared to the controls only model. In terms of best fit, models M1.5.5 and M1.6.1 exhibit the lower BIC values. Furthermore, the log term models outperform their original counterparts. Comparing single term models, M1.3.7 is the best performing model indicating the strong explanatory power of firm ERA experience in predicting ERA likelihood.

Let's now consider the goodness of fit for the count models employed to predict ERA intensity. I employ alternative negative binomial regression models[68] to predict ERA intensity. Similar to the above, the count models employed here are estimated with maximum likelihood. As such, I use the same set of criteria to assess goodness of fit. As illustrated in tables 4 and 5, the LR test indicates that all alternative models explain a greater proportion of variance compared to the restricted model (constant only). In line with the LR test, both pseudo R^2 measures illustrate a significant increase on variance explained by the full model compared

[68] As a robustness check I have also estimated the Poisson version of the alternative models reported here. The Poisson models yield similar results in terms of the direction and the significance reported in the negative binomial regression models presented in Table 6.3.

to controls only model. The full model exhibits a McFaden Adj. R^2 of 0.165 compared to 0.091 to the controls only model. In terms of the Cragg-Uhler R^2, the full model outperforms the controls only model by 0.2. When I introduce the independent variables separately, FIRM_EXP related models are the strongest performers on every measure of fit. In contrast, FIRM_RES models provide a marginal increase over the controls only model both in pseudo R^2 measures and the BIC. Model M1.5.5i exhibits the smallest BIC with 2522.884 significantly outperforming the full model.

I now discuss the overall fit of the GLS alternative models predicting strategic deviation. In contrast with the above, the GLS estimator is based on the linear regression model assumptions and as such the goodness of fit is assessed similarly to its OLS counterpart by referring to model's R^2. To account for intra-group correlation, I employ the cluster option implemented in STATA. Overall, the alternative models exhibit a higher R^2 both within and between group (firm) observations compared to the controls only model ranging from 0.0946 to 0.5509. More specifically, the alternative models explain a large variance across firms but perform poorly in between firm observations. As illustrated in table 6.1, I observe a significant increase in between R^2 of all alternative models over the controls only model. The full model performs similarly with models M1.3.2 and M1.5.1 but significantly outperforms the controls only model and other alternative models.

6.3 Results on hypotheses predicting firm ERA likelihood

Hypothesis H1a posits that COMP_ACT will positively affect the focal firm's ERA likelihood. As illustrated in Table 6.2, COMP_ACT has a positive and highly

significant relationship with ERA likelihood in all alternative models tested (single term model: $\beta = 0.007$, $p<0.05$; log model: $\beta = 1.093$, $p<0.001$). Thus, H1a is supported. As it is illustrated in figure 6.1, higher levels of COMP_ACT are associated with higher levels of likelihood (predicted probability) of the focal firm to engage in ERA.

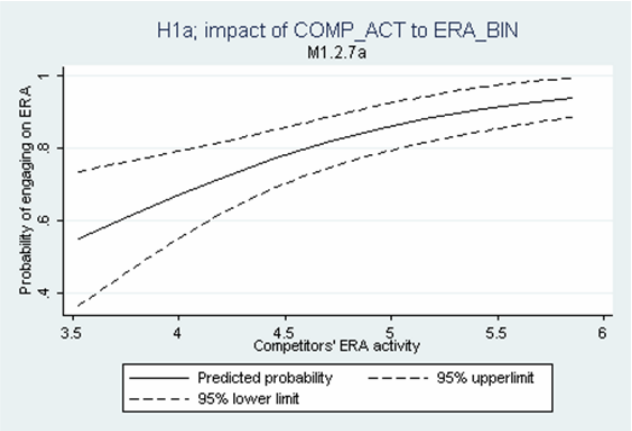


Figure 6-1. Impact of COMP_ACT on firm ERA likelihood

As illustrated by the confidence intervals (figure 6.1), the model predicting ERA likelihood given COMP_ACT performs better at higher values of predicting Pr(ERA_BIN=1). Furthermore, COMP_ACT has a stronger effect at lower levels of predicting ERA_BIN than at higher levels. Put it differently, an increase at COMP_ACT from 3.5 to 5 (log model) will increase the predicted probability by 0.4. At higher levels of COMP_ACT, an increase of COMP_ACT from 5 to 6 will increase Pr(ERA_BIN) by 0.2.

Hypothesis H2a posits that there is a positive relationship between firm's prior ERA experience (FIRM_EXP) and its resource commitment (FIRM_RES). As illustrated in Table 6.2, both FIRM_EXP ($\beta = 0.952$; $p<0.001$) and FIRM_RES ($\beta = 1.908$; $p<0.001$) exhibit a highly significant and positive relationship with firm ERA likelihood. In the case of resource commitment however, only one of the models provides support. More specifically, when FIRM_RES is measured as the

firm's R&D intensity lagged by two years (Model M1.4.2) the effect is positive but non-significant. In the log alternative model, the coefficient of FIRM_RES turns highly significant and as before positive (Model M1.4.8). One explanation for the non-significance of the single term model may be that R&D intensity takes very small values compared to the rest of the continuous variables included in the statistical model. By introducing the logged term, the assumed distribution of FIRM_RES better matches the distribution of the other variables in the model. Given the above, hypothesis H2a is supported both for FIRM_EXP and FIRM_RES. As above, figure 2 further illustrates the predicted probability of firm ERA likelihood given certain levels of FIRM_EXP and FIRM_RES.

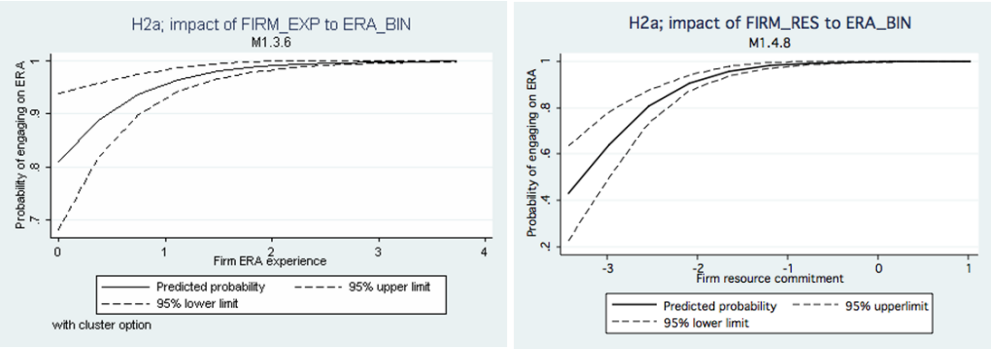


Figure 6-2. The impact of FIRM_EXP and FIRM_RES on firm ERA likelihood

Figure 6.2 provides important insights to the above predicted relationship. In the case of FIRM_EXP, I observe a very strong effect for firms with no experience and firms that previously performed at least one ERA action. Overall, the change in the range of the predicted probability is relatively small as firms with zero ERA experience are very likely to engage in ERA (predicted probability changes from 0.8 to 0.96). I observe a similar effect for the impact of resource commitment to firm ERA likelihood. In this case however, the effect of FIRM_RES is larger as the predicted probability changes from a minimum of 0.4 to 0.9. Given the above,

H2a is generally supported but figure 2 suggests a non-linear relationship between FIRM_EXP, FIRM_RES and firm ERA likelihood.

To further investigate the above hypothesis, I test for potential interaction effects between FIRM_EXP and FIRM_RES. As it is illustrated in Table 6.2, alternative models suggest the existence of an interaction effect between FIRM_EXP and FIRM_RES as a) the interaction variable coefficient is significant ($p<0.05$), b) there is a (slight) increase on the pseudo R square value of the interaction model (BIC larger for the interaction effect model). Given however the nature of the dependent variable of interest, I take under consideration suggestions of Norton and colleagues (Norton et al., 2004)[69] on interpreting interaction effects, and produce a graphical representation of the interaction effect across my sample ("true" interaction effect for every observation). Figure 6.3 illustrates the existence of an interaction effect between FIRM_RES and FIRM_EXP. As it is illustrated, the effect of FIRM_RES*FIRM_EXP is positive for firms with low ERA likelihood while it turns negative for firms with high ERA likelihood with an inflection point around 0.5 of the predicted probability. As illustrated in the right hand side graph of figure 6.3, for most of the observations in the sample, the interaction effect is not significant, especially for firms with high ERA likelihood, indicating a weak effect of the interaction term.

[69] I use the inteff library developed by Norton and colleagues (2003) on STATA to graphically illustrate interaction effects.

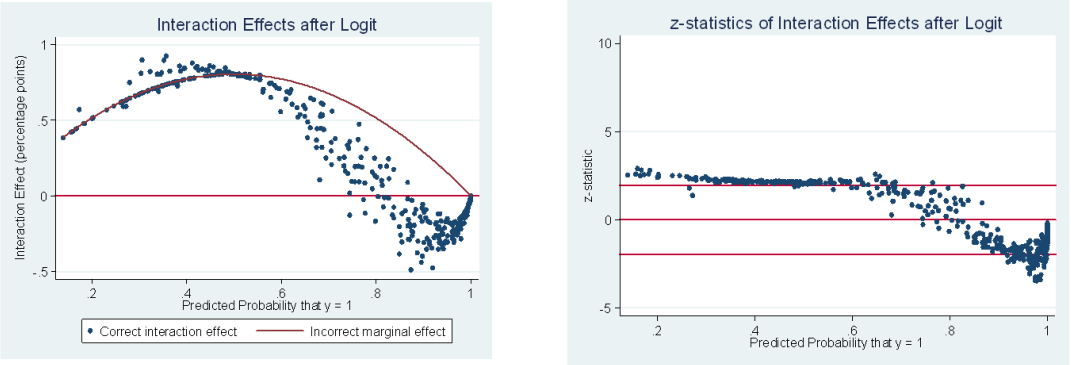


Figure 6-3. Interaction effect of FIRM_EXP and FIRM_RES

Hypothesis H3a posits that FIRM_EXP and FIRM_RES significantly moderate the impact of COMP_ACT to firm ERA likelihood. As illustrated above investigating interaction effects on non-linear models is a challenging exercise as the marginal effect of the interaction term depends on the effect of the other independent variables to the dependent variable (Long & Freese, 2006). More specifically, as illustrated in Table 6.2 (model M1.6.3), the interaction effect of interest is negative and significant while both single terms of COMP_ACT and FIRM_EXP*FIRM_RES are positive and significant. While this will be sufficient to conclude that a moderating effect exists, in non-linear models this is not a sufficient condition (Bowen & Wiersema, 2004). Following best practice, I first employ the Norton and colleagues (2004) estimation function to calculate the "true" interaction effect between FIRM_EXP*FIRM_RES and COMP_ACT across my sample (see footnote 74). Figure 6.4 illustrates the relationship between the interaction term and the predicted probability of the likelihood of firm engaging in ERA being one.

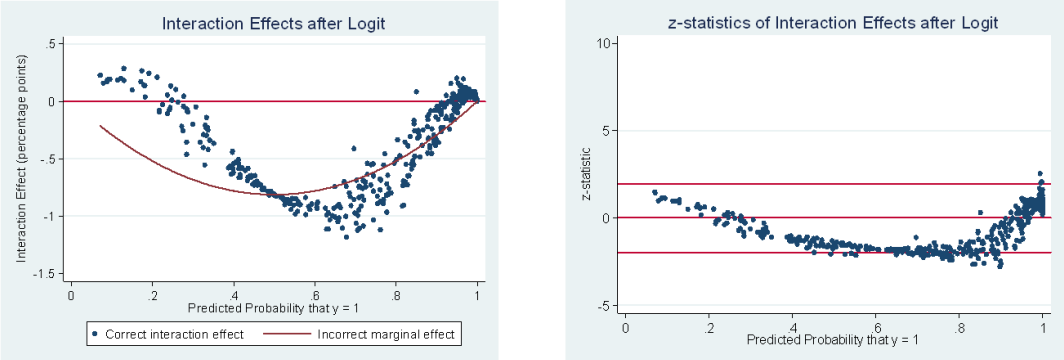


Figure 6-4. Interaction effect of FIRM_EXP*FIRM_RES and COMP_ACT

I observe a curvilinear moderating effect between the predicted probability and the interaction term with an inflection point around 0.7 and range between 0.1 and 0.9. For lower values of the predicted probability, the more negative the interaction effect the higher the likelihood of a firm engaging in ERA. As the predicted probability approaches 1, the interaction effect impact is reversed. Less negative values are associated with higher predicted probability of observing Pr(ERA_BIN)=1. Furthermore, figure 4 provides us with an important insight on the outliers of the predicted probability distribution. I observe that firms with very low and very high predicted ERA likelihood exhibit the lowest interaction effect.

6.4 Results on hypotheses predicting firm ERA intensity

H1b posits that COMP_ACT positively affects the focal firm's ERA intensity. As illustrated in Table 6.3, COMP_ACT has a positive and significant impact on ERA_COUNT ($\beta = 0.545$; $p<0.001$) thus providing support for H1b. As both Poisson and negative binomial estimators are based on Maximum Likelihood (Long, 1997), I provide a graphical representation of the hypothesized relationship to assist interpretation. In contrast with the ERA likelihood graphs presented in section 3, I plot the predicted probability of observing ***zero*** ERA intensity given

variables of interest. In light of consistency, the plotted graphs must be interpreted as predicting the opposite effect of the one hypothesized.

