The Influence of Strategic Patent Litigation on Firm Performance

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Acknowledgements

Abstract

Firms accumulate patents to protect their innovations from imitation. However, patents only provide the option to go to court against infringers. To exclusively benefit from their innovations, firms have to enforce their patents by filing a lawsuit. While previous research concentrated on the determinants and non-financial outcomes of patent litigation, this dissertation examines its effects on firm performance. Strategic patent litigation is very costly, but it can also enable the plaintiff to exclude competitors from the market and increase sales. However, not all firms are equally capable of benefitting from this trade-off. Hence, there is a need to examine the contingencies that influence the effectiveness of firms in generating profit from patent litigation. To fill this gap, this dissertation sheds light on organisational, industrial and institutional contingencies by looking at the repeated use of the same legal personnel, multi- and single invention industry factors, and the institutional targeting decisions of organisations. Therefore, this thesis contributes by highlighting the abilities of a firm to create barriers against imitation and the contingencies that can explain why some firms are unable to appropriate value from their innovations.

The analysis of panel data on litigation activities of U.S. manufacturing corporations matched with financial data showed that patent litigation can increase administrative costs and profitability but does not influence sales per se. These findings imply that firm-specific abilities can build imitation barriers which are traditionally thought to stem from asset characteristics. The moderating effects clarify that patent litigation negatively affects sales and profitability while firms significantly save costs if they rely on repeated legal representation, operate in single invention industries, and litigate repeatedly in the same courts. Thereby, this study differentiates from previous research by concentrating empirically on different measures of performance and firm-specific, industrial and institutional characteristics that nurture value creation from strategic patent litigation.

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1 Introduction

In today's fast-paced business environment firms constantly innovate to stay ahead of competition. However, businesses have to protect their intellectual property (IP) in order to gain economic rents (Ceccagnoli, 2009; James et al., 2013). Whereas IP is a legally defendable asset (Hall, 1992), its protection must be sufficient or imitation might impede the profit opportunities of the firm. According to the resource-based view (RBV), a firm cannot obtain sustained competitive advantage if other firms are able to imitate its valuable and rare assets or replicate the benefits of such (Wernerfelt, 1984; Barney, 1991; Peteraf, 1993). Thereby, from a RBV perspective, the source of inimitability derives from the nature of the asset itself as well as its development and embeddedness within the firm (Barney, 1991; Amit and Schoemaker, 1993). This postulate is extended by scholarship suggesting that firms can build isolating mechanisms to construct or secure inimitability (Rumelt, 1984; Peteraf, 1993; Liebeskind, 1996; Markman et al., 2004). Whereby firms can obtain IP rights, such as patents, to protect their innovations from imitation, these must be enforced respectively to preclude others from using, selling or manufacturing the patented inventions (Ziedonis, 2004; Somaya et al., 2012). Hence, many firms protect against imitation and try to capture value from their IP by litigating their patents. (Strategic) Patent litigation or enforcement is hereafter used when referring to the initiation of a patent infringement lawsuit by a plaintiff in a court of law. Thereby, the plaintiff, i.e. the patent holder, sues an alleged infringer and tries to balance the potential benefits and costs of litigation to increase profitability. Moreover, the focus hereafter is on proactive, rather than, defensive litigation endeavours as infringement lawsuit initiation implies strategic behaviour.

It is striking that research to date predominantly focused on isolating mechanism, such as patents, as barriers against imitation (De Carolis, 2003; Markman et al., 2004; Sherry and Teece, 2004; Ceccagnoli, 2009; Reitzig and Puranam, 2009; James et al., 2013), rather than strategic patent litigation as a vital driver of inimitability and performance. Even though, litigation is incredibly costly, time-consuming and risky (Lanjouw and Schankerman, 2001; Shane and Somaya, 2007; Bessen and Meurer, 2008b) and its sales implications are inconsistent (Rudy and Black, 2015), the existing litigation literature is both scarce and inconclusive about the role of patent enforcement for firm performance. Previous scholarship mainly focused on determinants of patent enforcement and settlement (Meurer, 1989; Lerner, 1995; Lanjouw and Schankerman, 2001; Somaya, 2003; Choi and Gerlach, 2015), whereby only a few articles have paid attention to the outcomes of patent litigation (Shane and Somaya, 2007; Agarwal et al., 2009; Aharony et al., 2015; Rudy and Black, 2015). Especially the influence of litigation on

sales and costs and, therefore, profitability for the firm is mainly overlooked. Hence, there is a need to investigate when the trade-off between sales and costs of strategic patent litigation is becoming beneficial for the firm.

Even less is known about the circumstances that influence the relationship between strategic patent litigation and firm performance. This prompts the necessity for a contingency approach to identify when firms can appropriate value from their IP protection. The central thesis of this paper is that strategic patent enforcement is key to RBV's inimitability of assets and firm performance. Thereby, this dissertation postulates, that to appropriate value from their patents, firms restore to patent litigation, which comes with anticipated benefit but also substantial costs for the plaintiff and, hence, its effects on profitability need to be considered in the unique context of the firm, its industrial environment and its institutional strategies.

The purpose of this dissertation is to assess the effect of patent litigation by a plaintiff in infringement suits on firm performance to fill the gap on the outcomes of patent enforcement. Thereby, it highlights the different organisational, industrial and institutional contingencies to which firms respond in order to build efficiencies in litigation. These strategic responses are possible moderators that influence the relationship between patent litigation and firm performance. Hence, there are three primary aims of this study:

The first aim is to expand the role of knowledge protection postulated in the RBV to include not only property rights as isolating mechanisms but also the strategic enforcement of such. To reach the RBV premise of inimitability of assets to achieve a competitive advantage, firms can resort to patents but also need to enforce them. Hence, strategic patent litigation is a vital aspect of rent appropriation from innovative activity. It is striking that research to date has tended to focus on isolating mechanism as protection of intellectual property against imitation (Sherry and Teece, 2004; Reitzig and Puranam, 2009; James et al., 2013) or patents themselves (De Carolis, 2003; Markman et al., 2004), rather than patent litigation as a vital driver of inimitability and performance.

The second aim is to explore the relationship of strategic patent litigation and performance in terms of sales and profitability while considering costs. This is necessary because little is known about the financial performance outcomes of patent litigation. Aharony et al. (2015), concentrated on alternative outcomes of patent litigation and found that it increases executive turnover. Shane and Somaya (2007) detected adverse effects of litigation on licensing in Universities. Agarwal et al. (2009), found that it can foster a reputation for toughness which reduces knowledge spillover effects. Furthermore, Lanjouw and Schankerman (2001), showed,

that litigation can decrease research and development (R&D) effectiveness for small firms. However, the only study on the effect of industry-specific patent litigation on sales showed inconclusive findings (Rudy and Black, 2015). Hence, the first empirical chapter is looking at litigation which comes with potential benefits and administrative costs that can influence the profitability of patent enforcement. Thereby, this dissertation is probably the first study to undertake a longitudinal analysis of sixteen years, incorporating litigation and financial data of U.S. companies to analyse the influence of strategic litigation on two different measures of performance: sales and profitability as well as costs. This is in line with previous literature, suggesting further research on the RBV's premise of inimitability and its influence on firm performance (De Carolis, 2003).

The third aim is to ascertain the role of strategic patent enforcement and its influence on performance with respect to several contingencies. Thereby, strategic IP enforcement refers to the firm's abilities in building, implementing and organising suitable patent litigation strategies. The mentioned contingencies encompass corporate, industrial, and institutional differences, that firms can (and have to) use for their advantage. Therefore, the second, third and fourth empirical chapters of this dissertation explore when some firms are more equipped in appropriating value through strategic patent enforcement than others.

The second empirical chapter follows the need to incorporate firm-specific contingencies. Previous literature looked at how firms can increase patenting performance by accumulating in-house legal expertise (Somaya et al., 2007) and discussed how to manage in-house and external legal personnel for cost reduction during litigation (Foster, 1986). However, scholarship has not addressed the role of attorneys for performance outcomes in patent litigation. Hence, the purpose of the second chapter is to look at how firms efficiently manage the litigation process by accumulating experience through the regular transaction with the same lawyers. It then assesses if such practices influence the strategic litigation - performance relationship. Firms might build on knowledge from previous work with the same attorneys on their cases, independently of the employment structure, for example, if the attorneys are employed in-house or provide their services by contracting. Thereby, reoccurring transactions are under scrutiny to shed light on efficiencies in managing legal structures in patent litigation.

The third empirical chapter examines how initiating patent litigation can be valuable for some firms and not for others, depending on industrial contingencies. For this purpose, it then concentrates on multi invention and single invention industries. Although research on the outcomes of strategic patent litigation is almost always set in the context of specific industries

(mostly semiconductor and pharmaceutical industries) (Shane and Somaya, 2007; Agarwal et al., 2009; Reitzig and Wagner, 2010; Rudy and Black, 2015) the moderating effect of industrial contingencies on the strategic patent litigation - firm performance relationship is unclear. Whereas in multi invention industries patent ownership and technologies are fragmented, in single invention industries patent ownership and technologies are concentrated (Ziedonis, 2004; Somaya et al., 2011; Somaya et al., 2012). The purpose of this distinction is to highlight the "cause" and not the "symptom" of effective patent litigation. This focus also redirects research attention away from the usually spotlighted pharmaceutical and semiconductor industry, contributing to the scarce knowledge of industry factors impacting strategic patent litigation and its influence on firm performance.

The fourth empirical chapter examines how firms respond to institutional contingencies, to strategically exploit the court system in the United States of America for patent litigation. Institutional targeting, also called forum shopping, is a strategy commonly used by plaintiffs in patent litigation. Nevertheless, its implications for firm performance are unknown. Only recently, research steered towards the role of institutions in patent litigation. However, Somaya and McDaniel (2012), Beukel and Zhao (2018) and Paik and Zhu (2016) only looked at the determinants of tribunal targeting. Hence, a focus on institutional targeting that can be employed by the firm in patent litigation is needed to further investigate performance implications. The fourth chapter proposes that firms that rely on forum shopping by repeatedly litigating at the same jurisdictional venue(s), enhancie their knowledge on specific venues and their abilities to deal with them. While such practices are not new, it is contributed to existent knowledge in the patent litigation field by examining the effect they have on financial performance.

Answering the three research aims contributes to the literature by clarifying the role of patent litigation in securing inimitability of assets and appropriating rents from IP rights. Scholarship is developed by unravelling the strategic patent litigation - performance relationship. Moreover, chapter two to four contribute by looking at the role of firm-specific strategies in patent enforcement that are shaped by organisational, industrial and institutional contingencies.

Building on the discussed purpose and contribution of the topic, the subsequent sections are organised as follows. First, the four main research chapters, their connectedness and the underlying research questions are introduced. Afterwards, the synopsis of the research questions with the design and methods of this dissertation is explained. Lastly, it is concluded by presenting the overall structure of the doctoral project.

1.1 Research Questions

This dissertation is comprised of four distinct but related chapters, each catered to a specific research question concerning strategic patent litigation. Considering that business nowadays is as multi-faceted as ever, its goal is to incorporate different angles of patent litigation into one coherent framework that explains why some firms profit from patent litigation and others do not. This framework is supposed to enrich the vast majority of single-dimensional litigation research with a link between different approaches to reach connectivity and depth at the same time.

1.1.1 Strategic Patent Litigation and Firm Performance

The four research gaps and research questions that address these gaps, outlined in *Table 1*, incorporate different perspectives of patent litigation strategy research and are each on their own necessary to address performance outcomes of patent litigation. Even though comprehensive in their own right, combining them offers a holistic picture of interconnectedness. *Table 1* shows the integrative framework of the four research questions.

Table 1 Integrative Framework of the Four Research Questions

Research Gap	Research Question
The Outcomes of Strategic Patent Litigation	**1:** What is the influence of strategic patent litigation on costs and firm performance, measured on sales and profitability.
Firm-Specific Legal Contingencies in Strategic Patent Litigation	**2:** How does the influence of strategic patent litigation on firm performance vary according to the repeated use of the same legal personnel?
Industrial Contingencies in Strategic Patent Litigation	**3:** How does the influence of strategic patent litigation on firm performance vary according to the industrial environment?
Institutional Contingencies in Strategic Patent Litigation	*4:* How does the influence of strategic patent litigation on firm performance vary according to the repeated litigation in the same courts?

The choice of each research question did not come easily. How could one integrate all research approaches on patent litigation and strategies into one cohesive framework? Especially because

we are talking about a field of research that is not only emerging and not yet grounded with theoretical roots but also widespread within different branches of disciplines.

The first research question serves as the groundwork for the other three research questions and helps to understand why firms litigate and what influence strategic patent litigation can have on firm sales, costs and profitability by building on the resource-based view of the firm. Characterisation of research question two to four is essential to find why some firms benefit from employing patent litigation more than others. Thereby, the second research question is directed towards firm-specific knowledge accumulated by attorneys in patent litigation. The third research question is concerned with the industrial differences that influence the relationship between patent litigation strategy and performance. The fourth research question sheds light on the role of institutional targeting in patent litigation, in particular: strategies directed towards benefitting from litigation by deciding on where to litigate. The four research questions offer a holistic approach which integrates firm-specific, industry-specific and institution-specific research areas to establish a refined understanding of strategic patent enforcement. All four areas present unique research gaps that this dissertation is trying to fill with a detailed investigation of the outcomes of strategic patent litigation and the three contingencies shaping these outcomes. Whereas the first research question introduces the topic of strategic litigation and provides a starting point on accumulating information on the possible outcomes of it, the last three research questions are directed towards innovative research areas with fewer previously build knowledge.

From a strategic management perspective, we often look at three different theories to explain performance through strategy. These three theories and their interconnectedness were titled "strategy tripod" by Peng et al. (2009). From the 1980s up to the 2000s, the resource-based view of the firm (Barney, 1991), the industry-based view (Porter, 1981), and the institution-based view of strategic management (Peng, 2002; Peng, 2003) were introduced to the field of strategic management and set into perspective as the three most significant theoretical drivers of strategy and performance. Accordingly, to reach comprehensiveness in strategic management research Peng et al. (2009), integrated the strategy tripod consistent of, firm-specific resources and capabilities, the industry-based competition, as well as institutional conditions, and transactions as cumulatively influencing strategy and firm performance.

Teece et al. (1986; 1997) introduced the notion to the field of strategic management, that although IP protection can be an effective imitation barrier, the value of its outcome is dependent on contextual conditions. Since then, in patent research, it is well established that the

advantages of patents and patent protection efficacy are context-dependent (Cohen et al., 2000; James et al., 2013) and firm, industry and country effects are known to influence the performance of the firm (Bamiatzi et al., 2016).

The patent system is considered to be extremely variable because of its dependence on context. Past research concerned with the appropriability of value from innovative activity proposed similar integrative models to incorporate multiple contingencies. One important study by James (2013), investigated the effect of the exogenous conditions such as technology, firm, industry and institutional environment on the selection and effectiveness of appropriability mechanisms and, ultimately, on competitive advantage. Hence, the author distinguished between the technological, firm-specific, industrial, institutional and environment to understand IP protection behaviour. Proposing a similar research setting, *Table 2* is derived from James et al. (2013) and Peng et al. (2009) and translated to the context of this dissertation.

The table shows how firm-specific efficiencies can be built by responding to firm, industry, and institutional contingencies to appropriate value from patent litigation. Therefore, utilising a similar thought than Pisano (2006), this dissertation argues, that value and appropriability from patents are not only exogenously given, they also must be endogenously pursued by firms. Which presupposes that the firm has special competences to build efficiencies in patent litigation and respond to unique circumstances. These are defined as the abilities of an organisation to respond to external contingencies of the patent system by building internal competencies of strategic patent litigation.

Table 2 Contingencies and Firm Responses Effecting the Performance Outcomes of Patent Litigation

	Firm-specific legal contingencies determined by the requirement of hiring attorneys for patent litigation	Industrial contingencies determined by technological and patent fragmentation	Institutional contingencies determined by a legal regime with intra-court differences
External Contingencies			
Response of the firm	Building efficiencies by using the same attorneys repeatedly	Integrating strategic litigation in multi and single invention environments	Exploiting the benefits of getting familiar with institutional characteristics

When combining strategic management and patent litigation approaches, three main research areas melt together: the firm itself, the industrial context and the institutional context. The four research questions present themselves in consecutive empirical chapters, creating valuable insights to fill the knowledge gaps. The following sections briefly introduce them:

1.1.2 Research Question 1 (Empirical Chapter 1)

Research Question 1: What is the influence of strategic patent litigation on costs and firm performance, looking at the two performance dimensions: firm sales and profitability.

As evaluated in the introduction, knowledge on patent litigation outcomes is still scarce, especially when it comes to the effect of litigation strategies on firm performance. In order to address this gap and to investigate if strategic litigation is beneficial for firm performance, this study looks at three dimensions of patent litigation outcomes: administrative costs, firm sales, and therefore, overall profitability.

The litigation phase is of particular importance due to its promising payoffs but also due to the many challenges which can decide about firm performance. Litigation outcomes are often unpredictable because the value of each patent and the risk of each litigation endeavour is unique (Lanjouw and Schankerman, 2001). Hence, the enforcement of property rights is neither certain of success (Marco, 2005; Somaya, 2012) nor a very convenient approach (Rudy and Black, 2015). Difficulties can occur, for example, if the enforceability of the exclusionary protection granted by the court is uncertain (Ziedonis, 2004; James et al., 2013), or if the litigation process is particularly time consuming and disruptive (Shane and Somaya, 2007; Gans et al., 2008) which can have significant monetary implications. Therefore, firms have to strategically manage the risks of litigation by considering the potential benefits of maintaining or increasing sales as well as possible detriments due to high costs and uncertainty carefully. Recent research found that patent litigation can positively influence firm sales (Rudy and Black, 2015). However, despite possible sales profits, the high costs involved in litigation and expensive long-term trials (Shane and Somaya, 2007; Lumineau and Oxley, 2012) can harm the overall benefits of increased sales. To determine the performance consequences of patent litigation, possible detrimental costs effects on firm profits should not be neglected.