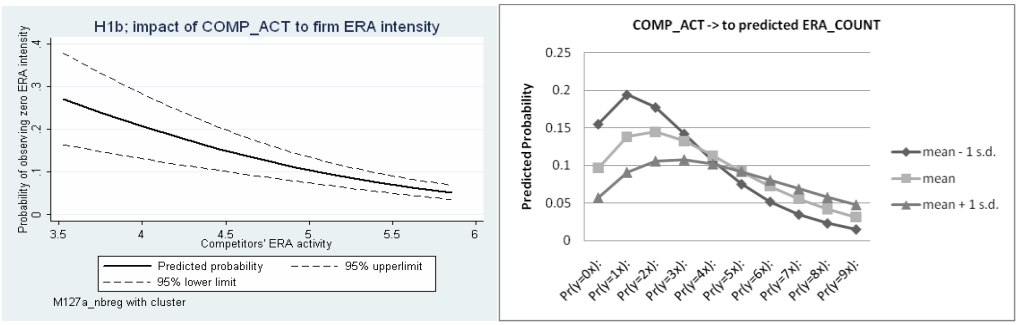


Figure 6-5. Impact of COMP_ACT to firm ERA intensity

As illustrated in Figure 6.5, the higher the value of COMP_ACT the lower the probability of observing zero ERA intensity. To disentangle this effect further, I plot the impact of COMP_ACT to ERA intensity for low ERA counts (0-9). As it is illustrated from the right hand side graph in figure 6.5, for zero, one, two, and three predicted ERA intensity (counts predicted) the higher the COMP_ACT (± one standard deviation around COMP_ACT mean)the higher the probability of observing a higher ERA count (intensity). However, for higher ERA counts (4 and above) I observe a reversed effect around COMP_ACT mean. While alternative statistical models tested suggest an overall positive and significant impact of COMP_ACT to ERA intensity such impact significantly decreases for higher predicted values of ERA intensity. I disentangle this effect further in section 6.5 where I discuss the magnitude (marginal effects) of the independent variables of interest and their relationship to ERA likelihood and intensity. Taking the above under consideration, H1b is supported.

H2b posits that firm ERA experience and resource commitment are positively related with ERA intensity. As illustrated in Table 6.3, I found a positive and

significant relationship of FIRM_EXP (β = 0.688; p < 0.001) and FIRM_RES (β = 0.881; p < 0.001) to predicted ERA intensity, providing support for hypothesis H2b.

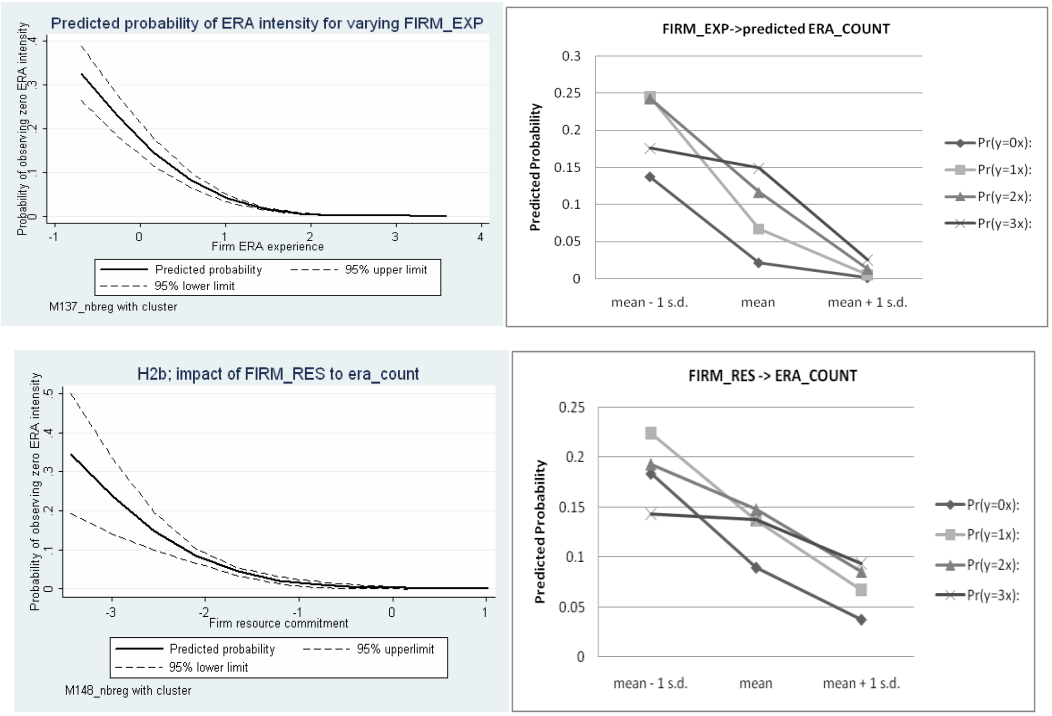


Figure 6-6. Impact of FIRM_EXP and FIRM_RES to ERA intensity

Figure 6.6 illustrates the positive relationship between FIRM_EXP, FIRM_RES and ERA intensity. The higher the FIRM_EXP and FIRM_RES the lower the predicted probability of observing zero ERA intensity. The effect is stronger for firms exhibiting low levels of FIRM_EXP and FIRM_RES while turning zero for very large values of FIRM_EXP and FIRM_RES. I investigate further hypothesis H2b by testing for an interaction effect between FIRM_EXP and FIRM_RES. As illustrated in Table 6.3, I observe a significant moderating effect of FIRM_EXP*FIRM_RES. Such moderating effect suggests that while taken individually FIRM_EXP and FIRM_RES are positively related with ERA intensity, their interaction is negatively associated with ERA intensity. This

finding suggests a competing effect of FIRM_EXP and FIRM_RES when predicting ERA intensity.

H3b posits a moderating effect of firm propensity factors (FIRM_EXP and FIRM_RES) between COMP_ACT and ERA intensity. Taking together, models M1.6.3 and M1.6.3i suggest the existence of a significant moderating effect providing support for hypothesis H3b. The interaction term of FIRM_EXP*FIRM_RES and COMP_ACT, introduced in model M1.6.3i, is significant and negative while the single terms remain significant and positive suggesting the existence of a moderating effect. The moderating effect presented in model M1.6.3i is supported by investigating the marginal effect of the interaction term across the sample (both factor and marginal change).

6.5 Marginal effects

In sections 6.3 and 6.4, I have presented results on hypotheses concerned with predicting firm ERA activity (H1-H3). The above results provide overall support for my hypothesized relationships in terms of direction. It is also important to gain a more in-depth understanding on the magnitude of the effects observed. In doing so, one can compare the predictive power of the independent variables to the dependent variables of interest. Scholars concerned with empirically investigating strategic behaviour, rarely discuss marginal effects in their empirical analysis. Following recent critiques on the application of nonlinear models to understand strategic choice (Wiersema & Bowen, 2009), I briefly discuss the magnitude (marginal effects) of the hypothesized relationships predicting firm ERA activity. Table 6.4 summarizes the marginal effects of the three main variables of interest,

COMP_ACT, FIRM_RES and FIRM_EXP, and their interaction, to firm ERA likelihood and intensity.

Let's first investigate the marginal effects of COMP_ACT, FIRM_EXP and FIRM_RES independently for ERA likelihood and intensity. In terms of predicting firm ERA likelihood, FIRM_RES exhibits the strongest marginal effect with 0.1749 compared to COMP_ACT and FIRM_EXP with 0.1232 and 0.0554 respectively. More importantly, when all three values are introduced to the full model, the combined marginal effect of FIRM_EXP and FIRM_RES significantly outperforms that of COMP_ACT. This observation illustrates that FIRM_RES*FIRM_EXP is much stronger predictor of firm ERA likelihood than COMP_ACT.

In terms of predicting ERA intensity, I overall observe the same patterns on the marginal effects of explanatory variables. In this case however, individual marginal effects of COMP_ACT, FIRM_EXP and FIRM_RES are stronger. FIRM_RES has the strongest marginal effect with 8.3028 compared to COMP_ACT and FIRM_RES with 0.0137 and 0.3615 respectively. Again, when COMP_ACT and FIRM_RES*FIRM_EXP (firm propensity) are introduced in the full model, firm propensity strongly outperforms COMP_ACT. The marginal effects observed in the full model, illustrate the existence of a strong moderating effect of firm propensity to the relationship of COMP_ACT and firm ERA intensity. More specifically, the marginal effect of the interaction term COMP_ACT*FIRM_EXP*FIRM_RES is almost equal with the marginal effect of COMP_ACT. Taken together, these marginal effects illustrate that firm propensity is a much stronger predictor of firm ERA intensity than competitors' ERA activity. As such I would expect firms with high ERA propensity to engage in ERA with a

high intensity irrespective its competitors' actions. However, the marginal and factor change of the propensity term suggests that there is a large variation of the marginal effect of firm propensity around its mean. Put it differently, firms with varying degrees of ERA propensity will respond very differently when engaging in ERA.

Table 6-4. Marginal and factor change of variables predicting firm ERA likelihood and intensity

Predicting ERA likelihood (effects reported from Logit)			
	Marginal change in predicted probability as independent variable changes from 1/2 standard deviation below base to 1/2 standard deviation above holding all other variables constant (at their mean)	***Marginal effect*** (the partial derivative of the predicted probability/rate with respect to a given independent variable)	***Factor change*** of independent variable for a standard deviation around its mean, holding all other variables constant (at their mean)
Competitors ERA activity (COMP_ACT)	0.0758 (0.079)	0.0008 (0.1232)	
Firm ERA experience (FIRM_EXP)	0.0694 (log model)	0.0554 (log model)	
Firm resource commitment (FIRM_RES)	0.1061 (log model)	0.1749 (log model)	
Firm propensity model[70]			
FIRM_EXP	0.0483	0.0059	
FIRM_RES	0.0013	0.0054	
*FIRM_EXP*FIRM_RES*	0.0423	0.0033	

[70] Values have been extracted from model M1.5.1i by running the SPost prchange command (Long & Freese, 2006) in STATA.

FULL MODEL[71] (Hypothesis H3a)			
COMP_ACT	0.004	0.0062	
FIRM_EXP*FIRM_RES	0.999	0.2018	
COMP_ACT*(*FIRM_EXP*FIRM_RES*)	-0.9873	-0.0285	
Predicting ERA intensity (effects reported from negative binomial regression models; log model effects in parentheses)			
Competitors ERA activity (COMP_ACT)	1.2770 (1.4675)	0.0137 (2.2901)	1.3485 (1.4158)
Firm ERA experience (FIRM_EXP)	2.3594 (3.7735)	0.3615 (3.2932)	1.7533 (2.1596)
Firm resource commitment (FIRM_RES)	1.8218 (2.1871)	8.3028 (3.6470)	1.5128 (1.6867)
Firm propensity model			
FIRM_EXP	0.5462	0.4882	1.1230
FIRM_RES	1.4389	2.6179	1.3560
FIRM_EXP*FIRM_RES	-2.8411	-1.1421	- 0.5517
FULL MODEL (Hypothesis H3b)			
COMP_ACT	1.6114	2.5179	1.9098
FIRM_EXP*FIRM_RES	25.5309	14.7156	43.8733
COMP_ACT*(*FIRM_EXP*FIRM_RES*)	-21.3290	-2.4191	-0.5371

6.6 ERA and strategic choice: predicting strategic deviation

I have illustrated above how competitors' ERA activity, firm ERA experience and its resource commitment are associated with the likelihood and intensity of engaging in ERA actions. My empirical analysis so far provides statistical support for the hypotheses proposed in chapter 4 and my conceptual framework. In this section, I provide empirical results for hypotheses H4 and H5 which connect the strategic deviation concept, as a proxy of strategic similarity, to the independent variables of interest. While so far I have illustrated how and in what magnitude

[71] Values have been extracted from model M1.6.3i by running the SPost prchange command (Long & Freese, 2006) in STATA.

COMP_ACT, FIRM_EXP and FIRM_RES, and their interaction, predict firm ERA activity, the empirical analysis presented in this section provide further insights for the competitive behaviour of my sample firms in the context of ERA.

Hypotheses H4 and H5 predict the relationship between COMP_ACT, FIRM_RES and FIRM_EXP and strategic deviation (STRAT_DEV). The STRAT_DEV measure empirically captures the relevant distance of a firm's strategy compared with the sample mean. Briefly, I focus on two relevant strategic dimensions; R&D-oriented ERA and market-oriented ERA (see section 5.5.2 for a rationale for choosing these strategic dimensions). Across these two dimensions, I calculate the STRAT_DEV measure for firm *i* at time *t*. Figure 6.7 illustrates the time trend for the two strategic dimensions that the STRAT_DEV measure calculation is based. In total, firms in the sample engage in more R&D-oriented ERA actions than market-oriented ERA actions. The time trend illustrated in figure 6.7 suggests that firm ERA behaviour changes over time. More specifically, between 1991 and 2006, firms focus more on R&D related ERA actions rather than marketing related ERA actions, as RND_ERA mean is almost two times larger than MKT_ERA mean. Looking closely at the sample, this observation supports the industrial model that large biopharmaceuticals firms were faced with resource constraints after the emergence of the biotechnology paradigm. Going back to figure 6.7, I observe two convergent points in 1995 (0.28 v 0.40) and 2005 (0.40 v 0.51) where RND_ERA and MKT_ERA proportional means almost equate. In the discussion chapter, I provide a detailed discussion on additional empirical analysis that I have carried out to investigate this important trend of firm ERA behaviour in relation to the biotechnology paradigm.