Throughout this dissertation, the cost aspect of strategic patent litigation is presented as a counterweight to the possible sales benefits of litigation. Thereby, although presented in the main results, the organisational cost of litigation should not be considered as a performance measurement. The influence of strategic litigation on organisational costs is illustrated to make the effect that strategic litigation can have on expenses more explicit. It is included as a narrative for explaining firm performance because of its importance when it comes to the strategic choices during litigation. For example, strategies during litigation can increase or diminish such cost significantly. Therefore, litigation specific influences on organisational costs can be the

missing piece to explain the influence of strategic patent litigation on firm performance. The focus on costs as well as performance outcomes is vital to fill the need for the recognition of patent litigation strategies as important protection mechanisms against imitation and means to extract financial value from innovations. Thereby, considering costs includes a valuable part of the cost-diminishing litigation strategies of companies.

1.1.3 Research Question 2 (Empirical Chapter 2)

Research Question 2: How does the influence of strategic patent litigation on firm performance vary according to the repeated use of the same legal personnel?

When taking a closer look at strategic patent litigation, the influence of patent litigation strategies on performance is not uniform across firms. Thus, it must be considered how factors pertaining to the indigenously firm-specific context influence the relationship between litigation strategies and performance to understand why some firms are able to benefit from innovation while others are not. Liebeskind (1996) argued that the ability of a firm to effectively protect valuable assets from imitation distinguishes it from competitors. Furthermore, the unique organisation of a company can provide an important isolating mechanism (Rumelt, 1984; Liebeskind, 1996). Some firms might be more able to protect their assets from imitation than others because of specific characteristics they possess. That means that similar assets possessed by different firms can still lead to different litigation outcomes. Firms have to strategically litigate to benefit from their patents in the given environment. Thereby, firms need a feasible and valuable patent litigation strategy that aligns with their litigation strengths and experiences.

To find such strategies and perform such litigation, companies can build on knowledge deriving from their previous legal associations. Therefore, knowledge from transaction cost economics (TCE) on firm-supplier relationships is integrated. More precise, attorneys that are employed on a regular basis accumulate firm-specific knowledge which they can leverage in future cases. Thereby, the concept of firm specificity of performance from Huckman and Pisano (2008) is incorporated. The endogenously accumulated expertise built by repeated firm-attorney relationships can be an important factor for performance outcomes when litigating. Specifically, this chapter investigates, if the repeated use of the same legal personnel influences the effect of strategic patent protection on firm performance.

Litigation strategies and cases are not built in a vacuum; they are dynamic and contextually embedded within the context of the firm. For many litigation cases, success comes down to the

ability of the lawyer to build a case. Thereby, legal representation and the execution of litigation is unique for each company. Therefore, this research question examines how the repeated use of the same legal personnel influence the patent litigation strategy – performance relationship.

1.1.4 Research Question 3 (Empirical Chapter 3)

Research Question 3: How does the influence of strategic patent litigation on firm performance vary according to the industrial environment?

It is well established in the patent literature that the effectiveness of patents and patent strategies is dependent on the industrial environment (Mansfield et al., 1981; Levin et al., 1987; Cohen et al., 2000; Somaya, 2012; Somaya et al., 2012). Surprisingly, although scholarship on patent litigation outcomes almost always incorporates industry measures (Shane and Somaya, 2007; Agarwal et al., 2009; Rudy and Black, 2015), knowledge about the utilisation and outcomes of strategic patent litigation across industries is scarce. Patent and litigation literature only fragmentarily concentrated on certain industries, the adoption of different patent strategies within them and the sales implications of litigation (Reitzig, 2004b; Ceccagnoli, 2009; Rudy and Black, 2015). Even less is known about how factors pertaining to the industry context influence the relationship between litigation and performance. Even though Rudy and Black (2015) found that the likelihood of initiation of patent infringement suit or a declaratory judgement suit can be dependent on the industry, it is still not clear how patent litigation enhances or diminishes the magnitude of firm sales and costs dependent on the characteristics of the industry. This dissertation focuses on multi invention and single invention-industries, which each comprise several industries that are distinguished by the fragmentation of patent ownership and technologies as main characteristics. Hence, the present study addresses this gap and investigates how inter-industry differences, influence the patent litigation - firm performance relationship. The question is, if the exogenously given industry context plays a significant role in determining the effectiveness of strategic litigation and its impact on costs and potential benefits. Answering this question offers theory development opportunities on how firms can maximise their value capture from patent protection (Cohen et al., 2000; Reitzig and Wagner, 2010; James et al., 2013).

In conclusion, although it was touched upon the value of litigation in various industries (see: (James et al., 2013)), it's outcome concerning strategic endeavours tailored to industry characteristics could open up a new route for theoretical explanations of why some firms can

outperform their competitors. Thereby, this chapter follows a research call of a multi-year study of patent litigation in multiple industries by Rudy and Black (2015).

1.1.5 Research Question 4 (Empirical Chapter 4)

Research Question 4: How does the influence of strategic patent litigation on firm performance vary according to the court specific experience of firms?

When trying to unravel the influence of strategic litigation on performance, it is not enough to focus on firms and their industrial environment. There is a need to address the formal institutional context of a firm. In the case of the legal institutions, companies need to respond to the institutionally given environment and find a comprehensive strategy that takes the court of law into account. Institutional targeting has played a major role in patent litigation for decades and became more and more important due to the increasing emphasis on speed and hope for more certainty during the litigation proceedings. Hence, this chapter investigates which role court targeting of firms plays when it comes to the influence of patent litigation on firm performance.

Whereas this study considers the industrial environment as exogenously given, the courts at which litigation lawsuits are filed are a mix between a given institution and a strategic choice. Indeed, all plaintiffs have to resort to traditional and existing courts (which means that institutions and industry regulations apply for all firms in the context) within the United States to litigate their patents. However, they are granted a certain degree of autonomy in choosing the jurisdiction where they want to litigate. In practice, the choice of location of the court might determine the outcome of the strategic litigation proceedings of the plaintiff in terms of benefits and the financial aspects of litigation. Previous literature has predominantly focused on determinants of tribunal targeting and the possible advantages for the suit itself (Somaya and McDaniel, 2012). However, the outcome of institutional targeting and its potential influence on firm-level performance received less attention.

Linking that to the theoretical question of how patent litigation affects firm performance, one must consider the firm's competencies to handle the jurisdictional environment to conclude how the choice of venue for litigation is influencing litigation success as well as how a firm can control this aspect of litigation by using targeting techniques.

1.2 Synopsis of the Research Questions, Design and Method

The influence of strategic patent litigation on performance is highlighted from four different angles that build upon each other. Beginning from the underlying investigation of the influence of strategic litigation on sales and profitability in general, the focus will be set on firm-specific knowledge, certain industries and finally, local institutions. All four research questions are dedicated to the relationship of patent litigation and performance as well as costs, yet, all four serve their specific purpose of creating a holistic picture that describes patent litigation as a means to create and maintain value by fostering inimitability of assets. Therefore, the design of this study is meant to provide four intertwined perspectives that are, yet essential in effecting the patent litigation – performance relationship.

In sum, the four research questions built a holistic framework of strategic patent litigation, illustrated in *Figure 1*:

Figure 1 The Influence of Strategic Patent Litigation on Firm Performance
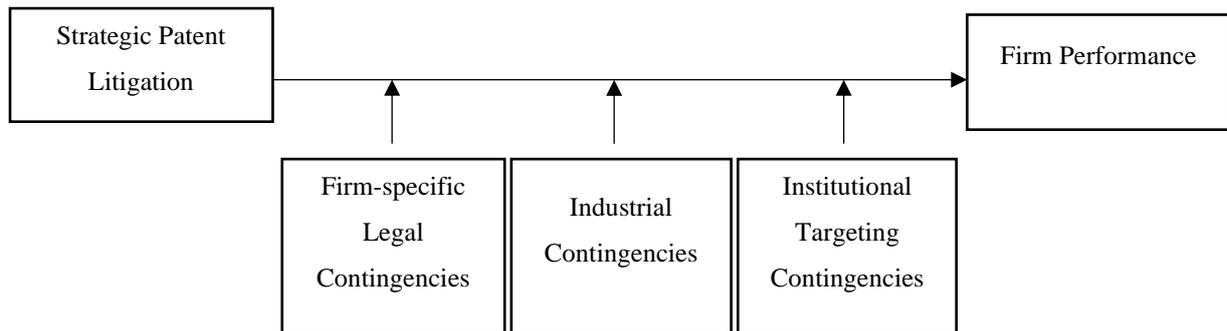
The research design in this dissertation is characterised by a deductive research approach to achieve the discovery of generalisable causal relations. Thereby, expected relationships are deduced from theory and tested by numerous observations. To provide coherence with regards to the different parts of the study, an overarching quantitative method was used to collect and analyse the data. Thereby, each chapter entails a quantitative empirical investigation based on the same sample of firms to ensure the coherence of the new findings. This is supposed to support the comparability of the different contingencies to provide a generalisable contribution to theory.

Data for this study was collected using litigation data provided by the United States Patent and Trademark Office and matching it with financial firm data from Thomson One Banker. Similar approaches were utilised in previous research (for example, see Somaya and McDaniel, 2012). By combining data on strategic patent litigation and firm performance, a novel dataset was created, that enriches scholarship on patent litigation. The timeframe of the dissertation data spans over 16 years, from 2000 to 2015, which brings exceptional data richness to the field in terms of consistency and data availability.

1.3 Dissertation Structure

The thesis is composed of a theoretical foundation relevant to the remainder of the dissertation, an initial review of the literature and research design and methodology that explains the data collection process, followed by four chapters, each addressing one of the four research questions, and a closing section, discussing the outcomes of the four chapters and the combined contribution of the dissertation.

2. Theoretical Framework and Literature Review

This section begins by defining the fundamental concepts of strategic patent litigation and firm performance. First, it discusses the theoretical framework by establishing the importance of the RBV and inimitability to appropriate value from strategic patent enforcement. Second, it highlights innovation and intellectual property. Third, the section presents the main logic of patents, patent strategies, patent litigation and strategic patent litigation. These sections also give a brief overview of the recent history of patent research. Fourth, the chapter provides a literature review that incorporates past research on multiple topics concerned with determinants and outcomes of patent enforcement.

3. Research Design and Methodology

The overall research design and methodology section begins by discussing positivism as the underlying philosophical approach of the dissertation. It will then go on to present the justification for the chosen quantitative research design. Afterwards, it explains the data collection and the extensive data cleaning and matching endeavours that produced the final dataset. The chapter is closing with a short section on research ethics and its utilisation in this research project.

4.-7. Empirical Chapters on the four Research Questions

The first empirical chapter of this dissertation examines the influence of strategic patent litigation on firm costs, sales and profitability. In the second empirical chapter investigates how the repeated legal representation by the same lawyers for the same firm can influence performance outcomes and costs. The third empirical chapter elaborates on how firms that operate in different industries but employ similar patent litigation strategies, experience different outcomes on costs, sales and profitability. The fourth empirical chapter focuses on institutional targeting and, how repeated litigation in the same courts influences the performance outcomes of patent litigation.

8. Integrated Discussion and Conclusion

The integrated discussion and conclusion shows the main outcomes from the four chapters by presenting the integrative framework *Table 1*, this time highlighting how the results from the four chapters filled the proposed research gaps. Then, the discussion of the academical and practical contributions and implications is conducted. Thereby the focus is on the contributions of this dissertation to reflect on the purpose and implications of the completed work. A thorough discussion of the limitations and future research opportunities follows before closing with a forward-directed conclusion of the doctoral project.

9. References

The last section of this dissertation presents the consulted and cited literature.

2 Theoretical Framework

In this chapter, sections *2.1 The Resource-Based Views' Postulate of Inimitability* and *2.2 Appropriability from Innovation* establish the foundational theoretical contribution of this dissertation. Sections *2.3 Definition of Key Constructs* to *2.4 Previous Research in the Field of Patent Litigation* discuss the various components of strategic patent litigation necessary to build the foundation of the theoretical framework. Thereby, these chapters not only explain the underlying constructs but they also present definitions and key concepts in the literature and critically examine them to understand the importance of patent litigation for the postulate of RBV's inimitability of assets. The section *2.4 Previous Research in the Field of Patent Litigation* discusses what we already know from previous work in the field necessary to understand the theoretical contribution and the contribution that can be made to the field by the integrative framework from *Table 1*.

2.1 The Resource-Based Views' Postulate of Inimitability

In the underlying integrative framework for this dissertation (*Table 1*) the question of the influence of strategic patent litigation on performance arises. Although knowledge in the area is growing, the influence of patent litigation strategies on firm performance in the context of the RBV is not yet sufficiently understood. The following chapter explains how the RBV's notion of inimitability of assets builds the necessary link between strategic patent litigation and firm performance.

Achieving a competitive advantage requires that the firm is capable of employing a strategy which allows it to capture value from its assets, whereby the values of this strategy are not and cannot be duplicated by competitors (Barney, 1991). Thereby, assets are often described as particular types of resources that are owned by an organisation and influence value generation (Barney, 1991; Amit and Schoemaker, 1993; Teece et al., 1997). Firm-specific assets can be tangible (for example, equipment, plants and monetary) or intangible (for example, internal technological knowledge, information processes, employees) in nature (Wernerfelt, 1984; Amit and Schoemaker, 1993). According to the RBV, a unique asset position possessed by the firm which is isolated against competitors is vital to achieving above-normal profitability (Wernerfelt, 1984; Teece et al., 1997). Therefore, the RBV postulates inimitability of assets as a driver of sustained competitive advantage. This is because successful barriers to imitation can lead to above normal profits (Barney, 1991). With the beginning of this century, inimitability

was predicted to be one of the most important research opportunities emerging from the RBV (Barney, 2001; De Carolis, 2003).

To explain how strategic litigation, rather than patenting, is a means, and sometimes a premise, to achieve inimitability of assets, the roots and evolution of the resource-based research stream have to be discussed:

The RBV is widely established and utilised in strategic management research (Teece et al., 1997). However, until it emerged, the competitive forces approach from Michael Porter (1980; 1981) was predominant. It represented the stance that a firm's industrial environment, rather than firm-specific characteristics, is impacting its competitive advantage. It assumed that resources and strategies within industries are mobile (Porter, 1981). Which led to the presumption that a heterogeneous asset position is short-lived because assets were thought to be easily traded enabling firms to implement similar strategies (Barney, 1991).

The RBV offered a new, firm-focused perspective. It provided a contrast to the assumptions predominant at the time by postulating long-lasting asset heterogeneity due to asset immobility between firms (Barney, 1991). RBV was pioneering due to its consideration of inter-firm variations as the source of competitive advantage. Hence, it challenged the assumption that firms gain sustained competitive advantage by strategically leveraging resources to respond to environmental opportunities in resource-homogenous industries. The RBV introduced two key assumptions: resource must be unevenly distributed between firms as well as immobile to allow firms to achieve above normal rents (Wernerfelt, 1984; Barney, 1991). Many concepts of assets and performance emerged with the RBV which motivated Peteraf (1993) to provide a clarifying model and further developed the underlying assumptions of Barneys' RBV. According to the author, a resource-based view requires four underlying economic assumptions. Those are heterogeneity (superior resources lead to monopoly rents), ex-ante limits to competition (initially limited competition for a superior asset position to keep the costs of sustaining that position low), imperfect mobility (necessary to bound the rents to the firm) and ex-post limits to competition (which sustain those rents by preserving heterogeneity). Those must be given to ensure a sustained competitive advantage (Peteraf, 1993).

Barney (1991), in his definition of RBV, elaborated on the specific characteristics of a resource. Whereby, even if a resource is valuable, rare and non-substitutable competitive firms could simply imitate this same resource. Therefore, a resource must also be inimitable to be the potential source of sustained competitive advantage. Furthermore, inimitability is a vital attribute of resources because imitation influences the rareness and value of the resource

(Polidoro and Toh, 2011). According to Barney (1991), inimitability can derive from firm-specific historical conditions (such as the time and place of a firms business), causal ambiguity (i.e. that the link between the resource and sustained competitive advantage is not sufficiently understood by the firm and competitors) or socially complex resources (for example interpersonal relationships or reputation). (Matheja, 2017, Understanding your discipline assignment, pp.2-3). However, a central argument of this dissertation is that inimitability does not solely emerge from one of those three traditional understandings. The consideration of patent litigation as a protection mechanism against resource imitation adds to the RBV assumption that a superior asset must be inimitable, valuable, rare and non-substitutable to enable the firm to employ a strategy to reach sustained competitive advantage. This thesis proposes that firm-specific abilities with respects to patent litigation against infringers is the missing link in our understanding of the RBV and barriers against imitation that lead to superior firm performance. This is based on the two arguments that many resources are not inherently inimitable, and patents constitute imperfect isolating mechanisms.

Traditionally, in Barney's approach, inimitability is presented as a key feature of the resource itself, which needs to be given to achieve sustained competitive rents (Barney, 1991; Amit and Schoemaker, 1993). However, in today's business environment and considering the technological advancement that companies are dealing with, inimitability based on historical conditions, causal ambiguity or socially complex resources is rare. Hence, a lot of attention in the strategic management literature has been dedicated to the protection of IP against imitation (Sherry and Teece, 2004; Reitzig and Puranam, 2009; James et al., 2013). Despite referring to inimitability as an inherent characteristic of a resource itself, assets that are not inimitable every so often can be protected by patents, as isolating mechanisms, to fabricate inimitability. It is well-established knowledge in the field of strategic management that IP rights, such as patents, are isolating mechanisms[1] that can provide barriers to imitation (Rumelt, 1984; Somaya, 2012; James et al., 2013) and recent research did value the possible positive relationship between isolating mechanisms and firm performance in the context of the RBV (Amit and Schoemaker, 1993; Teece et al., 1997). However, the present study complements the RBV by arguing that an effective imitation barrier to create or maintain value requires that firms actively enforce and protect their patents. Especially because patent enforcement, particularly litigation against infringers, can counteract the imperfect isolation posed by patents because of two reasons:

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[1] Isolating mechanisms can be categorised in formal (e.g., patents, trademarks) and informal (e.g., secrecy) property rights, first mover advantages (e.g., lead time), complementary assets (e.g., market capabilities) and information asymmetries (e.g., specific product knowledge) (Rumelt, 1984, 1987; Lawson et al., 2012; James et al., 2013)

First, literature postulates that a patent does not grant affirmative rights (Ziedonis, 2004). While it constitutes a possibility to protect IP by precluding others from using, manufacturing or selling a protected innovation, it grants no usage right per se (Marco, 2005; Somaya et al., 2012), but only an option to go to court (Marco, 2005). Consequently, a firm's strategy to protect against the infringement of an IP right is vital to secure its value (Chen et al., 2016). This indicates that especially the enforcement of a patent in court is likely to determine the overall rent generation from it. Therefore, the success of patent protection is not only dependent on a firm's ability to acquire patents but also on its take-up on its rights to enforce those patents in court to protect them from infringement. Such enforcement can be accomplished by the use or threatened use of litigation. During the litigation process, courts can be involved to legally exclude competitors from using the invention, to compensate the patentee with royalties (Somaya, 2012) or to challenge the validity of patents from competitors (Marco, 2005). Therefore, patent litigation expands the boundaries of and secures the protection offered by patents.

Second, filing a patent is a double-edged sword because it gives a firm the option to protect its resources while disclosing details on how these resources can be built. Patents disclose valuable information publicly, facilitating substitution and imitation (Langinier, 2005; Somaya et al., 2011). Hence, the patent is offering useful knowledge on how to imitate the IP it protects. Past research even found that imitability based on patent citations has a negative influence on performance (De Carolis, 2003). This suggests that patents alone are insufficient isolating mechanisms and do not suffice in building inimitability of assets. While modern businesses found a way to try to isolate from imitation (even if their resources themselves can be copied) by using patents, they also have to protect against the usage of knowledge exposed by the same patents. This is mostly done by the use or threatened use of litigation. Hence, whereas patents constitute a hurdle to imitation, litigation is inhibiting it. Thereby, patent enforcement is a strategic weapon to ensure inimitability of assets, even for those resources that can be easily imitated otherwise.

These arguments support that skilful enforcement of patents by using litigation can be the missing link that ensures a sufficient barrier to imitation and value creation. Liebeskind (1996) argued, that some firms, in comparison to their competitors, have superior knowledge-protection skills that prevent imitation. Hence, it should not be ignored that firms have to actively make sure that their assets cannot be copied by competitors. If this option is not strategically used, IP is simply disclosed, which may explain why some firms are better in securing inimitability and competitive advantage. Patent litigation allows imitation protection

constituted by the ability of the firm to create legal barriers to imitation, which makes the asset in question not inimitable from a technological perspective nor inimitable because of historical conditions, causal ambiguity or socially complex resources (Wernerfelt, 1984; Barney, 1991) but from an economic and legal perspective. A perspective of superior knowledge protection skills proposed by (Liebeskind, 1996), that makes firms more capable to deter imitation. Consequently, strategic litigation must be considered as a vital part of securing inimitability. Therefore, the RBV literature should be extended with regards to the role of the firm in litigation while trying to secure inimitability of assets and economic rents.

Strategy research shows that the organisation of protection by a firm can cater as a crucial factor in establishing isolating mechanisms (Rumelt, 1984). To profit from their innovations, firms need strategies to respond to the market and their given appropriability regimes (Pisano, 2006). In other words, sustained competitiveness may not only stem from patents but also from the ability of the firm to effectively protect its patents from imitation in its given context. This ability builds on the congruence between internal possibilities and strategies and the outside environment. However, this is not an easy task. Until now, it is not fully understood why some companies succeed in providing sufficient legal barriers by the use or threatened use of litigation to defend their assets and others do not. The question remains in which contexts firms can protect their patents to reach or maintain a superior performance position. Consequently, researching patent litigation with regards to a firm's internal and external contingencies might be central to answer the question of why some firms are more capable protectors than others. Hence, the acknowledgement of a firm's contingencies of efficient patent enforcement adds to our understanding of value creation from strategic litigation of patents.

The beginning of this paragraph stated, that achieving competitive advantage requires a firm *to employ a strategy that allows it to capture value* from its assets, by establishing inimitability (Barney, 1991). Afterwards, the aspects of inimitability and patent litigation were discussed thoroughly, whereby the latter enforces IP rights. However, the aspect of *strategic* patent litigation employment to *capture value* from assets needs an additional discourse. By building on the RBV and this demand of inimitability as the main driver of sustained competitive advantage (Wernerfelt, 1984; Barney, 1991; Peteraf, 1993), the momentousness of strategic patent litigation for firm-specific value creation is discussed in the next paragraph. The important aspect of this theoretical extension is appropriability. By understanding the concept of appropriability, it can be further and fully explained how and why patent litigation fits RBV.

2.2 Appropriation from Innovation

In the previous chapter, it was explained how the RBV's notion of inimitability of assets builds the necessary link between patent litigation and competitive advantage. In the present chapter, a firm's value appropriation abilities add to this link by integrating firm-specific abilities to strategically respond to certain contingencies with patent enforcement.

Appropriability refers to the degree to which a firm captures the value created when it introduces an innovation (Teece et al., 1997; Ceccagnoli, 2009). Thereby, IP protection mechanisms, such as functioning legal systems of protection and the type of innovation constitute so-called appropriability mechanisms or regimes (Teece, 1986; Cohen et al., 2000; Pisano, 2006). An efficient imitation barrier that increases the chances for profit is determined by a strong appropriability regime, which can be exogenously given (for example, IP rights regimes) (Cohen et al., 2000) or endogenously created (by competence or capabilities) (De Carolis, 2003). Hence, appropriability also refers to the extent to which firms can limit other firms from imitating their innovations by leveraging inter-firm differences (Ceccagnoli, 2009).

This is in line with Teece (1986), showing that the appropriability regime is given (for example, as the nature of the technology and the power of the legal environment) but profiting from innovations needs to be mastered by aligning the appropriability regime with the firm's litigation capabilities or assets. According to the author the strategy needs to be fitted to the appropriability regime and the tighter the regime, the more complementary specialised assets (for example, litigation (strategies)) need to be in place to profit from innovation. Pisano (2006) elaborates on Teece's logic that companies need to choose a complementary asset position fitted to the appropriability regime that surrounds them. Thereby, he suggests, that firms can even change the appropriability regime by drafting IP rights strategies that allow them to endogenously appropriate returns from their innovations. As an example of such strategies, the author names open source[2] or disclosure in genomics. However, even in less drastic examples, to profit from their innovations, firms need strategies to respond to the market and their given appropriability regimes.

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[2] For example, the car maker "Tesla" is operating in a niche market with firms manufacturing gasoline cars as its biggest competitor. Tesla's CEO decided to announce that they will not sue infringers to keep the market growing. However, patents are still filed and maintained. This strategic patent (and preparing for patent enforcement) behaviour is a means to shape the appropriability regime, by independently of patents, practising open innovation in order to increase profits.

Traditionally formal (e.g. patents, trademarks) and informal (e.g. secrecy) property rights, (Rumelt, 1984; Rumelt, 1987; James et al., 2013) are oftentimes referred to as isolating mechanisms that can determine the quality of appropriation. However, past research stresses that, in addition to the mere possession of patents, firms can strategically leverage the proficiency of them as an imitation barrier (Teece et al., 1997; Pisano, 2006; Somaya, 2012). It was argued before, that patents are offering insufficient guard against infringement. In practice, they need to be enforced to protect valuable IP. Thus, patents are oftentimes considered to provide imperfect appropriability (Teece, 1986). Therefore, the value and appropriability from patents are not only exogenously given, they must be endogenously pursued by firms. Which presupposes that the firm has special skills, such as "to integrate, build and reconfigure internal and external competences to address [..] environments." (Teece et al., 1997, p.516). Here, they are defined as the abilities of an organisation to respond to external contingencies by building internal competencies.

Translated to the patent litigation context, this could mean that firm-specific factors, for instance, strategies in patent litigation and legal efficiencies built by repeated experience with the same attorneys or courts, can enhance the appropriability from IP. In other words, sustained competitiveness may not only stem from patents but, in addition to the suggestions of the RBV, also stem from the ability of the firm to effectively protect its assets from imitation in congruence with its internal possibilities and strategies to address its outside environment. Particularly, researching strategic litigation with regards to a firm's internal capabilities to respond to external environments, as a way to protect patents from imitation, might be central to answer the question of why some firms are more capable protectors than others.

Appropriation from patent litigation

In the context of litigation, both traditional streams of the above-mentioned appropriability discussion are important. Firms use strategic litigation to respond to tight or loose appropriability regimes whereby the outcomes of these strategies might vary according to the differences in those appropriability regimes, for example, in different industries. Hence, during patent litigation, firms can either benefit or suffer from exogenously given appropriability regimes. Respectively, the appropriability regime being equal, some firms might be able to employ strategic litigation to appropriate value from their inventions better than other firms, due to firm-specific efficiencies build from past experiences. Firms then can employ their specific knowledge to create value while responding to a certain type of exogenously given appropriability regime, for example, through experience with legal parameters of litigation.

Previous literature is supporting this argument, providing compelling research that a firm's capabilities can determine positive performance outcomes compared to competitors (Teece, 1986; Rumelt, 1987; Liebeskind, 1996; Teece et al., 1997; Eisenhardt and Martin, 2000; Zollo and Winter, 2002; De Carolis, 2003; Reitzig and Puranam, 2009). Therefore, this dissertation argues, that an efficient imitation barrier that increases the chances for profit is dependent on a certain appropriability regime and the firm-specific efficiencies in strategic patent litigation. Thereby, the firm-specific efficiencies are considered closely, to argue that they are a means for appropriation of value, rather than its creation. Reitzig and Puranam (2009) suggested this novel approach and concentrated on value capture and protection from imitation to secure IP. Whereas the authors suggest this on the patent level, this dissertation argues that firm-specific abilities with regards to patent litigation are an important addition to understand value appropriability from patent rights by guarding or establishing inimitability. Consequently, this proposes, that a firm's value appropriation from an invention is not only affected by exogenous appropriability regimes (Cohen et al., 2000), or patent protection (De Carolis, 2003; Reitzig and Puranam, 2009) but also, or more so, by strategic litigation and the involved competences of the firm in different contexts.

This focus is important to fill the need for the recognition of strategic patent litigation as a vital contributor to financial performance. Furthermore, firms can build specific efficiencies tailored to strategic litigation that supports them benefitting from their patents in different contingencies. Hence, different levels of risks, costs and potential benefits of litigation can be achieved by firm-specific abilities and knowledge of building, implementing and organising patent litigation tailored to the specific context.

Taking this into account, the present research paper suggests that some firms 1. build firm-specific legal experience, which is not transferrable to other organisations, 2. have the ability to choose the right strategy for the given industry context, 3. better employ court targeting practices. Consequently, these firm-specific abilities influence the outcome of patent litigation in terms of performance. This contributes to existing knowledge on the RBV's notion of inimitability by considering imitation barriers determined by exogenous appropriability regimes and endogenously built abilities to capture profits from patent enforcement in such regimes.

2.3 Definition of Key Constructs

Throughout this dissertation, reappearing key constructs are discussed which refer to different fundamental concepts of the research framework. This is necessary to address the main concepts underlying strategic patent litigation as presented in the main framework *Table 1*. The following *Table 3* gives an overview of the key constructs, which are established and critically discussed in the following sections.

Table 3 Definition of Key Constructs

Chapter and Construct	Reference	Definition in this Dissertation
(*2.3.1*) (Product) Innovation	Schumpeter, 1934	The introduction of a product which is new to consumers or of higher quality than the product that was available in the past.
(*2.3.2*) Intellectual Property (IP)	Black's Law Dictionary	"Intellectual property is a category of intangible rights protecting commercially valuable products of the human intellect. The category comprises primarily trademark, copyright, and patent rights [..]."
(*2.3.3*) Patents	USPTO, 2020	"A patent for an invention is the grant of a property right to the inventor." In the United States, "The right conferred by the patent grant is, in the language of the statute and of the grant itself: "the right to exclude others from making, using, offering for sale, or selling" the invention in the United States or "importing" the invention into the United States."
(*2.3.4*) Patent Litigation	Lanjouw and Schankerman, 2001	"[..] the decision to file a lawsuit and, following that, either to resolve [their] differences in pretrial settlement negotiations or [..] going to trial."(p.131)
(*2.3.4*) Patent Litigation Strategies	Rudy and Black, 2015	Proactive Proprietary Patent Litigation Strategy or Proactive Defensive Patent Litigation Strategy.
(*2.3.4*) Strategic patent litigation	Rudy and Black, 2015	Proactive Proprietary Patent Litigation. A plaintiff filing an infringement lawsuit.
(*4.2*) Firm Performance		Financial performance. In particular: firm sales and firm profitability. Costs are considered to make the effect explicit.

2.3.1 Innovation

There is no "one size fits all" guide to successful innovation as it comes in all forms and sizes. According to Schumpeter (1942), the father of innovation research, innovation can be a new process, the initiation of a new market, new sources of material necessary for development, changes in the industrial organisation itself or incremental or radical innovation of a technology, product or service. From Rothwell and Gardiner (1985), we know that the process of innovation is lengthy. Starting from an idea which leads to the invention as such. Once the invention is commercialised, we speak of it as an innovation, and the cycle continues by incremental changes of that innovation. To be successful in the market and ahead of the competition, firms need to innovate. In the 1980s, Freeman et al. (1982), already wrote "not to innovate is to die" and with today's global, fast-paced economies, it is more necessary than ever. However, not all firms benefit equally from innovation.

One might say that, in a perfect world, a firm's value creation is integrated into market progress based on collective, open innovation. In today's economy, on the contrary, firm value creation is rooted in individual innovation protected by IP rights, often patents. This shows again that firms need to innovate and protect their innovations because otherwise, they might risk losing essential profits. The conundrum is that the same argument does not hold when thinking about the ideal open market, free of patents and IP. Without IP protection, markets might be more efficient, and innovation might increase, however, firms also lose one of their most important competitive advantages. Hence, patents are still vital in today's business environment, but it is important to note that appropriability from innovation and value-creating moves far beyond patents (Somaya et al., 2012). We do not know the realities of a market without patents, but one thing is certain: either "all" companies protect their innovations, or "none" do. Leaving little room for an in-between solution[3]. Put differently, firms need to protect their IP to capture rents from their innovation and also to foster new innovation. Thereby, research agrees that patents are a key tool to achieve both (Kitch, 1977; Mazzoleni and Nelson, 1998; Cohen et al., 2000; Rudy and Black, 2015). Whereby they might be more powerful to achieve the first.

Back to today's market, where without IP rights, fast, low-cost imitation is inevitable (Mansfield et al., 1981; Cockburn et al., 2002; DiMasi et al., 2003; Adams and Brantner, 2010; Liu and La Croix, 2015), hence firms are often discouraged to continue innovating without them. This is because the innovation always remains the same; the only thing that changes is

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[3] There are firms trying to establish an "open source" approach, not litigating against infringers, for example, Tesla.

which company is creating value from it. Sherry and Teece (2004) present one crucial point: innovation and value from that innovation are different concepts, where the innovation itself is independent (however related) to the intellectual property rights for that given innovation. Innovation, especially creating value from innovation by successful commercialisation, is a challenging goal that many companies do not achieve. Lacking the needed competencies for commercialisation may deter the firm from returns and enable other firms, customers or other players in the industry to profit instead. Those competitors often possess complementary assets that make it easier for them to profit from innovation through imitation as opposed to the originator of the IP (Teece, 1986). Therefore, argued based on Teece (1986), one crucial part of successful market positioning and commercialisation is the protection against competitors by fostering unique skills within an industry or within the firm. However, there is no "one size fits all" approach to innovation and also no formula that promises perfect IP protection skills.

In sum, the innovation itself is a fragile construct, and its value is bound to its intellectual property rights. These are supported or even created by firm-specific capabilities in the market.

2.3.2 Intellectual Property and Forms of Intellectual Property Protection

Intellectual property is an intangible asset often associated with innovation and it is most precious to the company if it is protected from imitation (Barney, 1991). IP rights such as patents, copyrights, trademarks (Teece et al., 1997; Sherry and Teece, 2004) and industrial designs can be filed for by a company to protect IP. However, firms can also capture value from intellectual property by relying on secrecy, lead time or complementary assets (Levin et al., 1987; Cohen et al., 2000; James et al., 2013). All of the above protection mechanisms can be isolating mechanisms against imitation. However, the focus on patents as a form of IP protection in the present research has three different reasons.

First, other than copyrights, trademarks or industrial designs, patents offer tangible IP rights that can be accumulated and enforced by law. Whereby, other isolating mechanisms, for example, secrecy can be used to prevent the imitation of IP and to diminish the "observability" of knowledge (Liebeskind, 1996) they are often subject to "leakage" problems. Patents hereby have the advantage, that they can protect valuable innovations that have high-value capture potential by law, even though they are often publicly disclosing vital information (Somaya et al., 2011). This means that patents constitute protection that can be defended by law and also traded.

Second, patents offer detailed precise protection, especially for technological innovation which can be protected by the strong appropriability regime in the United States of America. Secrecy or lead time is oftentimes more important in environments with weak appropriability where patent rights are fragile, unenforceable or are used complementarily (Beukel and Zhao, 2018). In such environments, patents are not less important, their purpose, however, can switch from value creation to other strategic means, for example, to the protection of other patents (Lanjouw and Schankerman, 2001; Beukel and Zhao, 2018) or to building patent portfolios to counter litigation risks (Ziedonis, 2004; Beukel and Zhao, 2018). Different products, processes and technologies need different imitation barriers (Teece et al., 1997). Here, the scope, longevity, protection ability and feasibility of each IP right is inherent to the industry and the present patent laws in it (Liu and La Croix, 2015). Hence, research significance of patents predominantly stems from both, them being tacit IP rights that can be accumulated and their importance on the market (Arora, 1997; Beukel and Zhao, 2018), especially in strong appropriability regimes such as the manufacturing industries in the United States of America (Somaya, 2012; James et al., 2013; Beukel and Zhao, 2018).

Third, the inherent imperfections of patents can be ironed out by patent litigation. Contrary to uncertain protection by secrecy or lead time, this offers another level of protection (Somaya, 2012). Thereby, patents are not only capable of protecting IP, patent litigation also enables a firm to take infringers economically accountable (Reitzig et al., 2007; Rudy and Black, 2015). Albeit no isolating mechanism is inherently perfect, the well-developed patent protection system grants three layers of certainty: legal right, litigation possibility and financial leverage. Other protection mechanisms, for example, secrecy, do neither constitute a formal right nor do they grant possible institutionally based leverage in case of imitation.