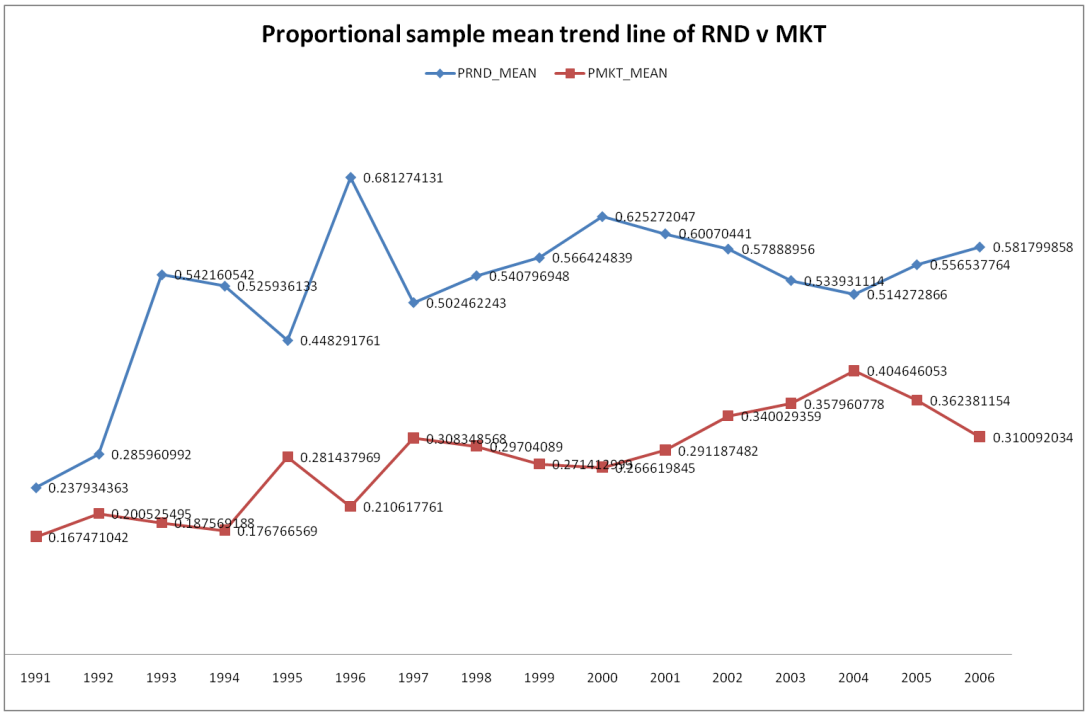


Figure 6-7. Proportional sample mean trend line of RND v MKT ERA

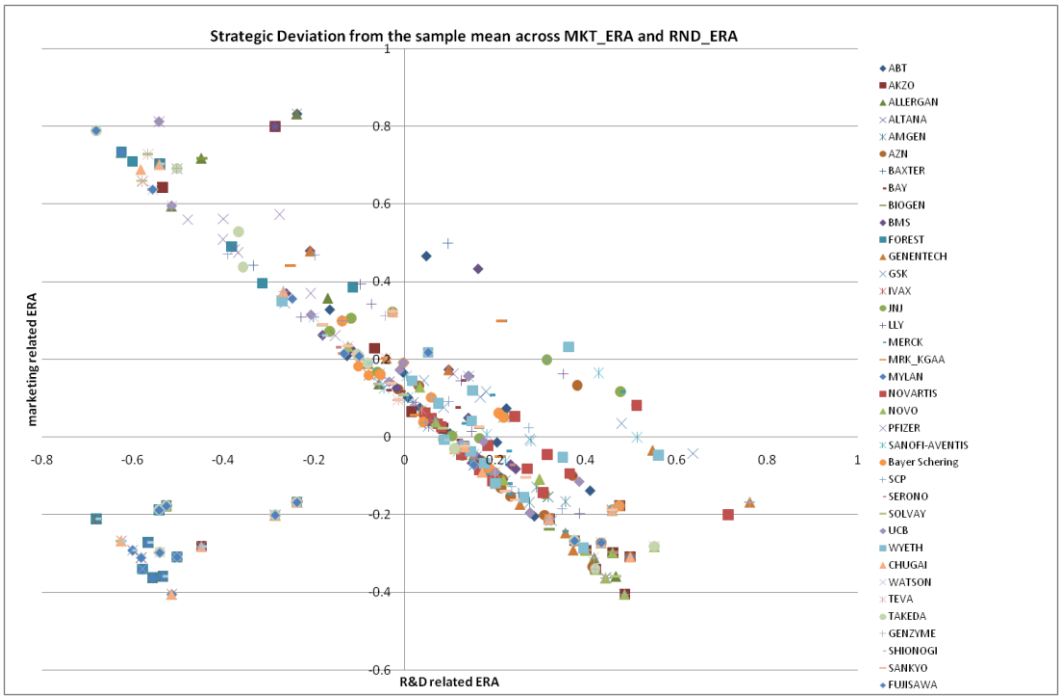


Figure 6-8. Strategic Deviation scatter plot for sample firms

Figure 8 illustrates strategic deviation of firm *i* at time *t* compared with the rest of the sample population and the sample mean. I analytically observe a similar

pattern for most of the observations in the sample. More specifically, firms exhibit the same proportion of agreements across the two strategic dimensions of MKT_ERA and RND_ERA.

As I have illustrated in the previous chapter, I operationalize STRAT_DEV as a continuous variable. I employ two set of statistical estimations to predict STRAT_DEV. I start with the OLS estimator as the base line as it is the most applied estimator of panel data in strategy research. I then provide a Generalized Least Square (GLS) estimator to account for any violations of the general linear model assumptions that my panel data may be sensitive to (refer to section 5.6.3 for a complete rationale on this). I first discuss the results on hypotheses proposed above based on the GLS estimation models.

As illustrated in Table 6.1, STRAT_DEV takes continuous values between 0.258 and 4.659 with a mean of 1.625 and a standard deviation 0.975. Recall that STRAT_DEV captures the strategic distance across a set of strategies for my sample firms. The lower the value of STRAT_DEV the smaller the firm's strategic distance compare to the sample mean at a particular point in time. In contrast, the higher the STRAT_DEV the more differentiated the firm from the sample mean across a set of strategies. Going back to Table 6.1, I observe a negative correlation between STRAT_DEV and ERA likelihood and ERA intensity (dependent variables in the above section).

Tables 6.5 (single term) and 6.6 (log term) illustrates the alternative GLS models for predicting STRAT_DEV. In the first model, I introduce only the control variables. The model suggests that Return on Equity (ROE) is negatively associated with STRAT_DEV ($\beta = -0.36932$; $p < 0.05$). This result suggests that

firms with poor financial performance will exhibit a lower STRAT_DEV, and thus conforming towards their competitors. However, when independent variables of interest are introduced in later models ROE turns insignificant. In addition, the controls only model illustrates a strong and negative relationship between European firms (Is European) and STRAT_DEV ($\beta = -0.42245$; $p < 0.001$). This effect is consistent across all alternative models.

As above, I proceed with my statistical analysis by introducing each variable to a separate model and then provide a full model by including all variables. Model M1.2.2 illustrates a non-significant and very weak relationship between COMP_ACT and STRAT_DEV. In turn, Model M1.3.2 reveals a highly significant and negative relationship between FIRM_EXP and STRAT_DEV ($\beta = -0.4557$; $p < 0.001$). This finding suggests that firms with higher levels of FIRM_EXP will exhibit lower levels of STRAT_DEV. In terms of FIRM_RES, Model M1.4.2 provides no support for a significant relationship with STRAT_DEV. In the log term version (M1.4.8), however, the relationship above turns significant ($\beta = -0.25332$; $p < 0.01$). This alternative model suggests a negative and significant relationship between FIRM_RES and STRAT_DEV.

Table. 6-5. Alternative GLS estimation SINGLE TERM fixed effects models for predicting strategic deviation (STRAT_DEV)

	M1.2.2		M1.3.2		M1.4.2		M1.5.1		M1.5.1i		M1.6.4		M1.6.4i	
	Coef	Std. Err	Coef	Std. Err	Coef	Std. Err	Coef	Std. Err	Coef	Std. Err	Coef	Std. Err	Coef	Std. Err
$COMP\_ACT_{i,t-2}$	-0.00126**	0									-0.00068+	0	-0.00061	0
$FIRM\_EXP_{i,t-2}$			-0.03876***	-0.008			-0.03902***	-0.008	-0.03844**	-0.013				
$FIRM\_RES_{i,t-2}$					0.11123	-0.231	0.18472	-0.226	0.18651	-0.229				
$FIRM\_EXP_{i,t-2}$*$FIRM\_RES_{i,t-2}$									-0.00422	-0.074	-0.14325**	-0.05	-0.06352	-0.16
$FIRM\_EXP_{i,t-2}$*$FIRM\_RES_{i,t-2}$ *$COMP\_ACT_{i,t-2}$													-0.00029	-0.001
Size $_{i,t-1}$	0.84948***	-0.206	0.72095***	-0.174	0.52160**	-0.176	0.73607***	-0.178	0.73831***	-0.182	0.85479***	-0.205	0.86606***	-0.206
Return on Assets (ROA) $_{i,t-1}$	-0.96441	-0.846	-0.91584	-0.834	-1.14882	-0.916	-0.94636	-0.898	-0.94312	-0.901	-1.12155+	-0.873	-1.13102^	-0.874
Returns on Equity (ROE) $_{i,t-1}$	-0.15478	-0.343	-0.16561	-0.339	-0.13528	-0.347	-0.15733	-0.34	-0.15767	-0.34	-0.14278	-0.342	-0.16177	-0.344
Debt-to-Equity (D-E) $_{i\,,\,t-1}$	0.06356	-0.067	0.05956	-0.066	0.05803	-0.068	0.05927	-0.067	0.05933	-0.067	0.05708	-0.067	0.05894	-0.067
Constant	-1.62564*	-0.811	-1.12450^	-0.71	-0.50332	-0.744	-1.21301^	-0.742	-1.22278^	-0.763	-1.63348*	-0.811	-1.70147*	-0.822
Overall R^2	0.037		0.064		0.024		0.066		0.066		0.052		0.053	

Notes:

N = 592 across 37 firms; Observations per group: min=13; avg.=15.9;max=16

Significant at: $^{+}$ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001

Country Dummies (Boolean) dropped

Table 6-6. Alternative GLS estimation LOG TERM fixed effects models for predicting strategic deviation (STRAT_DEV)

	M1.2.7		M1.3.6		M1.4.8		M1.5.5		M1.5.5i		M1.6.1		M1.6.1i	
	Coef	**Std. Err**	**Coef**	**Std. Err**	**Coef**	**Std. Err**	**Coef**	**Std. Err**	**Coef**	**Std. Err**	**Coef**	**Std. Err**	**Coef**	**Std. Err**
$COMP\_ACT_{i,t-2}$	-0.18064**	0.063									-0.29765**	0.091	-0.05986	0.114
$FIRM\_EXP_{i,t-2}$			-0.27717***	0.06			-0.22481***	0.056	-0.52672**	0.2				
$FIRM\_RES_{i,t-2}$					-0.18012^	0.132	-0.14057	0.159	0.03006	0.192				
$FIRM\_EXP_{i,t-2}$*$FIRM\_RES_{i,t-2}$									-0.13319^	0.085	0.02481	0.03	-0.43589**	0.138
$FIRM\_EXP_{i,t-2}$*$FIRM\_RES_{i,t-2}$ *$COMP\_ACT_{i,t-2}$													0.09262***	0.027
Size $_{i,t-1}$	0.83015***	0.203	0.53596*	0.245	0.49634**	0.173	0.70981**	0.22	0.82010***	0.231	0.94218***	0.241	0.82602***	0.241
Return on Assets (ROA) $_{i,t-1}$	-0.9614	0.846	0.11985	1.01	-1.50434+	0.9	-0.04525	0.972	0.1604	0.979	-0.11566	0.95	-0.13944	0.939
Returns on Equity (ROE) $_{i,t-1}$	-0.13477	0.343	-0.20281	0.339	-0.1049	0.347	-0.21935	0.341	-0.23155	0.34	-0.21673	0.34	-0.24999	0.336
Debt-to-Equity (D-E) $_{i\ ,\ t-1}$	0.06687	0.067	0.05403	0.074	0.04917	0.068	0.08925^	0.07	0.0854	0.069	0.12993+	0.07	0.13710*	0.07
Constant	-0.8756	0.721	-0.44243	1.047	-0.73368	0.755	-1.52494^	0.971	-1.60189+	0.971	-0.94848	0.901	-1.59577+	0.911
Overall R^2	0.037		0.055		0.027		0.055		0.06		0.06		0.083	

Notes:

N = 592 across 37 firms; Observations per group: min=13; avg.=15.9;max=16

Significant at: $^{+}$ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001

Country Dummies (Boolean) dropped

Table 6-7. Alternative GLS estimation SINGLE TERM random effects models for predicting strategic deviation (STRAT_DEV)

	M1.2.2		M1.3.2		M1.4.2		M1.5.1		M1.5.1i		M1.6.4		M1.6.4i	
	Coef	Std. Err	Coef	Std. Err	Coef	Std. Err	Coef	Std. Err	Coef	Std. Err	Coef	Std. Err	Coef	Std. Err
$COMP\_ACT_{i,t-2}$	-0.00003	0.001									0.00078+	0.001	0.00064	0.001
$FIRM\_EXP_{i,t-2}$			-0.04557***	0.01			-0.04476***	0.008	0.05365***	0.015				
$FIRM\_RES_{i,t-2}$					-0.17828	0.203	-0.08126	0.154	-0.10955	0.148				
$FIRM\_EXP_{i,t-2}$*$FIRM\_RES_{i,t-2}$									0.06505	0.076	-0.21317***	0.059	-0.31644*	0.158
$FIRM\_EXP_{i,t-2}$*$FIRM\_RES_{i,t-2}$ *$COMP\_ACT_{i,t-2}$													0.00039	0.001
Size $_{i,t-1}$	-0.14837	0.119	0.02318	0.11	-0.16279	0.13	0.00951	0.119	0.01722	0.118	-0.11544	0.107	-0.1124	0.108
Return on Assets (ROA) $_{i,t-1}$	-0.19846	0.593	-0.07967	0.53	-0.79468	0.68	-0.4808	0.658	-0.52547	0.66	-0.50803	0.59	-0.52663	0.599
Returns on Equity (ROE) $_{i,t-1}$	-0.38956*	0.181	-0.28479*	0.14	-0.31064+	0.181	-0.23529	0.143	-0.23028	0.144	-0.26764	0.168	-0.22861	0.17
Debt-to-Equity (D-E) $_{i\,,\,t-1}$	0.04328	0.08	0.0168	0.07	0.02991	0.082	0.00866	0.069	0.0121	0.069	0.01575	0.071	0.01265	0.071
Is US firm	-0.02944	0.142	0.08139	0.11	0.00934	0.14	0.10134	0.12	0.09201	0.124	0.11323	0.135	0.12118	0.126
Is Japanese firm	-0.40774***	0.123	-0.28909**	0.09	-0.38098**	0.121	-0.27543**	0.093	-0.28907**	0.093	-0.24542*	0.12	-0.23779*	0.114
Is European firm	-0.02219	0.153	-0.02868	0.15	-0.02836	0.154	-0.03501	0.152	-0.04247	0.153	-0.00468	0.152	-0.00417	0.152
Constant	2.45703***	0.446	1.88608***	0.4	2.56341***	0.48	1.97319***	0.426	1.95332***	0.42	2.23149***	0.388	2.24654***	0.396
R^2 (within)	0.0005		0.0344		0.0012		0.0352		0.0352		0.0149		0.0146	
R^2 (between)	0.3164		0.5641		0.351		0.5687		0.5687		0.5459		0.5509	
R^2 (overall)	0.0994		0.199		0.1108		0.2021		0.2021		0.1794		0.5509	
Wald chi square	54.67***		102.31***		46.66***		112.73***		112.73***		130.96***		133.57***	