In addition to the above-mentioned arguments, the focus on patents in this dissertation (rather than similar forms of isolating mechanisms, such as trademarks and copyrights) is based on their widespread heavy use in multiple industries, the thoroughly available data of patent enforcement and the predominant focus on patent litigation in the strategic and innovation literature (Somaya, 2003; Agarwal et al., 2009; Reitzig and Wagner, 2010; Polidoro and Toh, 2011; Somaya and McDaniel, 2012; Rudy and Black, 2015).

2.3.3 Patents

To protect innovation and generate profits from its commercialization, firms often resort to patents. Even though their usefulness is contested by many scholars, business experts and managers, patents still constitute one of the most important protection mechanisms.

Sherry and Teece (2004) have acknowledged the value of patents in several stages during their lifetime. Patents are granted for an innovation that is (a) different from prior art and (b) patentable. Thereby the mere patent application for an innovation increases its value. A new technological process can be protected if it is officially registered at the patent office of a state. The patent office can allocate patents to protect inventions for a specific period and geographic area. If a patent is granted by the Patent Office, the value increases even more because it allows the patent holder to exclude others from using the innovative ideas. Then, if a patent is infringed or its validity and scope have been confirmed in a court of law, its economic value reaches a peak (Sherry and Teece, 2004). Hence, patents are highly valuable, even if they do not secure profit generation per se (Lanjouw and Schankerman, 2001; Somaya, 2003).

However, while companies heavily invest in filing patents and maintaining them, which both costs fees (James et al., 2013), patenting can also have pitfalls. Even if the fees are disregarded, getting a patent granted comes with its unique challenges. Patent rights could be denied, could be too narrow or broad in scope or could be granted too late, disrupting, inter alia, licensing efforts (Gans et al., 2008). Additionally, they cannot be renewed after they expired (Sandner and Block, 2011). Arguably the main weakness of patents as an isolating mechanism is the need to disclose valuable information and knowledge when applying for the patent itself (Gans et al., 2008) Furthermore, even during the life span of a granted patent, it is vulnerable to invalidity and infringement suits, which, if successful, diminish the patent value entirely. However, if such suits are not successful, for example, because of non-infringement scope reallocations, the value of patents can even increase further (Sherry and Teece, 2004). Thus, despite its pitfalls, a patent is required for strategic patent litigation and, nevertheless, necessary to increase or secure the economic value of the IP it is covering.

The very essence of a patent is an exclusionary right (Ziedonis, 2004), which can be translated into economic terms as an "option to go to court" (Marco, 2005, p. 325). This means that the patent owner only has the right to preclude others from using, manufacturing or selling a product or service that uses the patented invention, which is to be differentiated from a mere affirmative, usage right (Ziedonis, 2004). However, this means, it is on the firm to act and

strategically protect the patent rights against competitors. Consequently, the value of the patent comes down to the enforcement, the legal protection of it, which is often fruitless (Cohen et al., 2000).

It needs to be mentioned that litigation is not the only way to capture value from a patent. Patent applications can also send a signal to competitors. Those signalling strategies are used to disseminate knowledge, signal a willingness to protect information or even guide the direction of innovation within an industry (Kultti et al., 2006; Kultti et al., 2007; James et al., 2013). One example for the latter is the automotive company, Tesla. Elon Musk, the CEO of Tesla, announced in 2012 that the company will not actively pursue litigation against infringers. With this strategy, the carmaker wants to increase innovation within the industry. Such strategies can work, but they are also very risky. Especially because research found that imitability negatively influences profitability (De Carolis, 2003). Another strategy would be the opposite, using the distraction technique to trick competitors into investing in patented innovations that are only patented by the firm to distract from other important technology but are otherwise not valuable (Langinier, 2005; Somaya, 2012).

It was already discussed that patents are often key for value creation from innovation, however, as with any other IP right protection incentives, there is the need for congruence between the patent itself and the patent strategy of the firm. Somaya (2012), state that companies need to confer the sense of usefulness to the customer. Visible patent strategies can be helpful, for example, if a company uses its patents to communicate value to customers or potential allies. Thereby, patents and patent strategies can be used as signals to increase the likelihood of alliances, licenses, financing or commercialization agreements with established firms or start-ups (Arora, 1995; Oxley, 1999; Gans et al., 2002; Mann and Sager, 2007; Gans et al., 2008; Haeussler et al., 2009; Somaya, 2012).

Patents are isolating mechanism that can protect assets from imitation. However, the underlying problematic about patents, and often isolating mechanism as such, is that their value cannot be directly determined (Schankerman, 1998). Hence, the value and costs of patents are context related. Previous studies explained the differences in costs and benefits of a patent-based value capture strategy with contextual factors such as competition intensity or the local IP regime as well as firm-specific capabilities such as R&D investment, innovation, knowledge or the patenting process management skills (James et al., 2013). This dissertation furthermore argues that patent value is dependent on the protective ability of the firm.

Moreover, a variety of studies established that patents are often not the only or main isolating mechanism employed by firms and that patent intensity is heavily industry-dependent (Mansfield et al., 1981; Levin et al., 1987; Schankerman, 1998; Cohen et al., 2000). However, those conclusions need to be treated with caution. Whereas Schankerman (1998) and Mazzoleni and Nelson (1998) are representing the traditional stance that patents are more effective and are used more often in some industries, like the pharmaceutical industry, Ziedonis (2004) is opposing this view by proposing that firm in fragmented markets, like the electronics industry, need to build large patent portfolios as well to protect against competitors.

2.3.3.1 Patent Strategies

Patents are an important means to protect intellectual property. From an organisational perspective, they also ensure a competitive advantage on the market (Granstrand, 2000; Rudy & Black, 2015). A vast majority of past research concentrated on incentives to patent inventions, for example, the protection against competitors or license royalties (for an overview, see: Ruby & Black, 2015). Others concentrated on the strategic management of patents (for an overview, see: Somaya, 2012), by integrating literature from economics, law and management (Somaya, 2003; Lumineau and Oxley, 2012; Somaya, 2012).

Patent strategies constitute the possible direction of a company's future actions to protect its intellectual property. A firm's patent strategy can be defined as the determination of the strategic utilisation of patents to achieve objectives and a competitive position. Thereby, the focus is set on the comprehensive part that patents play within a firm (Somaya, 2012). Patent strategies constitute the possible direction of a company's future actions to protect its intellectual property assets. Recent literature indicated that the generic strategic use of patents for this purpose can be distinguished by proprietary or defensive usage of patents (Somaya, 2003; Somaya, 2012; Rudy and Black, 2015). Somaya (2012), defined a third option as leveraging patent strategy.

2.3.3.2 Proprietary Patent Strategies

A patent provides the patentee with the ability to enforce the exclusion of competitors that want to take advantage of the invention protected by the patent. Thereby, the role of a patent is to ensure proprietary rights. By following a proprietary patent strategy, firms try to defend their inventions from imitation by securing enforcement right (i.e. patents) for them. Those, patent rights are then actively protected as a key competitive advantage. Therefore, firms are less likely

to engage in license agreements to keep sole commercialization rights and are more prone to actively track potential patent infringers (Teece, 1986; Rudy and Black, 2015).

A proprietary patent strategy aims to establish a competitive position on the market. Several additional advantages of patents can elucidate the benefits that firms may experience by following a proprietary strategy. For example, patents can not only be used to block competitors from copying a particular invention, but firms can also avoid detrimental consequences, for example, injunctive relief during patent litigations with the accumulation of patents (Somaya, 2012). Moreover, proprietary strategies can be implemented to use patents as a protection mechanism to prevent the imitation of inventions (Lippman and Rumelt, 2003; Rudy and Black, 2015). They are furthermore utilised to impede market entry for competitors (Clarkson and Toh, 2010; Rudy and Black, 2015). In conclusion, a proprietary patent strategy can be the means to ensure the protection of certain technologies and exclusivity of their commercialization rights.

2.3.3.3 Defensive Patent Strategies

Defensive patent strategies can be employed to safeguard the firm against patents that are possessed by other firms. Thereby, the firm has the objective to ensure its rights to use and commercialise inventions without interfering others property rights (Somaya, 2012). Put differently, the firm wants to avoid to be in a "competitive disadvantage" (Rudy and Black, 2015). For example, a firm could make efforts to accumulate a variety of patents that might be valuable to defend against competitive patents in the future. By following a defensive patent strategy, firms can minimise that threat of being restricted from using specific inventions that are protected by external patents. Therefore, those strategies typically comprise protective measures against the limitation of usage rights of technology, due to other companies' patents. Those protective measures can be leveraged by large patent portfolios or patent pools (which are formed through cross-licensing between companies) that also provide firms with the possibility to profit from future inventions (Somaya, 2012; Rudy and Black, 2015). Defensive patent strategies can be employed either ex-post or ex-ante and are often described by scholars in terms of "(defensive) blocking and preemption", "(defensive) thickets", "portfolio patenting" and other terms (Somaya, 2012).

If patents are used in such a defensive role, it often happens that mutual hold-up situations occur (Somaya, 2003). For example, two companies holding complementary patent rights could threaten each other by expressing their readiness to sue. Eventually, both parties can agree upon a beneficial solution. In sum, a defensive patent strategy reflects the incentives of firms to protect be protected from the accusations of infringement of competitive patent rights.

2.3.3.4 Leveraging Patent Strategies

Somaya (2012) presented a third generic patent strategy, the leveraging strategy. This strategy is predominantly aimed at maximising profits by bargaining compensations based on patent rights. The author indicates that leveraging patent strategies might be a good alternative if proprietary or defensive patent strategies are not necessary or feasible. This could be the case, for example, if the patent protects an invention that is not particularly important to the core business of the firm or if it might be possible to circumvent, "invent around" the patent. A leveraging patent strategy might, nevertheless, be valuable because patents can also be used to generate rents, for example, if the patent holder grants usage rights in exchange for a royalty (i.e. licensing). That is possible because of the special feature of patents that allows the patentee the exclusion of others from using the patented invention. The leveraging patent strategy clarifies the notion that flawless patent protection of every technology of a firm is often unnecessary as long as the central core technologies are thoroughly protected, and the protecting patents are hard to circumvent. Firms that exclusively deploy the leveraging strategy (mostly without even generating products on their own) are called patent sharks or trolls. In patent litigation, leveraging patent strategies can be powerful, especially because of reputation building or the opportunity to deter competitors with preliminary injunctions (Lanjouw and Schankerman, 2001; Somaya, 2012).

As shown in the sections above, patent strategies can be distinguished when it comes to their key characteristics. Moreover, the areas of application for different strategies can vary. Patent strategies can be aimed at one patent strategy domain or several domains at the same time. Somaya (2012) identified three comprehensive patent strategy domains: patent rights, licensing and enforcement. The Author indicated in his earlier work that the three domains entail nested choices. This means that some choices (for example, to licence a patent) are only possible if prior choices allow them (for example, owning the patent before).

In detail, patent rights refer to actions that have to do with the possession and development of patents and patent portfolios. Licensing comprises the decisions of the scope of sharing of patent rights (for example, alliances, open source). The enforcement domain is of particular interest because the following paragraphs are aimed at patent strategy outcomes, especially patent litigation strategy outcomes. According to Somaya (2012), the enforcement domain involves the strategic (or threat of) use of litigation against infringers. The next paragraph will emphasise this domain and show more extensive approaches to this patent strategy domain.

2.3.4 Patent Enforcement and Litigation Strategies

As argued in the previous paragraphs, to commercialise their innovations and gain profit, firms can protect their IP rights by enforcement. Therefore, it is not surprising the popularity of patent litigation is increasing. *Figure 2* shows the total number of infringement cases for all firms from the dataset used in this dissertation for each year between 2000 and 2015. The trend is clear, strategic patent litigation became more popular since the early twenty-first century with a rise in total numbers from approximately 1050 in 2000 to 1800 in 2015.[4]

Figure 2 Number of Infringement Suits per Year
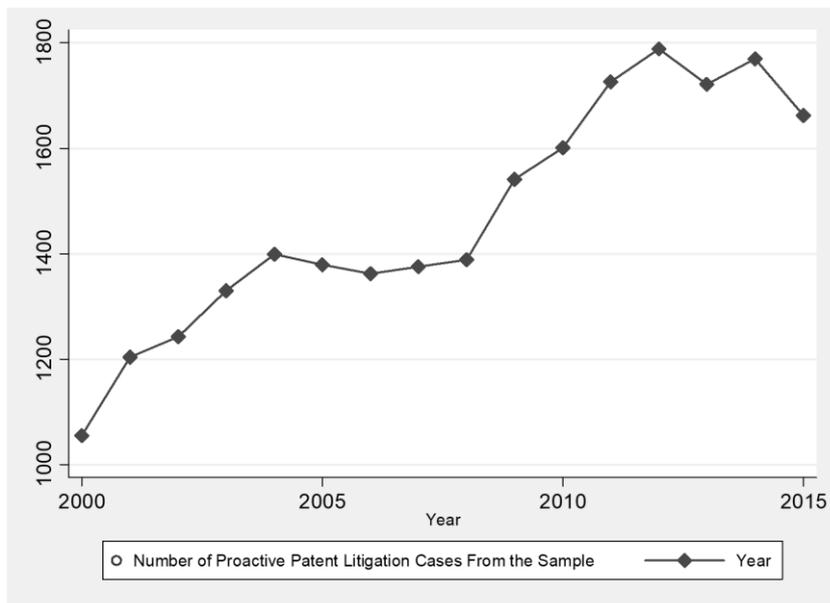
One important premise of patent litigation lawsuits is that it is a local endeavour dependent on the jurisdiction and only binding in such (Beukel and Zhao, 2018). However, litigation strategies are not just exogenously determined. Indeed, they are also chosen and endogenously manufactured by the management of the firm itself responding to the given external environment. That means, the value of patents is determined by the power of the patent holder to prove them valid and infringed in a court of law. If this endeavour is successful, patent litigation can lead to damage payments which are paid by the infringer to compensate for the patent holders loss and often lead to injunctions for the infringer to inhibit the further commercialization of the invention in question (Shapiro, 2010). It is striking that the number of patent litigation cases and the amount of damages awarded is increasing continuously (Shapiro, 2010). Even if many cases are ultimately settled out of court, filing an infringement case is one

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[4] The slight drop in 2015 was expected as it was the last year for which the USPTO provided litigation data, increasing the chances of incompleteness of the data.

of the most important means to ensure IP right protection. With increasing popularity and benefits of patent litigation, the question might not be to patent or allow competitors to patent (James et al., 2013). It is now important to ask: whether to litigate or "allow" competitors to litigate?

Litigation lawsuits can be patent infringement suits (Lanjouw and Schankerman, 2001; Agarwal et al., 2009; Polidoro and Toh, 2011; Rudy and Black, 2015) and declaratory judgement suits (Lanjouw and Schankerman, 2001; Rudy and Black, 2015). Firms that engage as the plaintiff in patent infringement suits follow a proactive proprietary patent litigation strategy (PPPL) (Rudy and Black, 2015). This implies that the firm is actively seeking and filing lawsuits against patent infringers. Firms that engage as the plaintiff in declaratory judgement lawsuits follow a proactive defensive patent litigation strategy (PDPL)(Rudy and Black, 2015). This implies that the firm, the potential infringer, is suing the patent owner to attain a patent invalidation, non-infringement or non-enforceability verdict usually to prevent restrictions of operations.

Litigation research has predominantly concentrated on offensive, proprietary strategy (Agarwal et al., 2009; Polidoro and Toh, 2011; Rudy and Black, 2015; Chen et al., 2016). However, some authors looked at proactive, defensive patent litigation (Lanjouw and Schankerman, 2001; Chen et al., 2015). Rudy and Black (2015) studied both strategies and defined proprietary litigation as characterised by the plaintiff in a patent infringement suit being the patent owner, suing a potential infringer, whereas, defensive litigation is characterised by the plaintiff in a declaratory judgement suit being the potential infringer, suing the patent owner. During litigation, both actions are manifested strategies that are expressed in the type of litigation suit that is pursued by the plaintiff. In addition to both proactive strategies, Rudy and Black (2015) also mention both reactive strategies. In reactive strategies, proprietary or defensive litigation is when the firm is the defendant in either of the two suit types. However, it can be debated if reactive participation in litigation can be strategic as both reactive litigation types require a plaintiff to start proceedings. Therefore, the focus of this dissertation is on proactive patent litigation.

2.3.4.1 *Patent Infringement Suits*

In a patent litigation, the patent owner initiates a lawsuit against a potential infringer (Polidoro and Toh, 2011). Thus, the patent owner is the plaintiff and the potential infringer is the defendant (Ziedonis, 2004; Rudy and Black, 2015). This type of litigation action is, for example, characterised by the patentees' incentive to detain imitation, obtain an injunction against the infringer or monetary damages. Thereby the patentee often proactively seeks to find

imitators to enforce patent rights (Polidoro and Toh, 2011) and exclude competitors from using the patented technology (Agarwal et al., 2009; Polidoro and Toh, 2011). The patent holder is responsible for monitoring the market for potential infringement activities. Therefore, the plaintiff in a patent infringement suit is pursuing a proactive proprietary patent litigation strategy (Rudy and Black, 2015) against an infringer firm which is either aware of its infringement activity or not (Shapiro, 2010).

In enforcement, proprietary patent strategies often lead to litigation in court as a settlement is less likely (Somaya, 2003; Rudy and Black, 2015). To litigate actively in court against an infringer can have other motives as well, for example, litigation can be an important strategy to protect other patents. Companies can use patent litigation for signalling effects (Agarwal et al., 2009), thereby, litigating an existing patent in court could deter competitors from infringing on related patents of the same company. Then, litigation would not only protect one patent but others as well. In conclusion, a proprietary patent strategy can be the means to ensure the protection of certain patented technology and exclusivity of its commercialization rights.

2.3.4.2   *Declaratory Judgement Suits*

Declaratory judgement suits are not as frequent as infringement suits (Lanjouw and Schankerman, 2001; Rudy and Black, 2015). A declaratory judgement suit is characterised by the potential infringer suing a patent owner. The potential infringer is the plaintiff (patent owner is the defendant) in declaratory judgement suits. The aim of a declaratory judgement suit could, inter alia, be to defend against potential infringement accusations, to prevent restrictions of operations or to seek monetary relief. Defensive patent litigation allows firms to defend against having a competitive disadvantage. Thereby, the firm proactively tries to obtain the legal right to use a specific invention by defending against the potential property rights (and enforcement of such) protected by the patents of others. Therefore, the plaintiff in a declaratory judgement suit is pursuing a proactive defensive patent litigation strategy (Rudy and Black, 2015).

There are two forms of declaratory judgement suits identified in the literature: patent invalidation suits and countersuits (Marco, 2005; Rudy and Black, 2015). A patent invalidation suit aims to declare the disputed patent invalid or to restrict the scope of it. Patent invalidation suits can be either initiated by a firm pre-emptively to challenge the validity of a competitor's patent in court or as a defensive action after an infringement suit has been filed against the firm by a patent owner (Lanjouw and Schankerman, 2001). The aim of countersuits is that the plaintiff of such either attempts to defend against being excluded from using an invention that is protected by competitor's patents or initiates a countersuit in the attempt of mutual hold-up.

The defensive action is conducted by a firm enforcing its own patents in court as a response to the infringement suit of another firm. By doing so, firms signal their willingness to enforce their patents in court which might lead to private settlement of the IP disputes because each firm deters the other from being able to make use of their patented inventions. Therefore, mutual hold-up can be used to access a competitor's technology (Somaya, 2003).

2.3.4.3 Differences in Patent Litigation Strategies

There are several important distinctions between the two patent litigation strategies because of which proactive proprietary patent litigation (strategic patent litigation in the following) is the main focus of this dissertation.

First, being a plaintiff in an infringement lawsuit is predominantly a means to ultimately increase performance outcomes by the exclusion of certain competitors and, thus, its performance outcomes might be more pronounced and can be more precisely interpreted. Especially because being the plaintiff in a proprietary patent litigation lawsuit is a strategic choice that can be prepared and evaluated. Being a plaintiff in a declaratory judgement lawsuit, however, is oftentimes a means to countersue, where the plaintiff has fewer strategic choices about the initiation of the lawsuit. Comparing firms that are strategically prepared to litigate probably gives more interpretable findings than comparing them with firms that are probably urged to litigate based on defence.

Second, successful patent infringement suits exclude competitors from using and commercialising a patented invention which may increase the patent owner's sales. If during the litigation phase the patent in dispute is found valid and infringed, there is a great possibility that the judge will place an injunction ordering the infringing firm to stop commercialising its product (Shapiro, 2010; Rudy and Black, 2015). Successful declaratory judgement suits override the exclusionary rights of the patent owner, allowing the plaintiff to commercialise the patented invention, which arguably could allow the plaintiff to generate sales (Rudy and Black, 2015). Nevertheless, after successful patent invalidations suits, the plaintiff must not automatically gain the right to exclude the patent owner from commercialising the product using the patented invention. Therefore, as opposed to infringement suits, patent invalidation suits can give rise to external effects. Whereas solely the patent owner benefits from possible positive outcomes of infringement suits, many firms in a specific industry can benefit from the invalidation of a patent due to one firm's successful invalidation suit. If the patent is no longer valid property rights cannot be enforced and the innovation is free to use. This implies that

defensive patent litigation rather prevents firms from having a competitive disadvantage than increasing their competitive advantage (Lanjouw and Schankerman, 2001).

Third, another important effect derived from strategic patent infringement deterrence is the signalling of the willingness to actively protect patents, to show toughness in infringement cases and to pursue high royalties in order to gain a competitive advantage in a key market (Somaya, 2003; Rudy and Black, 2015). When firms are actively pursuing infringers, other firms might be deterred from using or commercialising the litigated patent and performance outcomes might be more visible. In declaratory judgement suits, firms signal back the willingness to also enforce their patents in court, which might lead to private settlement of the IP dispute because each firm can deter the other from being able to make use of their patented inventions. Therefore, mutual hold-up can be used to access a competitor's technology (Somaya, 2003) which is less straightforward in its testable performance outcomes.

Fourth, proprietary patent litigation involves costs when it comes to monitoring infringement actions of competitors the costs involved in managing and controlling the proactive proprietary patent litigation process and the administrative costs involved. Thereby, the costs are closely tied to the enforcement process. Whereby proactive defensive litigation costs are concentrated at the patent level. Defensive patent litigation also involves substantial costs, especially building a patent portfolio that provides a barrier to imitation and infringement suits (James et al. 2013). Firms have to spend substantial amounts of money and other costly resources on the patenting process involving R&D and legal costs (Somaya et al. 2007). Although it is not in the scope of this dissertation, the costs involved in infringement suits are assessed to be more closely tied to the litigation process than other organisational proceedings, thus, the findings are most likely more accurate when focusing on proactive proprietary patent litigation.

Fifth, in strategic patent litigation cases, lawsuit are filed more frequently than in declaratory judgement matters. Previous scholarship acknowledged the majority of patent litigation cases by finding only fifteen percent of their data involving declaratory judgement proceedings (Lanjouw and Schankerman, 2001). The same effect can be found in the dataset used for this dissertation where only a small proportion of the cases were filed as declaratory judgement suits. Hence, a comparison would be driven by the imbalance of sample sizes.

A thorough, comparable and generalisable analysis is therefore only given when focusing on proactive proprietary patent litigation activities of companies. This is in line with previous research (Lanjouw and Lerner, 2001; Agarwal et al., 2009; Reitzig and Wagner, 2010; Polidoro

and Toh, 2011; Somaya and McDaniel, 2012; Beukel and Zhao, 2018) and practice, where the majority of filed cases are patent infringement lawsuits (Lanjouw and Schankerman, 2001).

2.4 Previous Research in the Field of Patent Litigation

Patent litigation is a relatively new field of research. Nevertheless, previous scholarship can be found with regards to its determinants and outcomes as well as related topics. However, the research areas and theoretical approaches are rather dispersed, subsuming different angles to grasp the economic value of patent enforcement strategies.

Somaya (2012), categorised patent enforcement and litigation as one of the three big patent strategy research domains, besides acquiring and maintaining patent rights and licensing. Authors in the patent litigation literature concentrated, inter alia, on research concerning patent litigation strategies (Rudy & Black, 2015), strategic determinants concerning patent litigation or settlement (Meurer, 1989; Somaya, 2003; Choi and Gerlach, 2015), characteristics of patents involved in litigation (Lanjouw and Schankerman, 2001), or patent litigation of cumulative innovations (Llobet, 2003).

A few studies concentrated on outcomes of patent litigation (Shane and Somaya, 2007; Agarwal et al., 2009; Reitzig and Wagner, 2010; Rudy and Black, 2015). However, from these studies, only Rudy and Black (2015) looked at firm-specific economic performance consequences deriving from patent litigation. Hence, this dominant research gap was identifiable from the literature and presented a unique area for contribution. While the reasons, why companies do involve in litigation, have been researched before, the financial outcomes for firms are less clear. Especially the influence of strategic patent litigation on sales and profitability as well as costs has not been consolidated, up to my current knowledge, in published research, yet. In addition, only very few authors concentrated on contingencies that influence the litigation - performance relationship.

Somaya et al. (2007) looked at in-house legal expertise and found, that it predicts a firm patenting performance. However, the authors did not focus on other, financial, outcomes of legal expertise nor legal expertise of patent litigation. While there exists some non-strategic work on attorneys in patent litigation and how to manage in-house and external personnel for cost reduction (Foster, 1986), it seems that there is no study up to date that addresses the role of attorneys for performance outcomes in patent litigation.

Rudy and Black (2015) looked at industrial contingencies of the strategic litigation process that influence performance outcomes but did only focus on the two more dominant industries in litigation research, the pharmaceutical and semiconductor industry. Furthermore, they only look at market share outcomes and, hence, the trade-off between costs and sales is overlooked.

Somaya and McDaniel (2012) and very recently Beukel and Zhao (2018) were concerned with the institutional targeting techniques of organisations. Whereby the former author team has looked at the determinants of tribunal targeting, the latter focused on determinants of targeting in a specific country, none of both has paid attention to the outcomes of forum shopping. Paik and Zhu (2016), although focusing on strategic institutional targeting in different appropriability regimes, are not looking at litigating firms, but those affected by it. Addressing this gap of the outcomes of repeated institutional targeting in patent litigation will advance knowledge in this research area significantly by filling our understanding of why some firms perform better in patent litigation than others.

Whereas previous literature has somewhat begun to explore strategic patent litigation empirically, one main missing factor is the theoretical implication it has. Polidoro and Toh (2011) contributed to RBV by comparing its implications of inimitability and non-substitutability and find that firms actions incorporate a trade-off of when to deter imitation. Reitzig and Wagner (2010) contributed to the knowledge-based view of the firm to find knowledge complementarities between patent filing and patent litigation. However, the theoretical focus of scholarship of strategic patent litigation is scarce. Hence, we do not know from previous research that litigation is adding to the RBV's notion of inimitability as an important value appropriation mechanism for firms. Furthermore, it is unclear how some firms are more competent in implementing patent litigation than others.

Building on RBV thinking, this dissertation further develops the thesis that strategic patent litigation strategy outcomes are influenced by firm, industry and institutional contingencies that some firms are more efficiently utilising for patent protection.

The remaining interesting findings from previous scholars in the patent enforcement domain are consolidated and presented in a comprehensive table (*Table 4*). The more comprehensive set of research concerning the determinants and outcomes of patent litigation is discussed in the following two chapters. These insights will further clarify why the present dissertation finds answers to four research gaps that can be identified from the literature while contributing to the resource-based view of the firm. It is important to note, that the table exclusively addresses studies that investigate the patent litigation context.

Table 4 Previous Research on Patent Litigation

Purpose of the study	Context	Key findings	Theory	Patent domain	Litigation (strategy)	Author (year), title and journal
Determinants of Patent Litigation						
Investigating settlement outcomes resulting from patent strategies. Or: why firms are willing to continue fighting patent suits despite the high cost?	Computer Research medicine U.S. Suits	Support for strategic stake (citations) explanations in non-settlement of patent suits. No clear empirical support for the mutual hold-up explanation.	Divergent expectations (DE), asymmetric information (AI), asymmetric stakes (AS) as drivers of non-settlement	Proprietary Strategy & Defensive Strategy	Proactive Infringement Suits & Proactive Declaratory Judgement Suits	Somaya (2003) Strategic Determinants of Decisions not to settle Patent Litigation Strategic Management Journal
Determinants of patent suits and heterogeneity in litigation risk	Drugs and health, Chemical Electronics Mechanical U.S Suits	Litigation risk increased for patents owned by individuals and firms with small patent portfolios. Firms with large portfolios are less likely to prosecute infringement suits.		Proprietary Strategy & (Defensive Strategy)	Proactive Infringement Suits & Proactive Invalidation Suits	Lanjouw and Schankerman (2001) Characteristics of Patent Litigation: A Window on Competition RAND Journal of Economics
Determinants of patent value, litigation rate and heterogeneity in patent litigation	Chemicals Computer and communication Drugs and medical Electronics Mechanical U.S. Suits	The value of a patent is a function of the enforceability of IP rights, technology and the degree of uncertainty over IP rights.		Real Options	Proactive Infringement Suits & Proactive Invalidation Suits	Marco (2005) The option value of patent litigation: Theory and evidence Review of Financial Economics

Determinants of litigation efforts How firms manage the trade-off between inimitability and nonsubstitutability?	Pharmaceutical Drugs U.S. Suits	Increased substitution threat results in decreased deterring of imitation the earlier the development stage and novelty and the lesser the commercial value of the innovation.	RBV	Proprietary Strategy	Proactive Infringement Suits	Polidoro and Toh (2011) Letting rivals come close or warding them off? The effects of substitution threat on imitation Academy of Management
How do asymmetric information, competitive rivalry (of top management teams) and market positions influence a firms reaction to patent litigation?	Electronic Products 216 Tawiwanese Executives	All three affect a firm's reactive patent litigation strategies. Managerial capabilities regarding legal astuteness in patent litigation are important.	Information- and rivalry-based theories	Defensive Strategy	Proactive Declaratory Judgement Suits	Chen et al. (2015) Information- and rivalry-based perspectives on reactive patent litigation strategy
What influence will legal and cognitive distances have on MNE conflict resolution strategy choice in international business IP disputes?	U.S. Suits	Legal distance is positively associated with the likelihood of an MNE choosing Negotiation (instead of litigation). Cognitive distance increases reliance on litigation and at the same time weakens the effect of legal distance.	IP, conflict management and institutional theory	Leveraging Strategy & Conflict resolution strategy	Litigation (strategy not specified)	Fainshmidt et al. (2014) Legal Distance, Cognitive Distance, and Conflict Resolution in International Business Intellectual Property Disputes Journal of International Management

Outcomes of Patent Litigation

Knowledge complementarities between outsourcing upstream (patent filings) and downstream (patent litigation) activities	Industry controlled for with complex industries share European applicants who filed at least 100 patent applications at the EPO	Increasing (decreasing) performance in conducting patent litigation the less (more) related patent filings are sourced out. Loss of relevant technological and legal knowledge through outsourcing.	TCE KBV	Patent Management Capabilities	Proactive Infringement Suits	Reitzig and Wagner (2010) The hidden costs of outsourcing: evidence from patent data Strategic Management Journal
Outcomes of University patent lawsuits	Electrical and computer Drugs and medical Chemical Mechanical Universities U.S. Suits	Qualitative and quantitative evidence that patent litigation harms university licensing activity (to the private sector) because it reduces time and resources available for marketing technologies and establishing licenses.		Patent Management Capabilities		Shane and Somaya (2007) The effects of patent litigation on university licensing efforts Journal of Economic Behavior and Organization
Outcomes of patent enforcement Corporate reputations for toughness	Semiconductor U.S. Suits (taking state differences into account)	Litigiousness reduces spillovers anticipated from departures of Human Capital, particularly when the hiring organizations are entrepreneurial ventures.	KBV	Leveraging & Signalling and Information Disclosure	Proactive Infringement Suits	Agarwal et al. (2009) Reputation for toughness in patent enforcement: implications for knowledge spillovers via inventor mobility Strategic Management Journal

Definition of patent litigation strategies	Semiconductor Pharmaceutical	Firms in the pharmaceutical industry are more likely to follow a PPPL strategy. Firms in the semiconductor industry are more likely to engage in a PDPL strategy.	Mentions: RBV and competitive dynamics perspective	Proprietary Strategy & Defensive Strategy & Non-Market Strategies in Patent Litigation	Proactive Infringement Suits & Proactive Declaratory Judgement Suits	Rudy and Black (2015) Attack or Defend? The Role of Institutional Context on Patent Litigation Strategies Journal of Management
Institutional context motivates type of patent litigation strategy Performance (sales) outcomes	U.S. Suits	Firms in the semiconductor industry with PDPL strategy enjoy higher sales.				
Examination of the economic role of preliminary injunctions in legal disputes	U.S. Suits	Injunction requests allow plaintiffs to go beyond the avoidance of "irreparable harm" to extract even greater profit by raising the costs of legal disputes. Litigation benefits stronger firms and is damaging to capital-constrained rivals.	Game theory	Leveraging Strategy	Proactive Infringement Suits	Lanjouw and Lerner (2001) Tilting the Table? The use of preliminary injunctions Journal of Law and Economics

Attorneys and Institutions in Patent Litigation

Understanding organizational decisions to target specific institutional venues (specialised and general-purpose tribunals) for nonmarket actions	U.S. Courts	Differences in expertise and procedural flexibility that typically accompany tribunal specialization. Developed theory about targeting decisions suggests two main drivers of tribunal targeting: expected settlement and expected returns.	Theories of settlement and adjudication developed in the law and economics literature	Non-Market Strategies in Patent Litigation	Proactive Infringement Suits	Somaya and McDaniel (2012) Tribunal Specialization and Institutional Targeting in Patent Enforcement Organization Science
How do multinational enterprises (MNEs) choose where to litigate?	U.S. Industries Country differences (For exmaple., foreign MNEs filing more than litigating)	MNEs prefer to litigate in countries with substantial track records to send strong signals to competitors. Especially if operating in highly concentrated industries and for radical innovations, which require expertise for a convincing verdict.		Proprietary Strategy & Signalling and Information Disclosure	Proactive Infringement Suits	Beukel and Zhao (2018) IP litigation is local, but those who litigate are global Journal of International Business Policy
Institution seeking behaviour in patent wars	Smartphone Industry in 20 countries incuding the U.S.	Targeting of weak institutions if not directly involved in litigation to take advantage of arbitrage opportunities.			Firms not directly involved in Patent Litigation but affected by it	Paik and Zhu (2016) The Impact of Patent Wars on Firm Strategy: Evidence from the Global Smartphone Industry Organization Science

2.4.1   Determinants of Patent Litigation in the Literature

Several studies looked at the determinants of litigation. Many of the firm-specific measures in patent protection research concentrate on firm characteristics that are important before litigating patents, for example, R&D intensity (Somaya et al., 2007; James et al., 2013; Rudy and Black, 2015), patenting capabilities such as internal patent filing competence (Reitzig and Wagner, 2010; James et al., 2013) or superior firm resources (Agarwal et al., 2009). Especially in the field of economics, researchers concentrated on patent litigation determinants (Lanjouw and Schankerman, 2001; Marco, 2005; Choi and Gerlach, 2015). Previous scholarship focused on determinants of patent enforcement and settlement (Meurer, 1989; Lerner, 1995; Somaya, 2003; Choi and Gerlach, 2015) and characteristics of patents involved in litigation (Lanjouw and Schankerman, 2001). Choi and Gerlach (2015) provided evidence that patent pools could also influence litigation incentives and even protect weak patents from being litigated in court. Polidoro and Toh (2011) found that increased substitution threat decreases deterring of imitation. Concerning the probability of patent litigation, Meurer (1989), proposed that the private information about the validity of a patent or the cost allocation of litigation could influence the settlement of patent litigations. Nevertheless, the findings reflect the rather disparate character of this research domain and cannot be easily structured.

One important work in the research area comes from Lanjouw and Schankerman (2001), who found several key determinants of patent litigation. The authors showed that litigation is more likely to occur if the patentees' patent is infringed or if the involved parties possessed different expectations regarding the litigation outcome. Patent litigation is increased for patents that provide a valuable base (for example, often cited, many claims and forward citations per claim) for subsequent patents. When pursuing an aggressive protection strategy, litigation was more likely if the company sought reputation benefits. Lastly, the authors found that litigation is determined by the strategic stakes of a firm. Lanjouw and Schankerman (2001) argue that litigation is less likely if the costs of trial exceed the expected costs of settlement. Therefore, a company might not initiate a patent litigation suit because of the incentive to defend its own patent but to strengthen its reputation or bargaining power in the future. This is especially interesting because a firm that follows this strategy should elaborate carefully on the trade-off between the costs of patent litigation and the potential performance outcomes but also theory could be enhanced by looking at the contingency factors that influence such a decision.