Notes:
N=592 across 37 firms; Observations per group: min=13; avg.=15.9; max=16
Significant at: + p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 6-8 Random effects GLS estimation LOG TERM models for predicting strategic deviation (STRAT_DEV)

	M1.2.7		M1.3.7		M1.4.8		M1.5.5		M1.5.5i		M1.6.1		M1.6.1i	
	Coef	Std. Err	Coef	Std. Err	Coef	Std. Err	Coef	Std. Err	Coef	Std. Err	Coef	Std. Err	Coef	Std. Err
$COMP\_ACT_{i,t-2}$	-0.01386	0.082									0.06554	0.083	0.30670***	0.079
$FIRM\_EXP_{i,t-2}$			-0.29752***	0.039			-0.27907***	0.05	-0.26828+	0.163				
$FIRM\_RES_{i,t-2}$					-0.25332*	0.109	-0.08025	0.135	-0.08502	0.131				
$FIRM\_EXP_{i,t-2}$*$FIRM\_RES_{i,t-2}$									0.00432	0.076	0.13510***	0.022	-0.44127***	0.101
FIRM_EXPi,t-2*FIRM_RESi,t-2 *COMP_ACTi,t-2													0.11340***	0.02
Size $_{i,t-1}$	-0.12881	0.116	-0.03457	0.12	-0.21425+	0.123	-0.06939	0.149	-0.06807	0.142	-0.0396	0.124	-0.02071	0.119
Return on Assets (ROA) $_{i,t-1}$	-0.2311	0.591	0.78464	0.667	-1.01396	0.744	0.61596	0.773	0.60054	0.758	0.88433	0.645	0.84843	0.654
Returns on Equity (ROE) $_{i,t-1}$	-0.37963*	0.178	-0.34693*	0.153	-0.26091	0.176	-0.32711*	0.157	-0.32618*	0.155	-0.37684*	0.149	-0.41415**	0.156
Debt-to-Equity (D-E) $_{i\ ,\ t-1}$	0.04164	0.08	0.03112	0.067	0.00787	0.08	0.02539	0.067	0.02583	0.067	0.05195	0.073	0.07105	0.065
Is US firm	-0.03512	0.144	0.12229	0.105	0.20511	0.137	0.1858	0.168	0.18668	0.159	0.05843	0.117	-0.01707	0.113
Is Japanese firm	-0.41925***	0.124	-0.22593*	0.09	-0.18411	0.141	-0.1653	0.154	-0.16602	0.146	-0.29608***	0.09	-0.34752***	0.089
Is European firm	-0.02387	0.154	-0.01419	0.196	0.1273	0.168	0.04114	0.214	0.04263	0.209	-0.06942	0.192	-0.12481	0.193
Constant	2.44957***	0.584	2.10490***	0.431	2.05591***	0.469	2.01630***	0.408	1.99863***	0.444	1.79237**	0.629	0.58709	0.564
R^2 (within)	0.001		0.0275		0.0026		0.0271		0.0271		0.0175		0.0475	
R^2 (between)	0.3006		0.6652		0.4482		0.6626		0.6616		0.6536		0.6491	
R^2 (overall)	0.0956		0.2204		0.1408		0.2208		0.2207		0.2119		0.2359	
Wald chi square	53.29***		189.30***		59.48***		180.96***		181.17		175.85***		172.35***	

Notes:
N=592 across 37 firms; Observations per group: min=13; avg.=15.9; max=16
Significant at: + p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 6-9 Robustness check - OLS alternative models for predicting strategic deviation

OLS estimation SINGLE TERM models for predicting strategic deviation (with cluster option)

	controls only		COMP_ACT(M1.2.2)		FIRM_EXP(M1.3.2)		FIRM_RES(M1.4.2)		FIRM_PROP(M1.5.1)		FIRM_PROP(M1.5.1i)		FULL MODEL(M1.6.4)		FULL MODEL(M1.6.4i)	
	coeff.	Std. Err	coeff.	Std. Err	coeff.	std. err	coeff.	std. err	coeff.	std. err	coeff.	std. err	coeff.	std. err	coeff.	std. err
COMP_ACT (t-2)			0.00034	0.001									0.00127**	0.001	0.00101+	0.001
FIRM_EXP(t-2)					-0.05441***	-0.009			-0.05174***	-0.009	-0.05931***	-0.016				
FIRM_RES(t-2)							-0.58626*	-0.274	-0.27956+	-0.201	-0.31391+	-0.197				
FIRM_EXP(t-2)*FIRM_RES(t-2)											0.05355	-0.077	-0.28028***	0.054	-0.44141**	0.159
FIRM_EXP(t-2)*FIRM_RES(t-2)*COMP_ACT(t-2)															0.00063	0.001
SIZE(t-1)	-0.42496**	-0.129	-0.43548**	0.133	-0.12841	-0.127	-0.48136***	-0.133	-0.17031	-0.137	-0.1644	-0.139	-0.29682*	0.119	-0.29363*	0.121
ROA(t-1)	1.26807	-0.916	1.23834	0.902	0.72038	-0.616	-0.16512	-0.854	-0.02829	-0.736	-0.0312	-0.737	0.18227	0.682	0.10574	0.669
ROE(t-1)	-0.78878*	-0.308	-0.77599*	0.303	-0.28284	-0.189	-0.53766*	-0.25	-0.17296	-0.165	-0.17307	-0.162	-0.27053	0.233	-0.18650	0.206
D-E(t-1)	0.1204	-0.101	0.12330	0.101	0.02853	-0.071	0.08087	-0.1	0.01223	-0.073	0.01627	-0.072	0.02773	0.077	0.02113	0.075
IS_AMERICAN	0.04755	-0.127	0.05243	0.131	0.14572	-0.102	0.15905	-0.128	0.19636+	-0.107	0.19094+	-0.109	0.20348+	0.113	0.21152+	0.108
IS_EUROPEAN	-0.26024*	-0.113	-0.25385*	0.115	-0.16696+	-0.086	-0.17353	-0.123	-0.12916	-0.096	-0.1386	-0.099	-0.09096	0.112	-0.08381	0.109
IS_ASIAN	0.0331	-0.151	0.03491	0.151	0.00892	-0.148	0.03162	-0.156	0.00696	-0.15	0.00273	-0.151	0.03979	0.149	0.03931	0.149
Constant	3.36378***	-0.475	3.33368***	0.469	2.40178***	-0.436	3.72538***	-0.495	2.63006***	-0.49	2.61316***	-0.494	2.76524***	0.408	2.80415***	0.412
R square	0.1204		0.1214		0.2098		0.1375		0.2143		0.2151		0.1915		0.1935	

N=592; significance levels at ***p<0.001, **p<0.05, *p<0.1; +p<0.10

OLS estimation LOG TERM models for predicting strategic deviation (with cluster option)

	COMP_ACT(M1.2.7)		FIRM_EXP(M1.3.7)		FIRM_RES(M1.4.8)		FIRM_PROP(M1.5.5)		FIRM_PROP(M1.5.5i)		FULL MODEL(M1.6.1)		FULL MODEL(M1.6.1i)	
	coeff.	std. err	coeff.	std. err	coeff.	std. err	coeff.	std. err	coeff.	std. err	coeff.	std. err	coeff.	std. err
COMP_ACT (t-2)	0.04031	-0.09									0.14386+	-0.081	0.38525***	-0.07
FIRM_EXP (avg 2 lags)			-0.36469***	-0.039			-0.34429***	-0.062	0.2055+	-0.163				
FIRM_RES (avg 2 lags)					-0.37780***	-0.092	-0.0749	-0.148	-0.13688	-0.146				
FIRM_EXP (avg 2 lags)*FIRM_RES (avg 2 lags)									0.05447	-0.072	0.17876***	-0.022	-0.39163***	-0.1
FIRM_EXP (avg 2 lags)*FIRM_RES (avg 2 lags)*COMP_ACT (t-2)													0.11276***	-0.02
SIZE(t-1)	-0.43273**	-0.132	-0.08579	-0.137	-0.50729***	-0.134	-0.1287	-0.197	-0.13942	-0.193	-0.02314	-0.139	0.00804	-0.138
ROA(t-1)	1.24503	-0.905	1.39886+	-0.701	-0.38976	-0.822	1.22033	-0.787	1.17343	-0.773	1.70192*	-0.671	1.76569*	-0.686
ROE(t-1)	-0.78222*	-0.304	-0.36159+	-0.18	-0.37571+	-0.218	-0.33014+	-0.181	-0.33032+	-0.175	-0.44362*	-0.168	-0.49976*	-0.187
D-E(t-1)	0.12236	-0.101	0.02257	-0.069	0.02096	-0.089	0.01369	-0.068	0.01528	-0.068	0.05644	-0.071	0.07301	-0.068
IS_AMERICAN	0.05116	-0.131	0.16176+	-0.092	0.38447***	-0.104	0.22217	-0.153	0.24656+	-0.145	0.07864	-0.103	0.003	-0.101
IS_EUROPEAN	-0.25565*	-0.116	-0.13865	-0.087	0.06959	-0.153	-0.07881	-0.173	-0.06041	-0.166	-0.24622**	-0.084	-0.29852**	-0.084
IS_ASIAN	0.03403	-0.151	0.00232	-0.195	0.24207	-0.178	0.0538	-0.226	0.07864	-0.224	-0.0735	-0.189	-0.1274	-0.19
Constant	3.18608***	-0.578	2.29677***	-0.473	2.76627***	-0.4	2.25584***	-0.434	2.13338***	-0.462	1.32401*	-0.613	0.07174	-0.564
R square	0.1211		0.2246		0.1611		0.2255		0.2264		0.2169		0.2423	

N=592; significance levels at ***p<0.001, **p<0.05, *p<0.1; +p<0.10

In relation to hypotheses H4 and H5 of predicting STRAT_DEV, full model M1.6.4 suggests that COM_ACT exhibits a positive and significant relationship with STRAT_DEV ($\beta = 0.00078$; $p < 0.10$) while the interaction term FIRM_EXP*FIRM_RES, describing firm ERA propensity, is significantly and negatively associated with STRAT_DEV ($\beta = -0.21317$; $p < 0.001$). These statistical findings, taken together, suggest that firms faced with high levels of COM_ACT will exhibit a higher tendency to strategically differentiate while higher FIRM_EXP and FIRM_RES (as firm-specific propensity factors to engage in ERA) are negatively associated with STRAT_DEV and thus leading to conformity. In addition, model M1.6.4i illustrates that there is no significant interaction of competitors' ERA activity and firm propensity predicting STRAT_DEV.

6.7 The significant effect of firm size in predicting firm ERA activity

The specified models presented above illustrate several important effects that have not being covered above as they are not directly part of my conceptual framework. Consistently across the econometric alternative models employed, I found firm size to be a significant predictor of firm ERA activity (ERA_BIN and ERA_COUNT). Scholars in the strategy literature have consistently highlighted the important effect of firm size on organizational action. I add to this discussion by briefly discussing the effect of firm size in predicting firm ERA activity.

Let's first consider the significant effect of firm size when predicting ERA likelihood and ERA intensity. As illustrated from the estimated alternative models, firm size has a highly significant and positive relationship with both ERA

likelihood and intensity. More specifically, larger firms in the sample will exhibit a higher probability engaging in ERA than smaller firms for the same level of COMP_ACT, FIRM_EXP and FIRM_RES. Figure 9 graphically illustrates this effect.

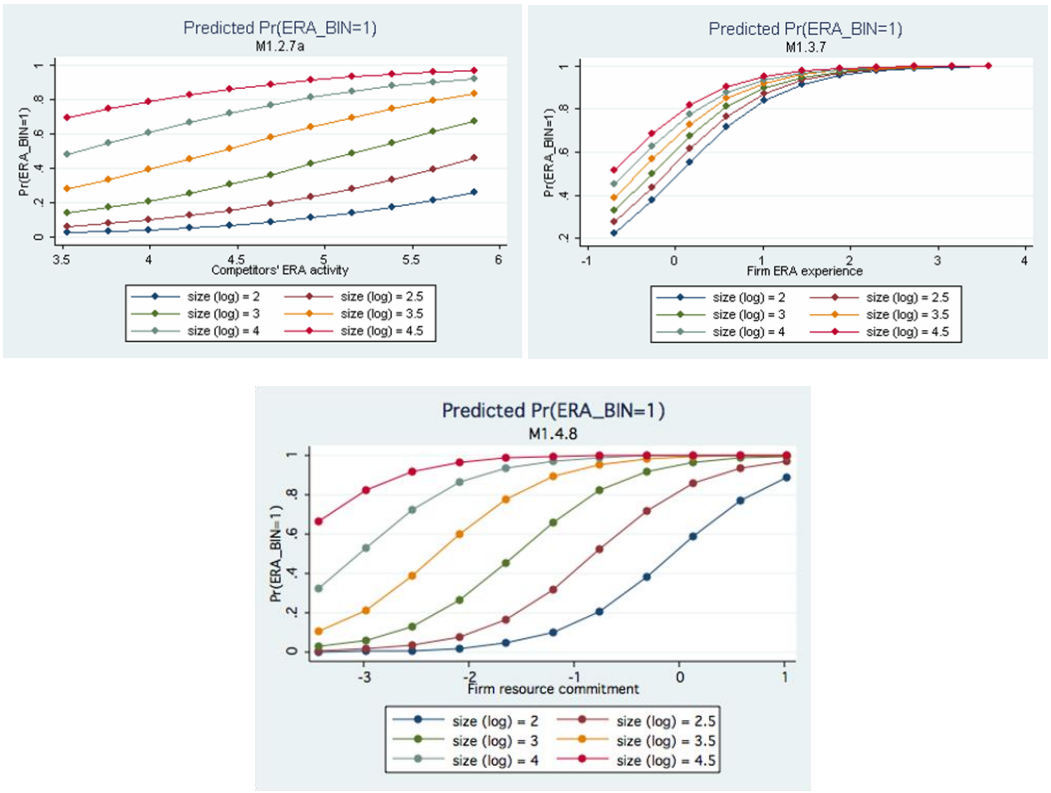


Figure 6-1 The effect of firm size on ERA likelihood

In terms of FIRM_RES, larger firms have a higher probability of engaging on ERA than smaller firms in line with varying levels of COMP_ACT and FIRM_EXP. However, middle size firms with smaller FIRM_RES will exhibit a higher increase on their respective ERA likelihood that small or large firms. I observe a similar effect of firm size when predicting ERA intensity. For example as illustrated in figure 10, smaller firms are more likely to exhibit a lower predicted ERA intensity than larger firms for the same level of COMP_ACT.