Somaya (2003) extended this litigation research by looking at the strategic determinants that affect patent suit settlement decisions. Thereby the author complemented existing studies concerning firm valuation, predatory behaviour and suit filing decisions. The article indicated several existing determinants of non-settlement (for example, irrational behaviour, reputational reasons, takeout competitors in key markets, extract royalties) and settlement (forced to compromise to access complementary patents, bargaining surplus and therefore shared litigation costs) of patent litigations. Nevertheless, the article did not address the underlying processes behind the strategic perspective as well as the performance implications of patent strategies that are pursued by firms.

As shown above, authors in the patent litigation literature concentrated, inter alia, on research concerning strategic protection or defensive decisions of patent litigation (Somaya, 2003), strategic determinants concerning patent litigation or settlement (Meurer, 1989; Somaya, 2003; Choi and Gerlach, 2015), characteristics of patents involved in litigation (Lanjouw and Schankerman, 2001), patent litigation of cumulative innovations (Llobet, 2003), or costs of patent litigation (Bebchuk, 1984). From this paragraph, we could see that a significant amount of research was done on determinants of patent litigation, however, when it comes to factors that influence the effect of patent litigation strategies on performance, the present study profits from an angle that highlights the actions and characteristics of firms that are relevant during strategic litigation.

It is well established in the literature that litigation itself is often the last resort to settle patent disputes and comes with many challenges. Research found that the enforcement of property rights through litigation is neither certain of success (Marco, 2005; Somaya, 2012) nor a very convenient approach (Rudy and Black, 2015). Before initiating an expensive trial process, firms often settle IP disputes in private negotiations, usually after they filed a lawsuit (Lanjouw and Schankerman, 2001; Somaya, 2003). Moreover, many times the patent holder may try to reach a license agreement with a competitor to receive royalty payments (Meurer, 1989). After filing a lawsuit, is most commonly recognised that companies either negotiate in private to settle disputes or go to trial (Lanjouw & Schankerman, 2001; Somaya, 2003). Although the determinants of patent litigation were addressed thoroughly, less attention has been given to potential performance outcomes of patent litigation. By looking at strategic patent litigation as well as its influence on costs, sales and profitability, it is possible to further refine knowledge on the benefits or detriments of patent enforcement. By incorporating knowledge on the determinants of patent litigation, one can extract valuable insights and an outlook for new research on patent litigation strategies.

2.4.2 Outcomes of Patent Litigation in the Literature

Other than the direct performance outcome of proactive proprietary patent litigation investigated by Rudy and Black (2015) mentioned before (see: *2.4*), litigation can have other outcomes that can affect the firm. Beukel and Zhao (2018), argue that settlement, injunction or litigation up to the final stages are a strategic choice of the suing company, thereby, each step does have implications for the firm as such. Litigation could, inter alia, be used to increase to worth of an existing patent or patent portfolio. Not surprisingly, as Sherry and Teece (2004) found that a valid and infringed patent is worth much more than a patent that has never been challenged in court. Therefore, IP litigation can redefine the existing boundaries or worth of patents (Teece, 2000; Linden and Somaya, 2003; Beukel and Zhao, 2018).

Shapiro (2012) showed that especially the power of injunctions (i.e. if an injunction is granted a court will stop the infringing party to commercialise the disputed technology) can be used as an important bargaining chip in IP disputes because it can put extreme pressure on the opposing party into agreeing to a settlement to be able to continue with the commercialisation of the disputed technology. Thus, litigation and the threat of injunction might increase the performance outcomes of the plaintiff.

Besides the advantages of the bargaining position, IP litigation can affect the reputation of a company. Agarwal (2009) found that litigiousness can reduce knowledge spillovers that occur if, for example, employees are unsatisfied with the protection of their IP output. The authors argue that patent litigation is a strategic means for companies to build a reputation for toughness and prevent other companies from benefitting from their human capital or R&D efforts. Somaya (2012) indicated that firms also might seek the "tailoring of technology standards" in their favour with strategic patent litigation. Other scholarship concentrated on more alternative outcomes of patent litigation and complements the eclectic stream of research. It was found that patent litigation leads to increases in executive turnover (Aharony et al., 2015), has negative effects on licensing in Universities (Shane and Somaya, 2007) and that increased performance in litigating can cause diminished outsourcing in related patent filings (Reitzig and Wagner, 2010).

This paragraph gives room to assume that even though not every IP dispute ends in litigation (Lanjouw and Schankerman, 2001; Somaya, 2003) and not every litigation case ends with a verdict (Somaya, 2003; Beukel and Zhao, 2018) it is nevertheless a powerful move to file a case which, regardless of the settlement, often has significant outcomes for the firm.

3 Research Design and Methodology

Chapter 3 presents the research design and methodological approach of this dissertation. A special focus is set on the extensive data collection efforts in order to create a unique patent litigation and firm performance dataset, unprecedented in patent litigation research.

3.1 Philosophical Approach

The quantitative research methodology of this thesis is based on a positivist philosophical orientation[5]. The following paragraph elaborates on the approaches of Thomas Kuhn (1962) and Karl Popper (1959; 1963) who shaped the underlying philosophical discourse on positivism. When discussing the philosophical approach of this thesis and its underlying philosophical assumptions, it is important to look at four different, but related, building blocks: paradigms including ontology and epistemology, as well as methodology. These blocks are the foundation of the positivist philosophical view of this study. The next paragraph discusses how paradigms, ontology and epistemology, according to Thomas Kuhn and Karl Popper influenced the present research.

All three words originate from the ancient Greek language. According to the Merriam Webster Dictionary, they translate to paradigm meaning "pattern", ontology meaning "study of being" and epistemology meaning "logical discourse of knowledge". A paradigm is an unquestioned general assumption about theory or methodology based on common agreements among a research community (Kuhn, 1962). It can be seen as a model assumption based on theories to capture reality and to define how reality is perceived. Paradigms are characterised by ontological and epistemological arrangements that conclude methodological suggestions (Guba, 1990). Ontology is defined as the specific nature of the reality or nature of truth. Epistemology defines the relationship between the researcher and the reality or the relationship between the researcher and the nature of the scientific explanation.

According to Kuhn (1962), a scientific community agrees on a paradigm and sticks to its practices and definitions. Thereby, the ultimate goal is to apply this paradigm to a vast set of

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[5] Parts of this chapter rest on: Matheja, Valerie (2016), Nature and Philosophy of Social Science Research. What justification can be given for quantitative research methodology? A discussion with reference to the competing perspectives of Karl Popper and Thomas S. Kuhn in the philosophy of social science.

instances. Kuhn (1962) presents an important point: scientists, are not easily convinced to let go of their hypotheses just because they were falsified. Positivist ontology, stresses the existence of an external social world, which is not existent in the mind but outside of it (Carson et al., 2001). In Kuhn's interpretation, the reality has to be conformed to the researcher's paradigm. In positivist epistemology, the researcher is independent of the reality. Although positivist research is most certainly also prone to bias from the researcher's emotions or decisions as Kuhn suggested. One important take away is that a researcher is never truly independent from the paradigm. Nevertheless, the philosophical logic of positivism is predominantly driving the present research design, which is discussed hereafter. The researchers' perspectives or beliefs should be rather independent of the single objective reality (Popper, 1959; Hudson and Ozanne, 1988). However, it should be acknowledged that, indeed, although independency of the researcher is the goal in this thesis, Kuhn (1962) made a valid point that somehow, even if not intended, the paradigm (especially practice of sticking to a paradigm despite falsification) also influences the research outcome.

To reflect how Poppers (1959) understanding of falsification and positivism influences this thesis, this chapter first elaborates on his work about the three worlds. Popper (1979; 2012) defines three worlds that profess reality and how reality is shaped. *World 1* includes inanimate and animate things that belong to the material world meaning, they are physical. It is assumed that, ontologically, they comprise an objective physical reality that is epistemologically independent of the researcher if it is not the researcher himself who is studied. *World 2* comprises the experiences of living beings, which can mean it is a reality that ontologically and epistemologically resides in the mind of the researcher. *World 3* combines World 1 and World 2 as it combines "objective products of the human mind" (Popper, 2012, p.8) that are both physical and products of the mind, for example, books. It can be seen as that ontologically there is a real world, but epistemologically this real world can only be assessed through the subjective mind (critical realism).

With the focus on World 1 and its ontology, the present thesis tries to find the one true reality, more so, a generalisation of it. From the epistemology viewpoint, Popper (1959) departs significantly from logical positivism by arguing for a deductive approach. In logical positivism, propositions are regarded as meaningless if they are not yet tested and verified (Outhwaite, 1987). Karl Popper (1959) was an advocate for not differentiating between meaningful and meaningless statements, which gives the first indication that inductive empirical methods would be unsuitable in the context of quantitative positivist research that is built from theory. Popper stresses that by observing alone, one cannot verify that a statement (and theory) is true. Even

though both might be important, observing and inducing knowledge from it is ultimately not sufficient to embody science in Poppers (1963) eyes. For positivists that follow Popper, it is sheer impossible to gather enough observations to exclude the possibility of exceptions to a proposed scenario. There might always be the one outlier observation that does not verify (or falsify) the underlying theory, leading to false conclusions (Popper, 1959; Benton and Craib, 2010; Ritchie et al., 2013). Thereby, Popper (1959) mainly criticises the idea of logical positivism, where a statement can only be science and meaningful if it is ultimately verified or falsified. According to him, scientific knowledge can be created from reality with observations, generalisation and abstraction. Thereby, rationality, mathematics and logic are important for deduction to generalise independently from any context and independently from the researcher to find the one single objective reality determined by existing theories.

With regards to World 2, Strategic literature has discussed the ontological positioning of strategy. In his quest to unravel knowledge creation in management science, Tsoukas discussed different approaches to tackle strategy philosophically and concluded that "types of knowledge are [..] social constructs which fight for acceptance within particular institutional settings" (Tsoukas, 1994, p.777). Based on this statement, patent litigation strategy employment can be viewed as context dependent. However, from a strategic management perspective, patent litigation and strategies are designed to respond to an external, independent reality while still constructed internally and dependent on the designer. In the present thesis, strategic patent litigation is therefore not regarded as only driven by the environment and institutional setting. It is rather that the internal ability to form strategies acknowledges the existence of the external reality. A strategy is objectively viewed and realised whereby it responds to an external reality. Thereby, the researcher tries to generate patterns that can be similar across different contexts. Put differently, the environment is acknowledged when planning strategies, and thus, also influencing how researchers research such strategies. Building a bridge to Popper, strategy and litigation and all its documents belong to the inanimate and animate world and form a reality independently from the researcher. Therefore, the strategic decisions result in tacit data points that can be analysed and generalised. Protecting IP with patent litigation is undoubtedly only makes sense in an environment where litigation in court is possible. If, for example, a company wants to protect its IP in a country with a weak institutional system, this company will have major difficulties to enforce their IP rights through litigation. Based on this ontological stetting, epistemologically, research on strategising should not be context-dependent, however, research should also not disregard the general similarities between the details of different situations. The

positivist researchers themselves should, however, always be independently assessing the topic of research.

World 3 brings the subject of research and the researcher together, Popper (1959) presented ideas that advocate a deductive philosophical approach instead and refused the need for ultimate empirical verification but accepts observation as a tool. Following this approach, the scientist deduces hypotheses from theory and tests them. In positivism, predominantly maths and logic are used to allocate meaning, embracing the possibility that single statements or observations refute the general theory. Popper hereby wants to open the possibility to differentiate between single statements and universal statements. Whereby single statements cannot prove the truth (universal statements), they can falsify it (Popper, 1959; Popper, 1963). Poppers work is grounding positivist research by proposing empirical work that is aimed to derive statements from theories that are testable to show that they are "not yet false or false" (Popper, 1959; Phillips, 1987) rather than continuing an unachievable search for the truth. This view is still vital for contemporary research as it is now common to form null Hypotheses that can be rejected or not rejected (but not be true) by data testing (Ritchie et al., 2013) but cannot be considered as true or false. Therefore, the last theory not yet falsified is not true it is just not yet false. One major discussed issue of Popper's falsification approach is that if a theory is falsified, it might lead to the inaccurate rejection of that theory. The debate is centred on common knowledge at a given time. From a revolutionary perspective, paradigms shift towards paradigms that avoid previous falsifications (Chalmers, 1978; Phillips, 1987). Kuhn opposes Popper as he critiqued that observation is theory-laden because it is not independent (objective) of the subjective view of the observer and his embeddedness within a paradigm (Kuhn, 1962; Bogen, 2014). Popper (1963) was aware of such influences, however, he refused to not bring this subjectiveness in conjunction with a decline of the scientific status of the new theories. However, incorporating Kuhn's criticism from above, especially when generalising, there are minor "falsifications" from outlier observations that do not establish a theory as false when sticking to a paradigm that allows exceptions to the rule.

In sum, this thesis concentrates on researching the influence of patent litigation on firm performance through logic and statistics to find a generalisable pattern in different contexts of the firm. Ontological, this thesis assumes that there is an objective physical reality of strategic actions and processes which are epistemologically independently from the researcher. Being aware of paradigm influences it is the goal to interpret objectively if falsification of theory must be derived. The goal is achieved by delivering a quantitative research design with panel data analysis to investigate the theoretically driven model, which is discussed below.

3.2 Quantitative Research Design

In line with Karl Popper's positivist approach, the present research uses deduction and strives for the identification of generalisable, explanatory causal relations.

The deductive research approach is defined by testing theoretical statements (hypotheses built on theory) in an empirical, statistical manner with gathered data. The necessary variables to conduct this study and to test the proposed conceptual model were identified from the literature. If hypotheses are based on theoretical assumptions and are tested separately using empirical evidence, it implies a deductive research approach (Saunders et al., 2009; De Vaus, 2011). The deductive part of this study makes it possible to analyse if the predicted relationships (among a firm's patent litigation strategy, performance and the moderation effects) derived from existing theory, are supported by the empirical findings.

Quantitative research is defined by using statistics to investigate a model with data in a mathematical manner. Quantitative methods are generally appropriate to investigate many different firm characteristics in a variety of industries based on extensive data. Hence, research can be conducted on a large scale (Saunders et al., 2009). Therefore, the quantitative approach in this study facilitates finding differences between industries and firms and helps to generalise findings on the influence of litigation on performance.

Even if sometimes contested (see: Priem and Butler, 2001), the RBV of the firm is a mature, well-known theory in strategic management and international business (Peng, 2001) literature. The use of such a well-established theoretical view alongside a deductive research approach is in congruence with the choice of quantitative data collection, which is also largely applicable when testing variable relationships (Edmondson and McManus, 2007; Saunders et al., 2009; De Vaus, 2011). The emphasis of the quantitative part of the study is on theory testing, where the assumptions of the RBV are examined and knowledge is complemented in the context of patent litigation strategies (in order to create or maintain inimitability) and its implications for competitive advantage.

Existing theories, as well as data, are vital to test causal relationships, whereby high sample sizes increase the possibility of finding exceptions to universal statements. Thereby positivist findings are broadly applicable for the whole research population (Wilson, 2010). The study is explanatory of nature, which means that a deeper understanding of a subject is created by testing a model. While descriptive research is limited to identifying and describing the relevant variables (De Vaus, 2011), the explanatory approach used in this research provides additional

insight and reasons by also developing and testing the causal explanations. By using explanatory research one can verify the proposed direct positive influence of patent litigation strategies on firm profitability with expected moderation effects of the industry as well as the firm-specific contingencies. Therefore, to explain the effect of patent litigation strategies on firm performance, the study draws from strategic management, patent and patent litigation literature as well as the RBV to develop, refine and expand existing knowledge of the outcomes of patent litigation in court. In line with this, the research questions of the study are aimed to find generalisations on the causal effects of patent litigation strategies on performance. Hence, the investigation of the causal effects of litigation strategies, industry factors, firm factors and performance is the main aim of the study.

3.3 Sample and Data Collection

To find data that provides credible and reliable findings, I identified a three-step approach. I followed these three steps to ensure that the data obtained was, on the one hand, focused enough to fit the research project and, on the other hand, widely applicable to litigation research projects that might follow in the past. First, I determined which sample and data criteria was important to answer the hypotheses. Second, I selected a valid data source that provided the sought-after data. Third, I identified the specific variables and downloaded the data. *Figure 3* illustrates the sample and data collection process.

Figure 3 The Sample and Data Collection Process

Step 1
Determining the sample and data criteria

Step 2
The selection of the databases

Step 3
Identifying and obtaining the variables
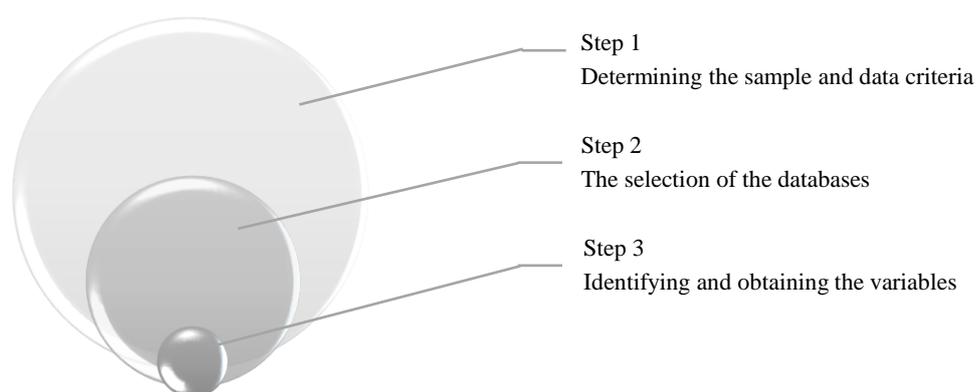
3.3.1 Step 1: Determining the Sample and Data Criteria

The U.S. is the principal country to conduct patent litigation research (Lanjouw and Schankerman, 2001; Somaya et al., 2007; Rudy and Black, 2015). This is not surprising because

the United States patent law enforcement system and IP protection regime is very robust compared to other countries due to the strong appropriability regime and available records (James et al., 2013). The United States of America is not only a beneficial setting for patent litigation research because of their consistent quality of available litigation data. It is also important to consider that the U.S. patent system is rooted in a stable institutional infrastructure. Companies need to make sure that they can rely on laws and a strong local enforcement system to harvest the fruits of litigation (Lerner, 1995; Lanjouw and Schankerman, 2004). Furthermore, the U.S. is home to innovative, strong and big markets and has a history of patenting and litigation. Litigation is dependent on jurisdictions with the above characteristics as it is vital to protect IP in markets that matter for the economic wellbeing of the firm. Not to forget, that litigation outcomes are only binding in the country of litigation (Beukel and Zhao, 2018). Thus, the United States' litigation environment provides opportunities for meaningful research. After all, as most litigation research is conducted in U.S. markets, concentrating on the same context enhances the comparability of litigation research to make findings as valuable as possible.

Comprehensive information on court cases (including distinctions between plaintiffs and defendants) was needed. Hence, the data should include U.S. companies that engaged in proprietary or defensive patent litigation in a timeframe of 16 years, from 2000-2015. Timeframes were adopted in the literature before (Somaya et al., 2007; Rudy and Black, 2015), however, while previous research concentrated on much shorter timeframes, a 16-year approach is more promising and necessary to receive the sought results. This is the case because litigation and the realisation of its outcomes can take up a substantial amount of time. Litigation data from after 1999 is often more complete than earlier data (Marco, 2005), which is important to obtain accurate results that reflect reality. Furthermore, obtaining data starting after the turn of the millennium adds to the topicality and relevance of patent litigation research.

Database data can overcome some problems associated with the collection of individual primary data. In the present research, this has two positive effects. First, secondary data helps to keep (cost and) time investments manageable (Cowton, 1998). Second, secondary data diminishes the risks and uncertainties related to primary data collection (Cowton, 1998). Potential data analysis delays due to insufficient responses, access problems, sample discrepancies or response bias can be diminished, and the prospects of the study can be met in the given timeframe. Hence, the necessary time investment for the whole study becomes more manageable. Unfortunately, secondary data comes with the detriment that the data is assembled by another party and nearly no control can be exercised over the sample and collection possibilities. However, this negative effect can be controlled by getting acquainted with the

nature of the data and how it has been assembled (Cowton, 1998). The present research is only possible by conducting a high-scope quantitative analysis based on financial and litigation data that is often difficult to obtain and unmanageable to collect separately for each entity.

The data sample criteria

In the process of conducting this research, I considered several research questions. It was a priority to make sure that the data was not narrowing down the possible research opportunities and interests. Thus, the downloading criteria for potentially necessary data were kept as broad as possible to allow further research proceedings. However, it was necessary to define some constraints for the downloading process to balance time commitment and data richness. I determined the following necessary criteria for the data to test the proposed hypotheses:

- Publicly traded and private firms
- Active and inactive firms
- Country code: USA
- The period from 2000 – 2015
- Manufacturing firms (SIC codes 20-39)

3.3.2 Step 2: The Selection of the Databases

Finding a suitable database was grounded on the two main necessities: access and content. To find the best possible fit, I evaluated the available options according to these two criteria. Recent research concentrated on a comprehensive list of data sources. The most frequently used database for financial data was "Compustat". For litigation data, many researchers consulted: Lex Machina, RPX (Rational Patent Exchange), LexisNexis and Westlaw, (for detailed descriptions see: (Marco et al., 2017). The main source of many of these litigation databases is Public Access to Court Electronic Records, or short, PACER. By using these mentioned databases, PACER is used indirectly by the majority of litigation scholars. Court records in the form of docket records are purchasable on PACER for a case-by-case fee. LexisNexis and Westlaw additionally source from other paper documents, however, this addition is most comprehensive for cases before the 2000s (Marco et al., 2017). All the above-mentioned databases were excluded from being possible data sources because they did not provide accessible litigation data from 2000-2015. Furthermore, access to them was not provided (by the University of Leeds, LUBS or CIBUL) or access to them was only available for purchase. Due to the financial restrictions of the PhD project, the use of those databases was inhibited.

Meanwhile, the financial data for the research project was downloaded from Thomson One Banker (TOB), a database to which access is provided by the University of Leeds. The database provides up-to date financial information from private and public companies starting from 1982. Thomson One Banker was suitable to cover all needed financial information. Meanwhile, a reliable source for litigation data was still absent. However, it was clear that PACER data was the main interest of the content focus.

In March 2017, the United States Patent and Trademark Office released an economic working paper calling for research on patent litigation, inter alia, the impact of patent litigation on a firms' financial situation. They conclude that a better insight into the effects of patent litigation is needed but restricted by limited information sources on court proceedings and involved parties and access problems for researchers. The authors state that: *"At this time, however, there is no reliable, comprehensive, free and publicly accessible source of patent litigation data. Researchers must rely on proprietary data that are typically costly and often do not provide formats that make it easy to integrate other data elements and sources"* (Marco et al., 2017; p.5). The report, "Patent Litigation Data from US District Court Electronic Records (1963-2015)", accompanied the Patent Litigation Docket Reports Data (PLDRD), in the following titled as Patent Litigation Dataset (PLD) or USPTO Dataset. This database is a free-to-access litigation database created in the attempt to provide comprehensive litigation data for advancements in research. The PLD was created by the Office of the Chief Economist at USPTO by downloading PACER data (based on docket reports from 94 US district court cases[6]) and RECAP (a plug-in for PACER users with free access to pre-purchased case data) data in March 2016, and it was provided to the public on the 29.12.2016. This makes the PLD to one of the most recently provided comprehensive databases and covers court records from 1963 to 2015 with a total of 74,623 unique cases. The report claims that the PLD has *"near complete coverage of patent litigation cases post -1999" (p.20).* However, collecting patent litigation data sourced from the PLD is a so far unprecedented endeavour for patent litigation research. The introductory phase of this database comes with benefits but also presented some drawbacks that I needed to overcome after downloading the data. Those problems will be discussed after describing how the data was obtained.

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[6] Additionally, the metadata for these cases is provided by the PLD which includes, inter alia, case identifier, parties involved, filing date, and district court location.

3.3.3 Step 3: Identifying and Obtaining the Variables

The proposed hypotheses are tested based on data from the Thomson One Banker financial database and the patent litigation database of the United States Patent and Trademark Office (USPTO). The sample consists of public and private U.S. companies operating in the manufacturing industries (Sic codes 2011-3999) that conducted proprietary and/or defensive patent litigation in U.S. district courts.

As mentioned in the last section, secondary data comes with the detriment that the data is assembled by another party and nearly no control can be exercised over the sample and collection possibilities. However, the databases used are not pre-managed or influenced by a certain effort to clean or present the data in a certain way. Both databases only provide access to raw, unfiltered data in the condition of as it was obtained. Therefore, some control over the sample and collection process was given, as inter alia, the sample, the country setting, the industries and the timeframe could be chosen independently. Hence, the data was suitable to be downloaded for the research project.

Obtaining Thomson One Banker data

The TOB financial data was downloaded according to the following criteria. I selected U.S. companies (country code: USA) in the manufacturing industries (SIC codes 20-39), both active and inactive from 2000-2015, publicly traded and private firms (variable: Private Entity Indicator) that had more than one employee, for download via the company screener. This last criterion was necessary to contain the high number of results. Companies that had less than one employee or did not report the number of employees were only downloaded if they reported sales at least once between 2000-2015 this was necessary to narrow down the amount of data to a reliable set of companies that provide financial information. Furthermore, I excluded approximately 1800 listings with exclusively missing data for every variable in every year from 2000-2015. I identified the variables for download by looking into common variables used in previous litigation research as well as by choosing additional variables needed to answer the research questions or possible research questions in the future. In total, I downloaded 53 variables using the company screener from TOB, each variable for the period of 16 years from 2000-2015 and each for firms in 19 different industries. TOB does not allow the download of more than 5000 observations in one download, therefore, I repeated the procedure manually several times for each industry and variable. I then merged the data merged afterwards.

Obtaining PLD data

I downloaded the PLD on the USPTO website[7] in ".csv" and ".dta" format. At the download stage, the database is divided into five different files with different content: attorneys (containing unique information about attorneys and their cases), cases (containing unique information about litigation cases), documents (containing additional written documents for some cases), names (containing firm names for unique cases) and pacer-cases (containing additional pacer-cases). All the databases resulted in a dataset of 74,629 unique court cases that indicate patents as the nature of suit (code 830).

3.4 Data Cleaning and Matching

After downloading the data from the two datasets, I needed to clean and match the two datasets. *Figure 4* depicts this process and the next section explains the procedure.

Figure 4 The Cleaning and Matching Process

Step 1
Cleaning the databases

Step 2
Matching the databases

Step 3
Preparing the final dataset for analysis
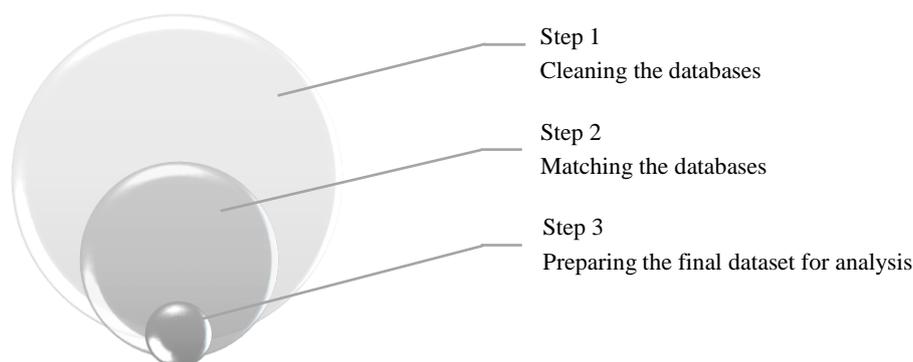
3.4.1 Transforming and Cleaning TOB data

I downloaded the Thomson One data containing data for all firms in all industries available on the database for each variable individually to excel documents. I matched the files into one excel file containing 19 sheets for the 19 industries, each sheet containing all of the downloaded variables (in rows, matched with excel macros) including all firms with missing data as well. I merged the variables for each company. If a company had missing data (because it was not available in the database and therefore not in the variable document) I left the field blank. If data were missing for one firm for one variable, I indicated it as #NV. I transformed the dataset

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[7] https://bulkdata.uspto.gov/data/patent/litigation/2015/

into a panel data format. During the research for this thesis, new, different variables proved to be interesting. I downloaded these variables additionally from TOB. I then brought them together with the original variables which required several reshaping, merging and cleaning attempts in excel and Stata. TOB is not consistent within itself, which poses some challenges for the researcher. For example, the same company is sometimes spelt differently for some entries so that merging is impeded. Furthermore, some observations were contradictory or displayed differently in TOB. This had to do with how TOB is sourcing their data. I treated such inconsistencies by token-based cleaning or manual identified cleaning. I additionally, contacted TOB to create awareness of the problem. The support team ensured that they would work on a solution with their troubleshooting team in the next couple of years. These inconsistencies, however, did not pose any problems for the research other than being time-consuming.

I prepared the complete dataset for matching with the PLD. The cleaning involved reshaping several variables, for example, the year of birth for each company which was transformed from a two- to a four-digit indicator. Then, I created a cleaning plan to be executed accurately for each dataset, TOB and PLD. I followed the recommendations by Thoma et al. (2010) to create the cleaning plan, which is described in the next paragraphs. This ensured that both datasets are cleaned simultaneously to provide company names that are as equal as possible to increase the accuracy of matching.

3.4.2 Transforming and Cleaning the PLD

The PLD is a valuable source of patent litigation data. However, compared to more established and often very expensive data providers, its content needed pre-assessment, transformation and cleaning. First, in the assessment stage, it was important to filter out the needed variables as well as their unique identification. This identification was necessary to merge the five PLD files by matching identical content. Second, I screened the variables in the dataset for missing, false or unnecessary data[8]. This is necessary because the database was neither cleaned nor standardised and entails many flaws from false numbering to typing errors and unstandardised text and abbreviations. Preparing the data for research in that way required thorough manual and automated attempts. From the perspective of the Chief Economists' office is this

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[8] PACER data is not always complete. Hence, the PLD comes with missing or faulty data for each variable. A summary of the missing data can be found in the "Patent Litigation Data from US District Court Electronic Records (1963-2015)" report. However, the summary is not completely accurate as a screening of the variables showed.

preparation of research datasets from the PLD a *"valuable contribution to future research and understanding."*

To create a valuable research dataset, I needed to minimise the amount of processed data. Therefore, I neglected the data files "attorneys" and "documents" at the initial stage. I conflated the files "cases" (containing case information from US district courts) "names" (containing plaintiff and defendant names for most cases) and "pacer_cases" (containing otherwise missing start and end dates for specific cases) by identifying common unique variables for 1:m (cases and names) and 1:1 (cases and dates) matching[9].

The case numbers of 197 cases were equal. Case numbers are solely unique within the same district court. Hence, I distinguished between cases from different district courts with a and b, resulting in 74,826 unique case numbers. Other than expected, it was indicated in the Patent Litigation Data from US District Court Electronic Records (1963-2015) report, that the case_row_id, party_row_count and case_row_count variables are not a unique common identifier between the three files. Therefore, the files needed to be matched using case numbers and district court information. To do that, I renamed the pacer cases case_numbers. They used four-digit years (for example, 1998) instead of the normal two-digit year case_names (for example, 98). Furthermore, the pacer cases did not indicate the judge initials at the end of the case name, however, to have a unique match I created a new case number from the combination of the case number and the court location initials to avoid mismatching. To create this case number, I had to standardise the court location initials in the cases and pacer cases file. I also conducted the above-mentioned a and b distinction manually for the pacer cases. Afterwards, I matched the new pacer case numbers with the case file document. Only 226 cases from the pacer_cases file could not be matched; this is because those cases did not exist in the USPTO file (cases and names). If a case was not available in USPTO, I added it as a new case to the merged file. Furthermore, I manually cleaned inconsistencies in the case numbers.

A large number of cases were missing the filing date information because it was already missing in the docket report source (Marco et al., 2017), it was useful to be able to complement this data by using the PACER metadata. After successfully matching the PACER-cases, I compared the start-and end-dates from the original USPTO cases sheet and the PACER-cases sheet. Dates in the PACER-case sheet for date_closed were in American date format (MM/DD/YYYY) while any other dates indicated in the PACER-cases sheet and the USPTO sheet were in the UK date

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[9] A full content list of the data files can be found in the "Patent Litigation Data from US District Court Electronic Records (1963-2015)" report.

format (DD/MM/YYYY). I changed the date closed dates in the pacer_cases file to the UK format. Then, I compared the two start_date rows and the two end_date rows with each other and took the date from the PACER-cases if the date was missing (or the other way around). This also applied to many variables, for example, party names or case names which could be complemented by using the information from all three data files.

To be able to match the names file, I converted the data to long format, allocating multiple rows per case for the cases within the "case" file. The problem was that in the "names" file, each case had several rows because it indicates plaintiff and defendant as well as other roles in separate rows. In the cases file, however, each case was allocated to one row. When bringing the two sheets together, multiple rows were the best way to capture the plaintiff and defendant distinction based on firm names. The main goal of matching the litigation data with the financial data from Thomson One Banker needed firm-year based data on litigation. Thus, I transformed the cases file by multiplying the information for each case by the number of parties involved in the case. Thereby, when matching the names and cases file, each company was represented in rows according to the cases they were involved with in court (i.e. name-party_type-case combinations).

The party_type column indicated multiple additional roles other than plaintiff or defendant[10]. Those additional party types are not standardised in the original database, thus, entailed many typing mistakes and different written forms of the same form of party type. To keep useful information, I standardised the party types to proceed with the matching of the cases and names files. I distinguished the involved entities into the original defendant (listed as the defendant) and the original plaintiff (listed as the plaintiff). The other columns are indicating several other party types, for example, 3rd party defendant and consolidated plaintiff, which I named additional defendant or additional plaintiff. If the original party_type was missing, I looked at an indication of counterclaim defendants or plaintiffs. Counterclaim defendants are usually also the plaintiff in the same case and vice versa. I cleaned missing defendants and plaintiffs accordingly from the counterclaim defendant/plaintiff column. I excluded all duplicate firms

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[10] ADR provider, amicus, appellant, appellee, arbitrator, appellant settlement officer, bankrupt party, claimant, conservator, consol, 3rd Pty dft, consol claimant, consol counter claimant, consol defendant/plaintiff, counter claimant, counter defendant, inventor dft, inventor pla, master commissioner, material witness, MDL notice, mediator (ADR panel), mediator (mandatory program), miscellaneous, movant, neutral, nominal defendant, non-party, notice, notice only, notice party, objector, other, other party, party, party of interest, petitioner, plaintiff – consolidated, plaintiff – defaulted, plaintiff, counter defendant, proposed, provider, real party in interest defendant/plaintiff, receiver, relator, respondent, selection required, special master, technical advisor, third party counter claimant, third party custodian, third party defendant/plaintiff, trustee, unknown, unknown party type, witness.

that were also listed as the original defendant or original plaintiff to avoid double counts. I also excluded party types that were not relevant for testing the hypotheses.

After merging the three data files, I replaced missing start dates with the first of January of the year indicated by the case number. Case numbers indicate the courthouse with the first digit, and the next two-digit reveal the year the case was filed, then the type of the case is indicated (in patent cases "cv" for civil) followed by a number that indicates the succession of cases filed with the court in the given year. Some case numbers conclude with the initials of the judge or magistrate judge the case was assigned to.

I initiated the first coarse round of cleaning to exclude cases that were unusable for further research, for example, cases that could not be assigned to a specific entity, for example, "a company", "all defendants", "an individual" or other paraphrases.

I then transformed the dataset into case-level data. The data was already in case-oriented form, however, the different party_types and party_names were differentiated by rows rather than columns. Therefore, the cases had several rows, depending on the parties involved. Thus, the newly created columns were party type based. If a "party name" was missing, the names were sometimes indicated by the "case name" column because it lists the first name as the plaintiff and the second name as the defendant, which is consistent with all other cases in the database. Before this transformation, I deleted duplicates, if several columns for one single case had the same party type and party name, for example, the same company was listed as the defendant in multiple rows. After the case level transformation, every case represented one row. One problem that arose is that the plaintiff and defendant roles were not hierarchical in the original dataset. Hence, it was not possible to identify an intrinsically order among all defendants (or plaintiffs). Therefore, I handled multiple defendants or plaintiffs as equals, receiving a row on their own.