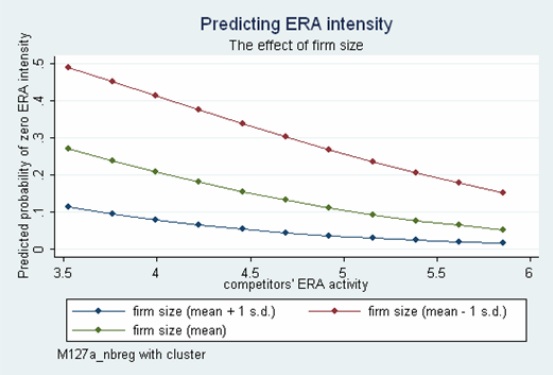


Figure 6-2 the effect of firm size on ERA intensity

The effect of firm size however turns insignificant when predicting strategic deviation (table 6.5). In contrast with firm size, past financial performance (3 control variables) has an inconsistent and insignificant effect across alternative models tested. If I consider the controls only models, I observe a positive and significant relationship between firm past financial performance (only for the ROA measure) and ERA likelihood and intensity.

6.8 Sensitivity analysis

The statistical analysis presented above provide overall empirical support for my hypothesized relationships and my conceptual framework. To increase the validity of my empirical analysis, I have three additional steps. First, I have employed a series of alternative econometric models to check the robustness of my empirical results. As I have discussed in section 5.6, my panel data design offers several strengths but also provides the researcher with several empirical challenges. Two of such challenges for example are unobserved heterogeneity and measurement error (e.g., Echambadi et al., 2006). As a robustness check to the alternative econometric models presented above, I have employed a series of additional models. In the case of predicting firm ERA activity (H1-H3), I have employed

both fixed- and random- effects Logit and negative binomial regression models. As illustrated in Table 6.10, alternative panel models provide consistent results (in terms of direction and significance), with the VCE cluster models presented above (Tables 6.2 and 6.3).

Table 6-10. Alternative econometric panel models (FE-RE) for predicting firm ERA activity

	COMP_ACT	FIRM_EXP	FIRM_RES	FIRM_EXP*FIRM_RES single term / interaction term model	COMP_ACT* FIRM_EXP*FIRM_RES single term / interaction term model
Panel Logit alternative models (*xtlogit*)					
FE	✓	✓	✓	✓	✓ (inverted significance)/ ✗
RE	✓	✓	✓	✓	✓/ ✓ (full support)
Panel negative binomial regression alternative models (*xtnbreg*)					
FE	✓	✓	✓	✓/✗	✓/✓
RE	✓	✓	✓	✓/✗	✓/✓

Furthermore, I test for reverse causality between my dependent and independent variables of interest by introducing the lagged term of the dependent variable in the models employed above. My estimations suggest that there is no evidence of reverse causality when estimating ERA_BIN, ERA_COUNT and STRAT_DEV (all alternative models). In terms of measurement error, single and log terms employed above yield similar estimates both in terms of direction and significance.

Following Long and Freese (2006), I estimate the Cook's statistic to identify influential residuals (outlier cases) that may affect that robustness of my estimated models. Cook's statistic captures the effect of an *ith* observation when removed from the calculation of the estimated coefficient vector β (hat) (Long and Freese, 2006: 115).

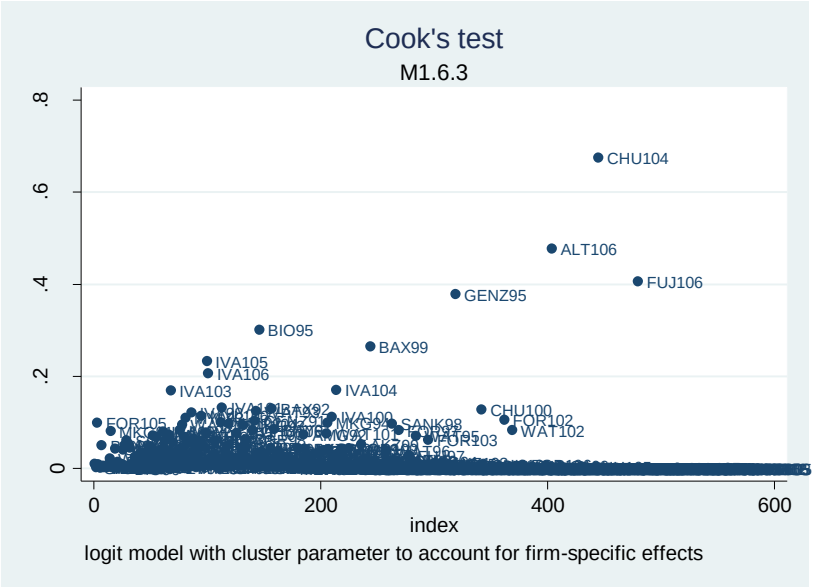


Figure 6-3. Cook's statistic for full specification Logit model

To account for outlier cases (figure 6.3 provides an example), I remove observations with high levels of cook's distance compare to the sample, and re-estimate the alternative models presented above. The outlier cases identified do not have an effect on the estimated coefficients and the overall fit of the models.

CHAPTER 7.

DISCUSSION

7.1 Introduction

This dissertation asks *"What is the role of firm strategy in ERA?*" In answering this overarching question, I set out to identify conditions that are associated with patterns of competing firms' behaviour when engaging in the acquisition of external resources. In doing so, I define *External Resource Acquisition* (henceforth ERA) as the strategic action to acquire external resources. By external resources, I refer to critical resources, that is "those factors that enable the firm to participate in its product market *relatively more* efficiently and effectively" (Peteraf & Barney, 2003: 316). In my empirical context, the global biopharmaceuticals industry, such critical resources take the form of knowledge based assets such as for example biological molecules, chemical libraries and other technological assets relevant to the drug development and discovery process.

As I have illustrated above, ERA has been perceived as a core strategic action for firm survival (Nicholls-Nixon & Woo, 2003). In today's hypercompetitive environments, firms are faced with changing technological bases, pressures to innovate, and short lived competitive advantages (Wiggins & Ruefli, 2002). In response, competing firms intensively engage in ERA in order to adapt to new technological regimes, improve competitive parity and ultimately sustain

competitive advantage through the identification of opportunities and the elimination of environmental uncertainty. Thus, ERA can be broadly perceived as a strategic action that firms engage in order to adapt to their competitive environment.

Strategy scholars thus far have predominantly treated ERA as solely a *resource-driven* action directed by firm-specific idiosyncratic attributes. While there are theoretical reasons for such treatment, which I discuss further later on, this predominant view of ERA treats the competitive environment of the firm as an exogenous factor, and thus fails to provide a sufficient explanation of ERA. I challenge this view by arguing that firms engage in ERA not only to improve their competitive position driven by their idiosyncratic attributes, but also to respond to their competitive environment and more specifically their competitors' ERA-related actions. I thus aim to provide a more complete treatment of firm ERA behaviour. As such, I propose that ERA can also be seen as a *competitor-driven* action. My view allows for a broader theoretical understanding on firm behaviour in the context of ERA. As such, I frame my arguments in the context of strategic choice theories. Overall, my empirical results, presented in chapter 6, provide support for both the resource- and competitor- driven views of ERA.

In this chapter, I discuss further my empirical findings in relation to prior empirical studies and relevant theory. I thus illustrate how my empirical analysis connects with the research questions I have set out to answer and the potential contributions that this research makes towards providing a better understanding on the complex link between ERA and firm strategy.

This chapter is organized as follows. I frame my empirical results within the theoretical framework of strategic choice. As such, I review my empirical findings in relation to the two views of ERA offered above. I then build on the significant interaction effect of competitors' ERA activity and firm level propensity factors (resource commitment and experience with ERA), and provide some theoretical insights on how the two views of ERA can be combined. I conclude this chapter with discussing limitations and suggesting avenues for further research.

7.2 Strategic choice theories and ERA

I have briefly argued above that to better understand ERA, a broader theoretical perspective must be adopted. I thus discuss my conceptualization of ERA and my empirical analysis in the context of strategic choice theories. Under this broad theoretical framework, competing firms can either take actions to differentiate from their competitors or conform to their competitors' actions. Differentiation and (interorganizational) imitation have been perceived as the two extremes of firm strategic behaviour[72]. On one hand, the RBV promotes differentiation by arguing that firms gain competitive advantage through acquiring or developing idiosyncratic resources (Barney, 1991; Wernerfelt, 1984). On the other hand, scholars have argued that imitation is a more viable strategic choice when firms are faced with high strategic uncertainty and seek legitimacy among their competitors by engaging in similar strategic actions (Haunschild & Miner, 1997; Lieberman & Asaba, 2006).

[72] As discussed in chapter 3, these two extremes of strategic choice must be viewed as a theoretical device rather than a complete description of firm strategy.

In the context of ERA, scholars have very much focused on differentiation and have significantly underplayed the role of imitation. My main argument is that ERA can be perceived as both a resource- and competitor-driven action. As such, I expect that firms direct their ERA actions with respect to their idiosyncratic attributes and their competitive environment. My empirical analysis, as presented in chapter 6, provides new insights to this front. I specifically find that competitors' ERA actions are positively associated with firm ERA activity (likelihood and the intensity), and thus provide empirical support for my argument that ERA can be perceived as competitor-driven. Furthermore, my empirical analysis provides support for a positive association of firm-specific idiosyncratic attributes and ERA action. More interestingly, my empirical analysis suggests the existence of a moderating effect between firm-specific attributes and competitors' ERA activity in predicting the focal firm's ERA activity. This finding suggests a more complex picture of ERA than assumed before.

This section proceeds as follows. In Section 7.2.1, I illustrate how my empirical analysis connects with the theoretical foundations of RBV and prior empirical work concerned with the firm-specific attributes of interest; resource commitment and prior experience. Section 7.2.2 is concerned with competitive explanations of ERA and more specifically imitation-based theories of competitive dynamics. Section 7.2.3 provides a more in-depth discussion on the important interaction effect of competitors' ERA activity and firm-specific attributes when predicting ERA related actions (likelihood and intensity). This section concludes with a summary of my contributions.

7.2.1 ERA and the resource based view of the firm

The RBV has been the most prominent theoretical framework for understanding firm behaviour and competitive advantage in the strategic management literature (Hoopes et al., 2003). The RBV treats firms as entities of idiosyncratic costly-to-copy resources (Barney, 1991; Conner, 1991). In turn it is assumed that, the strategic actions of firms are thus driven by the firm's idiosyncratic resources (Chen, 1996). Under this theoretical framework, firm behaviour is directed by such resource-driven actions to develop or acquire critical resources and achieve competitive advantage through unique product market strategies (Foss & Knudsen, 2003). In the theoretical context of the RBV, competing firms will strategically act to acquire external resources, only when such resources can be purchased at a price lower than their discounted present value suggesting the existence of informational advantages not reflected in the price of the resource traded in strategic factor markets (Barney, 1986; Foss & Knudsen, 2003). Thus, ERA, as a strategic action, will make sense when the focal firm possesses superior (and in that sense asymmetric) information for the value-generating potential of the resource to be acquired in relation to that of its competitors. Under this treatment of ERA, assuming the presence of strategic factor markets, scholars suggested that firms must focus their strategic efforts to develop resources internally, as only such resources can lead to competitive advantage (Dierickx & Cool, 1989).

In today's competitive environments, however, firms are faced with high uncertainty on what resources to possess in order to outperform their competitors. This is particularly true when firms compete in environments with rapid technological change and long innovation cycles (Nicholls-Nixon & Woo, 2003). Scholars thus far have significantly revisited RBV on what directs firms' resource-

driven actions and suggested that firms are not independent entities but rather strategically dependent (Dyer & Singh, 1998; Lavie, 2006). Empirical work in this context has suggested that firms engage in the acquisition of critical resources in order to access other firms' valuable resources through alliance networks (Das & Teng, 2000), to alleviate resource constraints (Combs & Ketchen, 1999), and to access complementary resources (Rothaermel, 2001b) and further enhance their knowledge base (Ahuja & Katila, 2001; Prabhu et al., 2005).

As such empirical work so far highlights the importance of firm-specific idiosyncratic resources when firms engage in ERA. Actually, it is very much the characteristics of these idiosyncratic resources that do not only drive firms to engage in ERA but enable ERA to be a value-creating strategic action. This is no surprise as the theoretical premises of the RBV, and consequently the notion of strategic factor markets, suggest that resources must be valuable, rare, inimitable and non-substitutable to provide firms with a competitive advantage over their competitors (Barney, 1991). The main assumption under these necessary conditions is that firms are inherently heterogeneous in the resources that they possess (Peteraf & Barney, 2003: 311). The RBV attributes strategic behaviour to such heterogeneous resources owned by the firm. It makes sense then to view ERA as a resource-driven action with the objective to enhance the value creating potential of the resources that the firm controls. Thus within the RBV paradigm firms "are encouraged to innovate by searching out new resources…as the basis for organizational rents" (Galunic & Rodan, 1998: 1193).

To test this view of ERA, and complement prior empirical research, I am concerned with two main constructs; resource commitment and ERA experience. Resource commitment captures the levels of internally developed resources owned

by the firm. I am also concerned with the levels of experience that the focal firm has accumulated by engaging in ERA related actions. My empirical analysis tests how these two attributes associate with patterns of ERA among competing firms. Overall, my empirical findings (see chapter 6; sections 3 and 4) show a positive association of resource commitment and prior experience with firm ERA activity. This empirical finding supports prior evidence on the direct and positive relationship of internal resources-what I term resource commitment- and ERA. For example, in their seminal study of the semiconductor industry, Eisenhardt and Schoonhoven (1996: 147) found that firms with fewer resources will exhibit lower rates of resource acquisition through alliance formation. My empirical analysis also provides support for previous empirical studies that have illustrated that highly R&D intensive firms will heavily engage in ERA (Hagedoorn, 1993), and will be better positioned to build on resources acquired externally (Veugelers, 1997: 314). Furthermore, Cassiman and Veugelers (2006) conceptualize internal resource development and ERA[73] as two distinct innovative strategies and provide empirical support that these two activities are indeed complementary, high levels of internal know how increase the return of ERA. They further show that such complementarity is positively associated with higher levels of innovative performance (as a measure of organizational performance).

The observed positive association of resource commitment and ERA can be also explained through the notion of absorptive capacity, which defined as "the ability to recognize the value of new information, assimilate it, and apply it to commercial ends" (Cohen & Levinthal, 1990). In terms of resource commitment, Cohen and

[73] Cassiman and Veugelers (2006) are not concerned with ERA per se but focus more on the acquisition of knowledge based assets. My conceptualization and operationalization of ERA takes into account such assets.

Levinthal (1990) argue that absorptive capacity is a by-product of internal R&D efforts. Thus, the ability to utilize external knowledge depends on internal R&D, and it is consequently reflected on R&D spending (similar to how resource commitment is defined here). This positive relationship is not only related with the firm's absorptive capacity but also with its broader technological environment. Scholars have shown that firms competing in highly intensive technological environments, will be more likely to engage in ERA (Miotti & Sachwald, 2003: 1484). In this case, firms will invest further on internal R&D in order to be able to better respond to new technological advancements in their environment. Not all scholars however agree with the positive relationship described above. For example, Jones et al. (2001) perceive ERA as a substitute for low levels of internal resources. Specifically, they argue that "firms with adequate resources for competing in new technology or industry will be less likely to look for external technology sources than those having limited or incomplete resources". Drawing from a survey of US based firms, they provide empirical support for a negative relationship between ERA and internal resources (Jones et al., 2001: 262). Another rationale of the positive relationship described above, is that firms with a larger resource base and higher levels of investments on internal R&D will be able to better exploit potential combinations of internal resources with resources acquired externally (Lane, Koka, & Pathak, 2006: 846).

While I am not directly concerned with the specific attributes of the external resources being acquired, there has been substantial work on understanding how such attributes may affect the positive relationship of resource commitment and ERA. Scholars in this research stream have been very much concerned with how resources, especially knowledge-based, can be transferred from the parent to the

target organization e.g. (Kogut & Zander, 1992). This important issue of transferability is mainly captured in the concept of ambiguity, under which Simonin (1999: 597) argues that "[ambiguity] lessens the propensity to learn from a partner. That is, when the degree of ambiguity associated with a partner's competence is high, chances of effectively repatriating and absorbing the competence are rather limited". Drawing from a US sample of firms, Simonin provides empirical support to the negative impact of ambiguity to knowledge transfer.

I am not only concerned with resource commitment but I also suggest that firm's prior experience with ERA will be positively associated with firm ERA activity. My empirical analysis provides overall support for this hypothesized relationship. Firm experience has been identified as an important factor of firm behaviour in several contexts such as new product introductions (Katila & Ahuja, 2002; Nerkar & Roberts, 2004), alliance success (Anand & Khanna, 2000a), and market entry (Delios et al., 2008). The rationale behind such positive relationship between experience and consequent firm action is that successful organizations develop capabilities based on their experiential-based knowledge (Levinthal & March, 1993: 86). Based on their experiential learning, organizations are more likely to engage in actions that have been previously successful. In relation to ERA, accumulated experience can be associated with more efficient search for resources that enable the firm to introduce new products (Katila & Ahuja, 2002). In this sense, not only experience is positively associated with firm action but also can be seen as directly related to how firms develop their resources and capabilities (Nerkar & Roberts, 2004). Accumulated experience with an organizational action however holds also negative consequences. As Levinthal and March (1993: 102)

argue “the self-reinforcing nature of learning makes it attractive for the organization to sustain current focus”. When firms are faced with environmental change however, experience may act as a resisting force to consequent actions. Paradoxically, the very distinct competencies a firm develops over time through its accumulated experience, can also restrict its response to environmental requirements, and thus make the firm rigid in terms of consequent actions (Leonard-Barton, 1992). I return again to this point when I provide further insights on the positive relationship between prior experience and ERA, and its interaction with competitors’ ERA activity.

While confirming prior empirical findings, my empirical analysis provides further insights to the relationship between firm-level idiosyncratic attributes and ERA. By taking under consideration methodological advances and best practice on applying non-linear econometric models (Hoetker, 2007), I illustrate important differences on firm ERA behaviour, as captured by the likelihood and intensity of ERA-related actions, in relation to the different levels of ERA experience and resource commitment that the firm possesses. the findings discussed below suggest a much more complex firm ERA behaviour than illustrated by prior empirical studies.

First, my empirical analysis shows (figures 2 and 6; chapter 6) that influence of ERA experience and resource commitment on the likelihood of the focal firm engaging in ERA is greater at lower levels of prior ERA experience (FIRM_EXP $< \log(2)$) and resource commitment (FIRM_RES $< \log(-1)$). Indeed, at higher levels of prior experience with ERA and resource commitment, the predicted probability of the firm engaging in ERA remains constant, suggesting a stable probability of firm engaging in ERA. This consistent behaviour is also illustrated

at the low marginal change when predicting the probability of a firm engaging in ERA (table 6.2; chapter 6). Put it differently, this finding suggest that a large portion of my sample firms (592 firm-year observations) consistently engage in ERA over time.

Second, by investigating simultaneously the effect of resource commitment and prior experience with ERA, I find that, resource commitment exhibits a higher marginal effect than prior experience in predicting ERA likelihood and intensity (table 6.3; chapter 6). This finding suggests that resource commitment is a stronger predictor than ERA experience, especially in the case of predicting ERA intensity. In relation to the discussion above, this finding highlights the importance of the resource base of the firm when engaging in ERA and thus further confirms RBV expectations.

I provide further insights on predicting ERA intensity at different levels of firm-level idiosyncratic attributes. In doing so, I investigate how different levels of ERA experience and resource commitment are associated with predicted ERA counts. Figure 7.1 illustrates predicted ERA counts around mean values of ERA experience and resource commitment (± one standard deviation around mean).

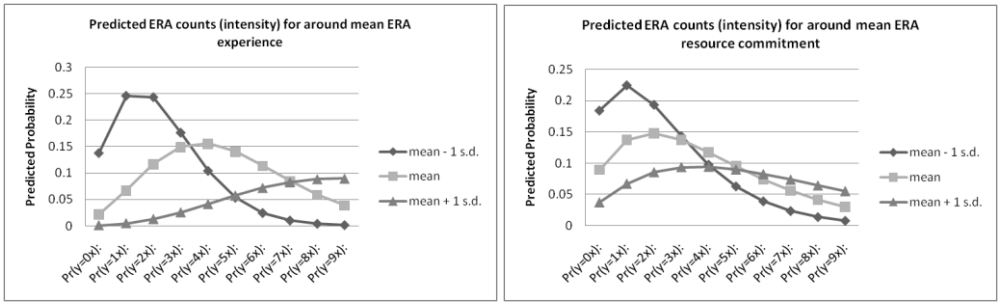


Figure 7-1. Predicting ERA intensity at different levels of FIRM_EXP and FIRM_RES

In line with my expectations, firms with lower levels of prior ERA experience and resource commitment exhibit a higher probability of zero ERA intensity (Pr(y=0x)). Put it differently, higher levels of ERA experience and resource commitment are associated with higher ERA intensity. However, figure 7.1 provides us with several other interesting insights. I observe a diminishing effect of the positive impact of ERA experience and resource commitment for high levels of predicted ERA intensity. This diminishing effect suggests a non-linear relationship between resource commitment and ERA intensity. More specifically, at a standard deviation below the mean value observed, higher levels of ERA experience and resource commitment increase the predicted probability for initial levels of ERA activity (0→2 predicted ERA actions). Above this threshold, and for larger values of ERA intensity (2→9 predicted ERA actions), however, the predicted probability decreases significantly. I observe the same pattern at the mean and one standard deviation above the mean values of ERA experience and resource commitment but with a smaller diminishing effect in terms of the predicted probability. This important finding suggests that the positive and significant effect, illustrated above, between these firm-specific idiosyncratic attributes and ERA intensity, holds *only* when firms engage in few ERA-related actions. While I have initially hypothesized a linear relationship between these idiosyncratic attributes and ERA intensity, this finding suggests an inverted curvilinear relationship (inv U; figure 7.1).

My empirical analysis also provides further insights on the interaction effect between firm prior ERA experience and resource commitment. I found a curvilinear interaction effect between ERA experience and resource commitment on ERA likelihood (figure 3; chapter 6). More specifically, I observe a positive

interaction effect for firms with lower predicted ERA likelihood while such interaction turns negative for firms with high ERA likelihood (inflection point around 0.7 of the predicted probability). In the case of ERA intensity, I similarly observe a significant interaction effect between firm ERA experience and resource commitment (table 6.3; chapter 6). As indicated by the marginal effect of the interaction term, while these two factors taken independently have a significant and positive effect on ERA intensity, their combined effect has a negative impact on predicted ERA intensity. This finding suggests that there is an additive effect of firm ERA experience and resource commitment on predicting ERA intensity. While, as discussed before, resource commitment is a stronger predictor of ERA intensity than ERA experience, this finding suggests that firms with low levels of resource commitment will direct their consequent ERA actions in relation to their prior experience. On the other hand however, firms with high levels of resource commitment will engage in ERA more intensively regardless their prior experience.

In relation to my main empirical findings, I also find that for the same levels of ERA experience, size is a moderating factor. Thus, large firms will exhibit a higher likelihood of engaging in ERA than small firms. While firm size has a significant impact in terms of the effect of ERA experience to ERA likelihood, firm behaviour follows the same pattern as discussed above. In the case of resource commitment, large firms exhibit a stable behaviour (as indicated by the predicted probability) while smaller firms' higher levels of resource commitment increase their likelihood of engaging in ERA and the intensity of their ERA-related actions. As with ERA experience, for the same level of resource commitment larger firms exhibit a higher ERA likelihood than smaller firms, and they are more likely to

engage in more ERA actions. One possible explanation of the effect of size is the presence of economies of scale and scope. In their empirical study of the pharmaceuticals industry, Henderson and Cockburn (1996) suggest that biopharmaceuticals research is benefited by the existence of economies of scale and scope. More specifically, they suggest that large firms are benefited from economies of scale and scope by spreading their investment on R&D across a wider resource base.

7.2.2 ERA, imitation and competition

In contrast with the RBV, which suggests that the firm's optimal goal is to devise unique strategies based on its idiosyncratic attributes and differentiate from its competitors, competitive dynamics (CD) scholars have long argued that firm behaviour may be contingent to that of its competitors. In that sense firms may strategically act towards conforming rather than differentiating from their competitors. Several factors are associated with such strategic behaviour. Briefly, firms may respond to the strategic moves of their competitors (Chen & MacMillan, 1992; Miller & Chen, 1994), adopt successful industry-wide strategic recipes or adapt to the strategic actions of similar competitors (Garcia-Pont & Nohria, 2002). While these factors are examined in somewhat individual research streams, and draw upon different theoretical perspectives, the underlying assumption here is that firms strategically choose to act in similar ways under the pressure of facing competitive disadvantage (Abrahamson & Rosenkopf, 1993). Put differently, competing firms are strategically interdependent. Such strategic interdependence suggests that the strategic actions of competing firms will increase the likelihood of a focal firm taking the same action.

Scholars have employed several concepts to describe such strategic interdependence as for example interorganizational imitation (Haunschild & Miner, 1997; Lieberman & Asaba, 2006) or group level pattern clustering (Gimeno et al., 2005). Firm imitative behaviour has been examined in several empirical contexts such as bank branching behaviour (Barreto & Baden-Fuller, 2006), international expansion moves (Delios et al., 2008; Gimeno et al., 2005), entry timing (Ethiraj & Zhu, 2008), and mergers & acquisitions (Haunschild & Miner, 1997; Xia et al., 2008).

To my knowledge, few empirical studies [74] so far have investigated interorganizational imitation in the context of ERA. I make a significant contribution towards this end by assessing the relationship between competitors' ERA activity and the focal firm's ERA likelihood and ERA intensity. More specifically, I hypothesize that a firm will engage in ERA as a strategic response to its competitors (Hypotheses H1a,b), and as such, I expect a positive relationship between competitors' ERA activity and consequent ERA actions of the focal firm. My empirical analysis provides overall support for my hypotheses by illustrating a positive relationship between competitors' ERA activity and the focal firm's likelihood and intensity of engaging in ERA-related actions.

In the case of ERA likelihood, the influence of competitors' ERA activity is greater at lower levels (explain a larger change in the probability of the firm to engage in ERA). While my empirical design does not allow for observing the exact time sequence of ERA actions that the firm engage in, this finding suggests that firms will immediately respond to the ERA actions of their competitors. Put it

[74] A recent exception is the study of Park and Zhou (2005) which investigates the competitive dynamics of strategic alliances.

differently, firms will be more sensitive to respond to initial levels of competitors' ERA activity. This will be particularly true when firms are faced with high resource scarcity. In such competitive environments, firms will engage in ERA in order to weaken the competitive position of its rivals by preempting strategically important resources or denying access to partners (Lieberman & Montgomery, 1988; Park & Zhou, 2005). Furthermore, my sample consists of large biopharmaceuticals firms that compete in similar product markets while faced with high environment uncertainty. For such firms, following the actions of their competitors may result in the preservation of the status quo (Lieberman & Asaba, 2006: 367).

In line with the finding presented above, I found that competitors' ERA activity has a greater impact (as captured by its marginal effect) on ERA intensity than ERA likelihood. This finding suggests that firms are not only more likely to engage in ERA when they are faced with high competitors' ERA activity but they respond to the frequency of the actions of their competitors. Drawing from neo-institutional theory, Haunschild and Miner (1997) describe this effect as frequency-based imitation and argue that firms will engage in a similar practice (in my case action), both consciously and unconsciously, in order to increase their legitimacy among their competitors. As briefly described above, empirical research concerned with various practices/actions in several empirical contexts provide support for the existence of frequency-based imitation among competitor firms.

In the context of ERA, I propose that such frequency-based imitation is primarily driven by a) the uncertainty of the resources that a firm must possess to achieve their strategic objectives across the markets that they compete, and b) the availability (scarcity) of such resources in the resource environment that the firm

competes in. Institutional theorists suggest that environmental uncertainty increase the importance of social considerations, and as such the higher the uncertainty that a firm is faced with the more will rely on adopted practices/actions (Haunschild & Miner, 1997: 479). Resource scarcity relates both with frequency-based imitation and competition. When firms compete in environments with high resource scarcity they are faced with higher levels of competition, and as such, they will more intensively engage in ERA to secure critical resources (Lieberman & Asaba, 2006: 373).Resource scarcity must be considered here as an end state that firms are faced with after the resource space is occupied by a large number of competitor firms. When for example, biotechnologies where introduced to the biopharmaceuticals industry in the late 1980s, ERA-related actions start to emerge. Biotechnology has been considered as competence-destroying technology that established biopharmaceuticals firms must adapt to(Pisano, 1990). As such, biopharmaceuticals firms have rapidly started to engage in ERA-related actions in order to acquire biotechnology-related resources. In line with ecological views of frequency-based imitation, biopharmaceuticals firms in my sample and time frame observed, engage more intensively in ERA at the earlier stages of the introduction of biotechnology than at later stages. Figure 2 analytically illustrates this important time element across the observed sample frame.

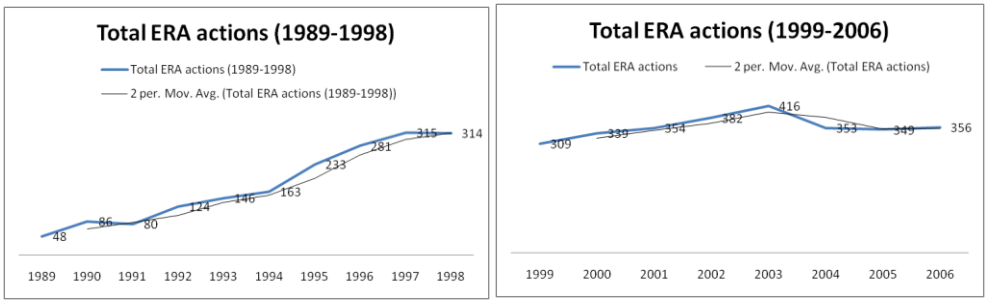


Figure 7-2 Total ERA activity of sample firms

I investigate this further by splitting the sample in two time periods and estimate the impact of competitors' ERA activity to firm ERA likelihood and intensity. As illustrated in Table 7.1, the impact of competitors' ERA activity to the likelihood and the intensity of the firm engaging in ERA, is much stronger at the first time period. This additional finding provides empirical support to the argument above that biopharmaceutical firms will be more likely to engage in ERA related actions at earlier stages of the biotechnology introduction. In these early stages, biopharmaceuticals firms will be more sensitive to the ERA actions of their competitors as they are faced with a) higher uncertainty in terms of the resources that should possess, b) a larger resource space, and c) limited prior ERA experience. As such, biopharmaceuticals firms will more intensively engage in ERA related actions in order to capture resource opportunities. To further deal with high levels of uncertainty, firms may engage in ERA in order to broaden their resource base and develop more capabilities that can be leveraged in respond to environmental change (Sirmon et al., 2007: 277). At the second time period, competitors' ERA activity is negatively associated with ERA likelihood and intensity. At this late stage of the biopharmaceutical introduction, firms will be less likely to engage in ERA in response to their competitors, and with less intensity.

Table 7-1 Two time periods effect of COMP_ACT to ERA

	Stats	**1989-1998**	**1999-2006**
Competitors' ERA activity and ERA likelihood	Coeff. (std. err)	1.346*** (0.283)	-0.449 (1.625)
	Marg. Eff.	0.2150	-0.0178
Competitors' ERA activity and ERA intensity	Coeff. (std. err)	0.715*** (0.105)	-0.457* (0.345)
	Marg. Eff.	1.893	-2.86

This finding on the differential impact of competitors' ERA activity across time suggests that frequency-based imitation is contingent to the resource environment that competitor firms are faced with. As such, I argue that high resource uncertainty and availability will be associated with stronger patterns of frequency-based imitation, as indicated by the contrasting effect of competitors' ERA activity at the first and second time period. At the earlier stages of the biotechnology introduction, firms may be more sensitive to the information they receive and share from their environment and as such more prone to follow the actions of their competitors. From an ecological point of view, firms will exhibit a higher pattern of ecological contagion while observing and interpreting the strategies of their competitors in relation to their own efforts (Dobrev, 2007). At the later stages of the phenomenon, I observe that competitors' ERA activity is negatively associated with the likelihood and intensity of the firm to engage in ERA (table 7.1). As I argue later on (section 2.3), these firm-specific idiosyncratic attributes will direct the firm's actions at varying levels of competitors' ERA activity that the firm is faced with. Competing firms at this stage are faced with higher levels of competition for acquiring critical resources. At this later stage firms will be less prone to follow their competitors and direct their actions in relation to their internal resources and accumulated experience. As such firms may engage in ERA to differentiate from their competitors and thus swift away from competitive positions where they are faced with high competition. In contrast with earlier stages of the biotechnology paradigm, firms are faced with a more constrained resource space and as such stronger competition. At these later stages, firms are less likely to direct their actions in relation to that of its competitors. One

sociological explanation for this is that firms, as social actors, are less constrained by a collective frame of reference (Dobrev & Kim, 2006: 235).

I investigate further this important time element of the impact of competitors' ERA activity and the focal firm's likelihood and intensity of engaging in ERA by assessing competitors' ERA activity across different markets. In doing so, I analyze competitors' ERA activity across the nine biggest therapeutic areas that my sample firms operate in. As illustrated in Table 7.2, competitors' ERA activity has a differential impact on ERA likelihood and intensity across market segments. When looking at the total sample frame, this additional analysis provides further support to my overall finding of the positive impact of competitors' ERA activity to ERA likelihood and intensity. This additional analysis also shows that the time element observed above is market specific. Looking closely at the differential impact of competitors' ERA activity across the two time periods (columns 2 and 3), I observe that the pattern illustrated above (table 7.1) holds only for the cardiovascular, cancer and respiratory markets.

Both from a competitive dynamics and organizational ecology(Dobrev, Kim, & Carroll, 2002) point of view, scholars have argued that firms are faced with varying levels of competitors' pressures across markets that compete in. As such, one might rightly argue that the likelihood and intensity of the firm to engage in ERA varies across different markets in relation to competitors' ERA activity specific to that market.

Table 7-2 competitors' ERA activity and ERA across therapeutic markets

	total sample frame			1991-1998			1999-2006		
	coefficient	std. err	marginal effect	coefficient	std. err	marginal effect	coefficient	std. err	marginal effect
competitors' ERA activity and ERA likelihood per therapeutic market									
cardiovascular	0.02616	(0.064)	0.0017	0.23536**	(0.082)	0.0293	-0.05888	(0.097)	-0.0004
Central Nervous System	0.35801*	(0.174)	0.0229	0.20128*	(0.084)	0.0251	0.79575^	(0.524)	0.0050
infection	0.22560**	(0.079)	0.0144	0.04873	(0.097)	0.0061	0.28759*	(0.116)	0.0018
cancer	0.0377	(0.064)	0.0024	0.20099**	(0.074)	0.0251	-0.10473	(0.086)	-0.0007
immune	0.1603	(0.167)	0.0103	0.36654^	(0.239)	0.0457	0.32865^	(0.211)	0.0021
gastrointenstinal	0.12594	(0.189)	0.0081	-0.23720	(0.406)	-0.0296	-0.33430^	(0.236)	-0.0021
inflammatory	0.18832^	(0.126)	0.0121	0.06970	(0.148)	0.0087	0.21846	(0.340)	0.0014
respiratory	-0.21425	(0.208)	-0.0137	0.01561	(0.250)	0.0019	-0.69839*	(0.353)	-0.0044
metabolic	0.128	(0.161)	0.0082	-0.27265^	(0.185)	-0.0340	0.15640	(0.240)	0.0010
competitors' ERA activity and ERA intensity per therapeutic market									
cardiovascular	-0.00636	(0.017)	-0.0263	0.07493*	(0.031)	0.1785	-0.02816*	(0.013)	-0.1698
Central Nervous System	0.07194***	(0.019)	0.2981	0.07767***	(0.023)	0.1850	0.06649**	(0.022)	0.4009
infection	0.07077**	(0.022)	0.2932	0.11218***	(0.030)	0.2673	0.03691+	(0.021)	0.2226
cancer	0.01255	(0.018)	0.0520	0.06906**	(0.023)	0.1645	-0.00399	(0.019)	-0.0241
immune	0.04932+	(0.029)	0.2044	0.16173*	(0.064)	0.3853	0.02054	(0.028)	0.1238
gastrointenstinal	-0.15753***	(0.046)	-0.6528	-0.25456*	(0.104)	-0.6065	-0.12872**	(0.042)	-0.7761
inflammatory	0.03626+	(0.020)	0.1503	0.08019^	(0.051)	0.1910	0.02276	(0.022)	0.1373
respiratory	-0.02426	(0.048)	-0.1005	-0.02419	(0.049)	-0.0576	-0.06477	(0.059)	-0.3905
metabolic	0.07228*	(0.030)	0.2995	0.01739	(0.048)	0.0414	0.06778+	(0.037)	0.4087

7.2.3 The interaction effect of firm-specific propensity factors and competitors' ERA activity

I have illustrated so far how my empirical analysis connects with prior research under the theoretical expectations of RBV and interorganizational imitation theories. In this section, I provide further insights on the interaction effect between the firm-level propensity factors, ERA experience and resource commitment, and competitors' ERA activity when predicting the likelihood and intensity of the focal firm engaging in ERA actions. By investigating this effect, I make a significant theoretical contribution. So far scholars concerned with ERA focused independently on either firm-level attributes as drivers of ERA or at a lesser degree with the competitive dynamics of competing firms engaging in ERA. I bridge these two rather independent streams of research by empirically showing how competitor- and firm- specific factors interact and consequently affect patterns of

ERA behaviour among competing firms. In doing so, I address recent calls for further empirical research in this research stream (Capron & Chatain, 2008). Furthermore, I argue that to provide a more complete picture on the conditions under which firms engage in ERA, one needs to incorporate both firms specific factors and the external resource environment (Sirmon et al., 2007).

Let's first consider the interaction effect when predicting the likelihood of the firm engaging in ERA. My empirical analysis provides statistical support on the existence of a significant and negative interaction effect between competitors' ERA activity and firm-level propensity factors. More specifically, I find that the firm-level propensity factors moderate the positive impact of competitors' ERA activity to firm ERA likelihood. As I have illustrated in section 6.3 (section 3; chapter 6), I untangle this moderating effect further by analyzing its distribution across my sample. I observe a curvilinear (U-shape) relationship between the interaction effect and the predicted probability of observing an ERA action ($Pr_{(ERA\_BIN)}$= 1). At lower levels of the predicted probability (y <~0.7 in figure 4; chapter 6), the interaction effect increases (takes a larger negative value; negative slope) while the predicted probability increases. However, after that inflection point the higher the observed predicted probability the smaller (moves closer to zero; positive slope) the interaction effect. Moreover, I observe that the interaction effect turns zero at the very low and very high levels of the predicted probability. While this finding provides general support for the existence of a moderating effect between firm propensity factors and competitors' ERA activity and the likelihood of the focal firm to engage in ERA (Hypothesis H3a), my empirical analysis suggests that such moderating effect is stronger for firms that exhibit low likelihood of engaging in ERA. In contrast, the moderating effect significantly

diminishes (approaches zero) for firms with higher levels of predicted ERA likelihood.

I observe a similar moderating effect when predicting ERA intensity. As illustrated by the estimated marginal effects in the full model (table 6.4; chapter 6), resource commitment and prior ERA experience, taken together, are a much stronger predictor than competitors' ERA activity in predicting ERA intensity. While this effect is in line with the corresponding marginal effects in predicting ERA likelihood, the magnitude of the effect is much stronger in the case of ERA intensity. This finding suggests that firms with higher levels of experience and resource commitment are exhibit lower ERA intensity. To illustrate this point further, I investigate the interaction effect of firm propensity factors and competitors' ERA activity for a standard deviation around its mean.

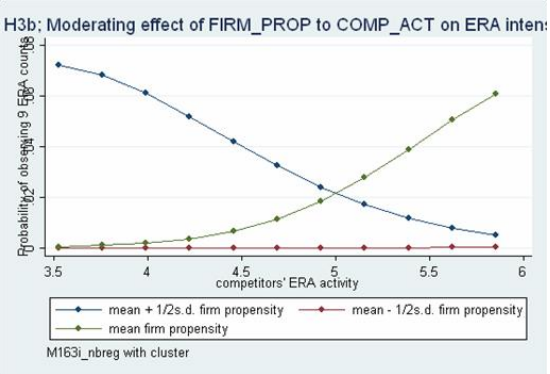


Figure 7-3 the moderating effect of firm propensity factors and competitors' ERA activity

As illustrated in figure 3, at half standard deviation above competitors' ERA activity mean, the moderating effect of propensity factors on the relationship between competitors' ERA activity on predicting ERA intensity decrease significantly. The moderating effect however significantly diminishes at lower

levels of propensity factors. This suggests that firms with high levels of propensity factors will be less likely to engage in ERA actions in response to competitors' actions. As such, these firms will be less prone to engage in frequency-based imitative behaviour. In relation to the discussion presented above, I show that firm-specific idiosyncratic attributes- resource commitment and ERA experience-will direct the firm's actions in relation to its competitors and the firm's resource environment. The observed moderating effect suggests that firms with high levels of resource commitment and prior experience with ERA will have an independent view of the resource environment in relation to their competitors. Such independent view of the resource environment can be constructed by increased legitimacy associated with high levels of prior ERA actions. From a competitive view point, these firms are insulated by high levels of competition. On the other hand, firms with lower levels of resource commitment and experience will be more prone to the actions of their competitors, and thus face high levels of competition. While these firms may not be able to intensively engage in ERA actions, given their limited level of resources, they will engage in ERA to stay abreast with their competitors.

Table 7-3 Summary of contributions

Empirical finding	Theoretical perspective	Contribution
ERA as a resource-driven action		
Prior experience and resource commitment are positively associated with ERA likelihood and intensity	RBV Resource constraints as driver of ERA Higher levels of absorptive capacity are associated with higher potential to utilize externally acquired resources	Firm-specific idiosyncratic attributes drive firm ERA behaviour Higher levels of internally developed resources are associated with higher ERA likelihood intensity
Asymmetric effect of firm propensity factors: FIRM_EXP > FIRM_RES when predicting ERA likelihood FIRM_RES > FIRM_EXP when predicting ERA intensity	RBV	Heterogeneous firm ERA behaviour at varying levels of experience and resource commitment Two stage strategic process when firms engaging in ERA
ERA as a competitor-driven action		
Competitors' ERA activity has a positive and significant effect on the likelihood and intensity of the focal firm to engage in ERA	Competitive dynamics	Firms engage in ERA as a response to competitors' ERA-related actions
	Imitative behaviour	Frequency-based imitation as an explanation of ERA actions.
The positive and significant effect of competitors' ERA activity to the likelihood and the intensity of the firm engaging in ERA is diminishing over time. Biopharmaceuticals firms will be more likely to	organizational ecology	Differential impact of competitors' ERA activity across time suggests that frequency-based imitation is contingent to the resource environment that competitor firms

engage in ERA related actions at earlier stages of the biotechnology introduction.		are faced with. Such contagion effect is stronger at the earlier stages of the biotechnology technological paradigm.
Firm-specific propensity factors, ERA experience and resource commitment moderate the positive effect of competitors' ERA activity to the focal firm's ERA likelihood and intensity	RBV Competitive dynamics	Firms respond to their competitors' actions in relation to their idiosyncratic attributes Firms with high levels of resource commitment and prior experience are insulated from competitors' pressures when engaging in ERA Firms with low levels of resource commitment and prior experience direct their ERA actions in line with their competitors.

7.3 Limitations and further research

This dissertation investigates the link between ERA and firm strategy. Drawing from an extensive sample of ERA actions of the largest global biopharmaceutical firms, and a time frame that captures the emerging technological paradigm of biotechnology, this dissertation provides an extensive empirical account of strategic behaviour when competing firms engage in ERA.

While this dissertation contributes both theoretically and empirically in better understanding the complex link between firm strategy and ERA, it is faced with a number of limitations.

First, I have excluded from my empirical analysis any interfirm collaborative agreement that did not explicitly concerned with the acquisition of a resource. While this restriction in the way that ERA actions are coded increases the internal validity of the study, it excludes a large number of collaborative agreements that might indirectly involve some short of resource acquisition. For example, scholars concerned with strategic alliances have shown how firms engage in collaborative agreements to acquire higher-order resources, such as specific capabilities, to gain competitive advantage (e.g., McEvily & Marcus, 2005). An extension of this dissertation might be to include such collaborative agreements and investigate differences in patterns of firm ERA behaviour for different types of resources.

Second, scholars concerned with the link between idiosyncratic resources and competitive advantage have intensively critiqued the operationalization of internal resources through the use of R&D intensity. As I have argued in section 5.5.3, my main concern is not with internal resources and their implication for

competitive advantage. My resource-driven view of ERA, however, is built on the premises of the RBV and the assumption that idiosyncratic resources contribute to competitive advantage. A better proxy of internal resources may increase the construct validity of my study. For example, strategy scholars have used patent data to measure the structural characteristics of the resource base of the firm (e.g., Ahuja & Katila, 2001; Grant, 1996). Apart from using a different proxy, I could follow recent attempts to employ sophisticated mathematical techniques to more effectively measure resource commitment. One way to do this would be to use a similar approach with Dutta, Narasimhan, and Rajiv (2005) that employ a stochastic frontier estimation technique to measure R&D capability.

Third, my empirical analysis could benefit from an alternative operationalization of ERA likelihood. Remember, that the likelihood of a firm engaging in ERA (H1-H3) is operationalized as a dichotomous variable. While, my empirical analysis takes under consideration best practice of employing nonlinear (in this case Logit) models to predict ERA likelihood, econometric models employed can only predict whether a firm engages in ERA but not when. To also account for when an event occurs, a survival analysis must be employed. Survival analysis allows the probability of an event at one point in time to differ from the probability of that event occurring at a different point in time (Morita, Lee, & Mowday, 1993). A future study could employ a survival analysis to simultaneously investigate when and whether my sample firms engage in ERA. For example, this methodology would be particularly appropriate for extending the additional empirical analysis presented in the discussion chapter on different patterns of ERA across market. In particular, strategy scholars have employed

survival models to model entry in markets and technological fields (e.g., Mitchell, 1989). Such future study could also contribute to the population ecology field by investigating further the evolution of resource spaces and ERA. In this case, I will be able to observe similarities in patterns of ERA behaviour for a set of competing firms across different resource spaces and over time. Following recent research on competition for external resources and imitation (Dobrev, 2007), such study could extend the empirical support for imitation in the context of ERA. While this dissertation makes the first step on investigating imitation in this context, more empirical work is needed if we are to really understand the wider implications of ERA for firm strategy.

CHAPTER 8.

CONCLUSION

I have set out to investigate the link between ERA and firm strategy. Specifically, I have drawn from the empirical context of the biopharmaceuticals industry, and the emerging paradigm of biotechnology, to answer my overarching research question *"What is the role of firm strategy in ERA?"*. To answer this research question, I build on strategic choice theories, and propose two distinct but complementary views of firm ERA behaviour. In my resource-driven view of ERA, I expect firms to direct their ERA actions according to their idiosyncratic attributes. In the competitor-driven view of ERA, I propose that firms engage in ERA as a response to their competitive environment. Overall, my empirical findings provide support for my thesis.

Theoretically, this dissertation suggests a more complex picture of firm strategic behaviour when firms engaging in ERA than previously assumed.

Empirically, this dissertation complements recent efforts of simultaneously investigating firm- and competitor- specific explanations of strategic action (e.g., Park et al., 2002). My empirical analysis suggests that firms with high levels of idiosyncratic attributes are less likely to engage in ERA in response to competitors' actions. Such firms, will have an independent view of the resource environment in relation to their competitors. On the other hand, competing firms

with low levels of idiosyncratic attributes are more prone to their competitors' actions. These firms will be more likely to strategically conform towards their competitors' strategy. In line with previous empirical research on ERA, I find that firms with high levels of resource commitment and prior experience will gain more from engaging in ERA. However, my empirical analysis goes one step further and shows that the very idiosyncratic attributes that firms develop over time, may restrict their response to environmental requirements, and thus make them rigid in terms of consequent actions. Furthermore, my empirical analysis shows that internal resources are a more powerful predictor of firm ERA activity than prior experience accumulated over time. In relation to my assumption of ERA as a competitor-driven action, I show that firms are not only more likely to engage in ERA when they are faced with high competitors' ERA activity but they also respond to the frequency of the actions of their competitors. This is an important contribution as it provides further insights on imitative behaviour in a novel empirical context (Lieberman & Asaba, 2006).

In addition to my main empirical findings, this dissertation suggests that firm strategic behaviour in the context of ERA changes over time. While scholars have argued that ultimately firms engage in ERA to adapt to environmental changes, no empirical accounts exist to this end. Specifically, I find that in the early stages of the biotechnology paradigm, biopharmaceutical firms are more sensitive to the ERA actions of their competitors as they are faced with a) higher uncertainty in terms of the resources that should possess, b) a larger resource space, and c) limited prior ERA experience. As such, competing firms will intensively engage in ERA in order to capture resource opportunities that will enable them to broaden their resource base and develop more capabilities

that can be leveraged in respond to environmental change (Sirmon et al., 2007) but also prevent competitors from gaining access to critical resources (Lieberman & Montgomery, 1988). At later stages of the biotechnology paradigm, however, firms direct their actions in relation to their idiosyncratic attributes. Competing firms are faced with a more constrained resource space and stronger competition for resources. This empirical finding provides support for Kogut and Zander's (1992) view of short- versus long-term strategy when competing firms are faced with shifting technological paradigms.

In this dissertation, I have taken the first step towards understanding the complex link between firm strategy and ERA. By no means, this has been an easy endeavour as my thesis draws from different theoretical perspectives and aims to provide a more holistic understanding of firm ERA behaviour. A natural next step would be to investigate further this interesting yet challenging research topic. For example, one way forward would be to employ more sophisticated quantitative methods towards investigating firm ERA behaviour across markets. Through my empirical analysis of ERA during the biotechnology paradigm, I came across some other interesting empirical results that warrant further investigation. Most notably, I found that firm ERA behaviour is contingent to the evolution of the biotechnology paradigm. Connecting to the population ecology literature, this finding could lead to further interesting research about ERA and the evolution of firm behaviour in the biopharmaceuticals industry. In the future, I would also like to employ a multi-level empirical analysis to further understand ERA. At a broader level, I feel that our understanding of firm strategy can be enriched by adopting a multi-theoretical perspective.

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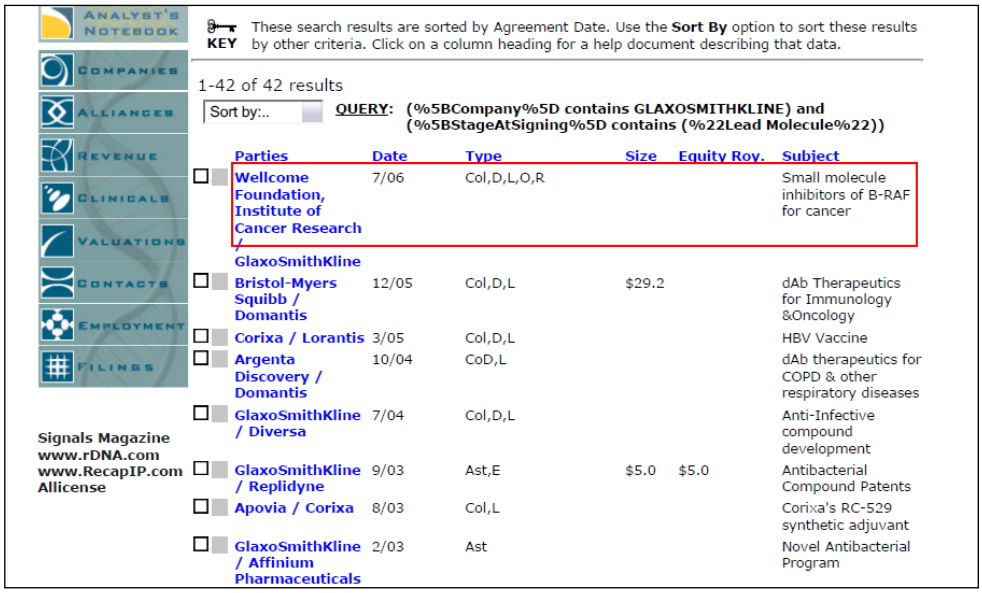
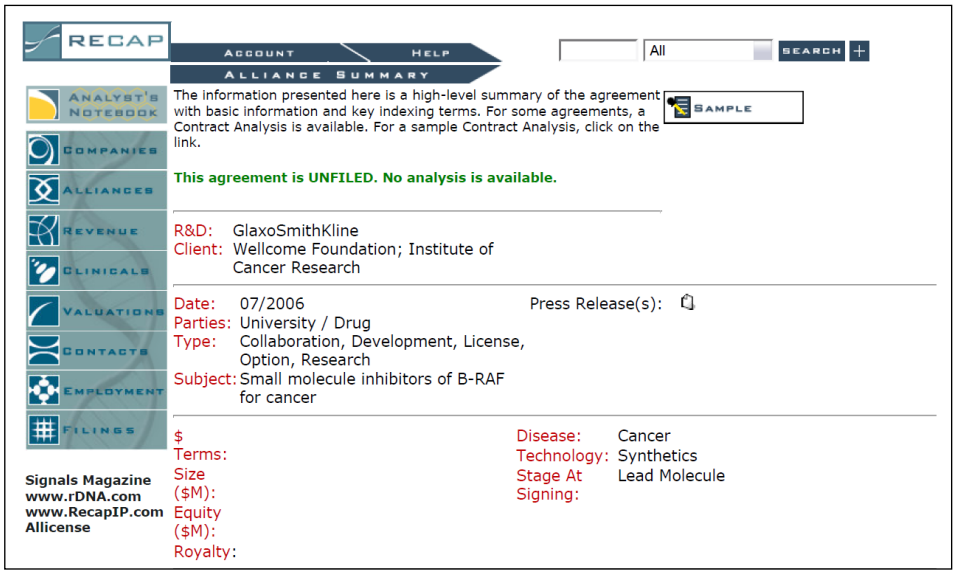
APPENDIX A – QUERYING THE RECAP ALLIANCES DATABASE

This is an example of querying the RECAP alliances database for any agreements that contain sample firm “Glaxosmithkline” in the development stage of “Lead Molecule”. The query returns a screen with 42 agreements between Glaxosmithkline and other firms. This screen contains main information on the agreements such parties involved, the date of signing, agreement type, the total value of the agreement, and the technological subject involved.



As an example, consider the first result of the query. This agreement involved Glaxosmithkline (as the client) and the Institute of Cancer Research. The agreement can be characterized as a licensing R&D based agreement. The database holds no information for the exact value of the agreement. This is not surprising as some times firms do not include this information in the press release. By clicking on the parties field, we get a second screen with more extensive information and a copy of the original press release. One important information not included in the above result screen is the therapeutic area (disease field) that the technology of the agreement will be applied. Using this information, we can derive market-specific ERA data on the sample firms.


RECAP
Account
Help
All
SEARCH
Alliance Summary
Analyst's Notebook
Companies
Alliances
Revenue
Clinicals
Valuations
Contacts
Employment
Filings
The information presented here is a high-level summary of the agreement with basic information and key indexing terms. For some agreements, a Contract Analysis is available. For a sample Contract Analysis, click on the link.
Sample
This agreement is UNFILED. No analysis is available.
R&D: GlaxoSmithKline
Client: Wellcome Foundation; Institute of Cancer Research
Date: 07/2006
Parties: University / Drug
Type: Collaboration, Development, License, Option, Research
Subject: Small molecule inhibitors of B-RAF for cancer
Press Release(s):
$ Terms:
Size ($M):
Equity ($M):
Royalty:
Disease: Cancer
Technology: Synthetics
Stage At Signing: Lead Molecule
Signals Magazine
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Allicense