I only kept cases for further analysis if the case-causes were concerning patent litigation. I cleaned the variable case_cause and distinguished between infringement suits or declaratory judgement cases. I excluded a few cases that did not concern these matters or were unclear to identify. Lastly, I neglected cases that ended before 2000. After this point, the database contained 52.577 cases.

I transformed the cases into firm-case unique combinations, duplicating the case as often as it involved plaintiffs and defendants and giving each firm case combination a new column indicating if the firm was an original plaintiff, an additional plaintiff, an original defendant or

an additional defendant. Then, I transformed the data to panel data format from 2000 to 2015, creating the variable "case in year" indicating if the case took place in the given year with "0" or "1".

The next step was cleaning the database by standardising firm names and creating date variables. I simultaneously carried out the cleaning for both datasets. However, the USPTO dataset contained unique terminology that was cleaned first. For example, the dataset contained firm names that ended with "a division of", "a city/state corporation", "a subsidiary of" or "dba" "d/b/a" and "also known as". I excluded the cases with unknown party names, for example, if instead of the name the case displayed "company", "corporation", "citizen", "party", "plaintiff", "multiple plaintiffs", "known as", "terminated", "doe", "individual doing business", "a business" or any type of numbers, dates, missing names or similar content. Then, I removed city or state additions, for example, "a Delaware corporation", "Delaware". However, I did not clean companies that were displayed as "company name of Delaware" as this terminology is common to distinguish between different firm entities and, thus, firms in the TOB dataset would have ended up with the same name.

3.4.3 Simultaneous Cleaning of PLD and TOB

The next step was cleaning punctuation in both the USPTO and TOB dataset. Inter alia, I used punctuation cleaning to standardise all common punctuation marks, for example, the exclamation mark, but also including all different types of brackets, slashes, quotations marks, mathematical signs, at-sign or abbreviations (for example comm., aka, fka, incop., int'l, pty, .com). Then, I harmonised company forms. This included, inter alia, to change common company forms to one specific abbreviation. For example, I changed "limited liability company", "limited liability companies", "limited liability corporation", "limited liability co", "ltd liability co", " l c" and different forms of spelling mistakes to "llc". I did this for all company types, including but not limited to company additions ending with plc, lp, corp, inc, ltd, gmbh, ag, kg, holding, group, company, america, usa, service, system, associates, brands, technologies, enterprise, laboratories, pharmaceuticals, and industries. I conducted no cleaning without checking the results manually and revising if problems occurred.

I used the trim function to make lower case transformations. Furthermore, the dataset contained a lot of missing and additional blanks. I cleaned additional blanks with a function and missing blanks manually by identifying the cases in which they appeared, inter alia, before pty, lp, inc, ltd, llc, et al, and then using a function to remove them.

3.4.4 Internal Harmonisation of the USPTO Dataset

The consolidation of the USPTO database was the next step after the initial cleaning phase. The data was supposed to be matched internally to reach harmonisation of the data, meaning firm names should be uniform and not duplicated throughout the cases. Duplicates can appear due to spelling differences (see also: (Reitzig and Wagner, 2010)), but also, if a case was, for example, registered multiple times because of venue changes (Agarwal et al., 2009). Thus, I needed to assign all cases to one firm, which I identified by harmonisation. For example, the cases of "Apple inc." and "Apple incorporated" needed to be combined without duplication of each case and with consideration of already duplicated cases. I evaluated different approaches to reach the best possible internal harmonisation. First, I considered the fuzzy name matching command matchit according to token-based similarity issues.

Matchit with token-based similarities can identify the most common grams within a dataset. However, one major problem during the USPTO und TOB dataset merging was the difference in headquarter-subsidiary reporting. Because of this problem, the token-based similarity approach was not suitable for internal harmonisation as it would not distinguish between different firm entities. For example, "Ranbaxi inc" is a private subsidiary of "Ranbaxi pharmaceuticals inc", which is Canadian and therefore not listed in the TOB database. "Ranbaxi inc", however, is in the database. To perform internal harmonisation, it needed to be clear if different company forms are consolidated in the TOB dataset or not. Furthermore, token matchit did not provide sufficient success rates.

I decided to conduct the internal harmonisation by using fuzzy name matching on USPTO firm names and TOB firm names (from full datasets). By incorporating TOB, I did the internal harmonisation of USPTO simultaneously with the matching of the databases. I merged the datasets and then conducted fuzzy name matching on merged firms with unmerged USPTO firms and unmerged firms with unmerged USPTO firms. I ran the fuzzy matching several times up to .86 similarity scores. Thereby, I checked the observations manually, looking for false matches or false mismatches. If I identified patterns of common causes, I corrected them and repeated matchit. This step involved that several times up to 5000 firms needed to be checked manually. The followed sequence was 1. merge 2. match 3. cleaning wrong matches manually 4. assign newly identified matches to the original firm name.

I split the USPTO dataset between public and private firms and consolidated public firms with similar fuzzy matched names. I only consolidated private firms if the company form was

matching. Furthermore, I only changed firm names if they were completely similar except spelling errors or missing company forms. For example, if one company name indicated "inc" and the other indicated "llc", I did not consolidate them. However, I did consolidate them if one company indicated "co" and the other "corp". For example, I matched public firms if companies that did not have a company form indicated or had a different form indicated, for example, "walt disney" was matched with similar firms, for example, "walt disney inc" or "walt disney corp" with "walt disney licensing inc". I identified the main company form for companies with missing company forms in USPTO from Bloomberg. I manually checked all instances with Google and Bloomberg company screener, which required approximately 600 manually checked firms.

Moreover, I consolidated companies when the entity in USPTO was more constrained than in TOB, for example, "gameloft se" (TOB) was matched with "gameloft us inc" (USPTO), being a subsidiary of the former, or "minnesota mining and manufacturing co inc" (TOB) was matched with "minnesota mining and manufacturing inc". Thereby, I also matched the most common abbreviations, inter alia, "3m". In general, I identified companies that matched by typos, mixed up names, companies that were written together or had a blank in the name or companies with a missing company form, for example, "comcast cable international" and "comcast international cable" or "ben and jerrys inc" and "ben and jerrys" or "all sensors corp" and "allsensors corp inc". This step accounts for subsidiaries of public firms. However, private firms were not consolidated in that case. I only consolidated private firms in case of spelling errors or company form abbreviation cases, for example, "co" and "corp". This step takes the subsidiaries of public firms into account because TOB reports public firms in consolidated accounts, however, reports private firms unconsolidated. However, the consolidated subsidiaries cannot be identified. Hence, the matchit process is consolidating USPTO subsidiaries with the headquarter companies, however, this step is only meant to increase the resulting case-data slightly because USPTO itself is often including headquarter and subsidiaries as different parties within a case. That means that case-level matching with TOB is still accurate when matching headquarters cases to consolidated firms.

I did not consolidate entities if there was reason to believe that they stem from different, unrelated industries, for example, "noah education holding ltd" (TOB) and "noah systems inc" (USPTO). Especially, when the "smaller"-seeming entity is listed in the TOB database, in this case, education holding instead of inc. The same applies to, for example, "chatsworth data solutions inc" (TOB) and "chatsworth inc" (USPTO) or "tradiran" (TOB) and "tradiran telecom ltd" (USPTO). Furthermore, I did not match different company forms, for example, "geospace

technology corp" (TOB) with "geospace products co inc" (USPTO). The same applies to companies where the name indicated a difference, for example, "lawson products inc" (TOB) not with "lawson software inc" (USPTO) or "continental teves inc" (TOB) not with "continental teves ag" or "lump llc" (TOB) not with "lump inc" (USPTO).

I repeated the matchit with grams and weights for the matchit command. The bigram (or trigram) similarity function and the weights function enhances the accuracy because the former accounts for differences between "Org" and "Organization" and the latter is useful to give more importance to the firm name than organisational form (Chaudhuri et al., 2003).

After this step, I repeated the matching without the public and private distinction. Not cleaning different company forms again. This step resulted in approximately 12000 firms to manually screen, thereby, I considered the matchit results up to .8 similarity scores to expand the matching and get better results. The matching proceeded as follows:

1. Merge all USPTO and all TOB firms. Fuzzynamematch unmerged-TOB firms with unmerged-USPTO firms.
2. Merge all USPTO and all TOB firms. Fuzzynamematch merged-TOB and merged-USPTO firms with unmerged-USPTO firms.

Lastly, I calculated several time-indicating variables, inter alia, year-counts, day-counts and case-counts as well as attorney and court dates.

- Count of cases per Year for each Party_type (total cases per year)
- Count of cases per year for each company using one of the four strategies (for example, casesyearorigdef)
- The calculated number of days of litigation for each company in every single year (first case level then cumulated by firm and Party_type)

Then, I transformed the USPTO file into firm-year panel data from 2000-2015, to finally merged it with the TOB database. After merging the two datasets, I assigned a zero to missing case data, which is especially necessary for non-merged TOB firms, as it is assumed that these companies did not litigate.

3.4.5 The Final Dataset

The proposed hypotheses are tested based on data from the Thomson One Banker financial database and the patent litigation database of the United States Patent and Trademark Office (USPTO). The sample consists of public and private U.S. companies operating in the manufacturing industries (Sic codes 2011-3999) that conducted proprietary and/or defensive patent litigation in U.S. district courts.

The matching from firm and subsidiary level data posed some difficulties, however, after a thorough investigation, it became clear, that TOB reported financial statements on a consolidated level for the headquarter and the subsidiaries. Simultaneously, although the case-count of the USPTO case data is not consolidated, it is usually the case that headquarters were consolidated with its subsidiaries. After a thorough investigation, I found that for cases where this was not possible, for example, small headquarters with entirely different names, it is safe to assume that litigation cases for those exceptions carry little to no weight for the overall case-count of the headquarter.

The overall matching scores are considered high, even though many USPTO companies could not be matched. This is because only manufacturing firms are included in the TOB database, which excludes many companies with many cases that are listed in USPTO, for example, eBay. Furthermore, not all companies in USPTO are U.S. companies, hence, the dataset contains many companies that are outside the boundaries of the set sample. The final dataset comprises nearly half a million observations.

3.5 Variables

Previous studies used the logarithms based Inverse Hyperbolic Sine transformation (IHS) to normalise variables (Burbidge et al., 1988; Kafouros and Aliyev, 2016a). Compared to log transformation, IHS is useful if values can get negative, for example, profitability (Burbidge et al., 1988). Hence, I IHS transformed all continuous dependent and control variables. Predictors are not IHS transformed to avoid log-log models and enhance interpretability. All non-transformed variables are not skewed.

3.5.1 Dependent Variables

3.5.1.1 Firm Costs

To measure organisational costs of patent litigation I used General and Administrative (G&A) expenses per Employee. I divided these cost by the number of employees to avoid absolute cost measurement. Previous literature utilised G&A expenses to depict firm managerial costs, executive compensation and other administrative costs, inter alia, legal consulting (Hashai et al., 2015). Patent litigation lawsuits require the time of managers and comprise a variety of other costs, such as substantial legal fees (Chen et al., 2016). Therefore, G&A expenses are a suitable measure for firm costs in patent litigation.

In the following, a more thorough discussion on the measurement of firm costs is provided.

Highlighting the costs of patent litigation is common in litigation research. Indeed, many previous scholars in the field dedicated substantial thoughts to the importance of the financial parameters of litigation (Mansfield et al., 1981; Lerner, 1995; Lanjouw and Schankerman, 2001; Bessen and Meurer, 2008a; Reitzig and Wagner, 2010; Chen et al., 2016). However, the measurement of the exact cost of litigation comes with unique challenges, as financial litigation data is not disclosed by companies. Hence, the goal of theory and measurement alignment was met by identifying a proxy that reflects litigation costs. In the following, I will elaborate on the two incorporated measures: general and administrative expenses and duration of patent litigation. First, I will discuss the characteristics of the two measurements. Second, I elaborate why I choose general and administrative expenses, rather than litigation duration, as measurement of litigation costs.

The measure of general and administrative expenses can be used to measure the organisational costs of strategic patent litigation. The measurement reflects the indirect costs of a company which are not related to making a product or conducting services as well as interest. General and administrative expenses can therefore show the expenses of a company related to its strategic behaviour. Litigation requires the attention of executives and other employees (Shane and Somaya, 2007; Bessen and Meurer, 2008a; Aharony et al., 2015; Chen et al., 2016) which can reflect heavily in personnel salaries. Furthermore, the costs of outside legal counsel are an equally important expense that can determine the costs of strategic patent litigation (Lanjouw and Schankerman, 2001; Chen et al., 2016). Both constructs are incorporated in the general and administrative expenses variable. The measure combines personnel and legal counsel compensation as well as costs for communicating and travelling (Hashai et al., 2015), the latter

being another important expense that can increase litigation costs for organisations (Lanjouw and Schankerman, 2001). To avoid absolute cost measurement, general and administrative expenses can be normalized by the size of the firm.

Duration of litigation lawsuits can be a significant factor in determining litigation costs. The average litigation length or duration of litigation cases can be measured on the time period a firm is litigating each year across its cases. Thereby, dividing the days per year of each case of a plaintiff in patent litigation by the total number of cases of a plaintiff firm in the given year shows the average duration of patent litigation. Little attention has been paid to the duration of lawsuits and its influence on litigation costs in previous literature. Cases can either settle within weeks, months or years and instinctively, legal costs are linked with the progression of time during a lawsuit (Bessen and Meurer, 2008). The longer a lawsuit lasts, the longer the personnel has to be compensated which can increase costs. However, Love and Yoon (2017), indicate that different cost occur at different stages of a lawsuit, separating costs of discovery and summary judgements (usually less costly) from trial costs. Hereby, the chances of a case going through trial increase with proceeded time of the case since filing. Hence, duration of litigation lawsuits can reflect the costs involved.

However, this argument already shows that it can be misleading to measure the costs of litigation solely by the duration of a case. This is because cases are unique in their timeline and characterized by the merits of the disputed patent and the firm itself (Foster, 1986; Bessen and Meurer, 2008a; Love and Yoon, 2017). Ultimately, the costs of litigation are not dependent on duration alone. Differences between the duration of litigation lawsuits and costs of litigation lawsuits can be explained by the team size and experience of legal representatives and employees of the firm, the characteristics of the patent case, as well as the characteristics of the firm. In the next three sections, I will bring forward the three main characteristics that explain differences of duration and financial costs of patent litigation.

Legal representation

Regardless of the duration of a litigation case, it is necessary to dedicate employee and attorney time to a lawsuit. Hereby, inter alia, the size of the case determines the amount of personnel needed. Consequently, a case with a high number of dedicated personnel will be more expensive than a case with a small team assigned. Hence, the duration of the case cannot solely determine the costs of a lawsuit, as cases can be smaller and larger in size and the number of such dedicated personnel reflects in litigation costs (see Foster, 1986). Patent suits might carry varying numbers of assigned lawyers and employees at different pay rates. These differences can also

explain why the costs of similar sized patent lawsuits with equal duration can vary. A firms staffing decision can lower the costs of a lawsuit, for example, if staff is reduced during slack periods that do not require considerate care (Foster, 1986). Furthermore, experienced firms can either facilitate proceedings or reduce their personnel hours needed for litigation (Lanjouw Schankerman, 2001), while case duration might be more rigid, due to court regulations and common waiting periods or slack times (Foster, 1986). Hence, costs can differ considerably between cases, especially if firms diverge in the ability to manage and control the costs of legal teams and employees working on the cases. The size of the litigation team as well as its experience (which can also reflect in salaries) can determine the general and administrative costs of a firm.

Characteristics of the Patent Case

Litigation lawsuits can differ in significantly in costs depending on the number of working hours needed. Some lawsuits might require staffing of expert witnesses or come with increased amounts of required documents (Love and Yoon, 2017). If, during discovery, it is necessary to produce a bulk of documents in a short time, more personnel is needed, increasing costs. Thereby, the duration of a lawsuit cannot account for such costs. Furthermore, especially valuable patents might be litigated with heightened scrutiny and might involve an increased allocation of resources. Hence, a key aspect of litigation costs is the "profile" of the lawsuit which is often determined by its stakes (Love and Yoon, 2017). Furthermore, costs can occur at varying stages of a lawsuit, sometimes earlier or later in the case. These costs can be dependent on the dispute itself or even regional differences. For example, some courts make faster decisions when it comes to transferring cases to different venues than others (Love and Yoon, 2017), making it difficult to compare case lengths and, hence, drawing conclusions on litigation costs. As an example, if two similar sized cases are compared, one is filed and settled within a year; the other is filed, transferred after eight months and then settled quickly within two months, both lasted equally long but the first might come with higher costs than the second lawsuit, simply because the second lawsuit involved a waiting period to transfer.

Characteristics of the firm

Litigation costs can also be dependent on the characteristics of a firm, as for example, firm size, industrial differences or location (Bessen and Meurer, 2008). As the sample for this dissertation consists of public and private firms of different sizes, industries and lawsuit locations, the organizational costs of litigation can deviate from litigation duration. Lanjouw and Schankerman (2001), show that litigation costs differ between domestic and foreign firms. This

can be mainly attributed to the firms' knowledge of local courts and proximity issues (e.g. travel times, translation and expenses). The Authors also show that firm size can determine litigation costs. The differences in the amount of external personnel needed can determine litigation costs and increase such for smaller firms (Lanjouw and Schankerman, 2001; Lanjouw and Lerner 1996). Ultimately, these differences can be accounted for when looking at general and administrative expense. The costs of personnel might vary a lot between smaller and bigger companies because of the necessary reliance on outside counsel which is often more expensive than in-house legal teams. Bigger, more experienced firms might also be better equipped to reduce disruption and, therefore, reduce the costs during litigation. Therefore, I further relativized general and administrative costs by firm size. By doing that it can be seen if a company is accumulating extraordinarily high costs, for example, due to intense coordination with multiple lawyers or lawsuits.

In conclusion, whereas the duration of litigation can be a useful variable in providing a first indication of the costs of strategic patent litigation, general and administrative expenses are needed to holistically measure the organisational costs of patent litigation. However, the full model does incorporate the average duration of litigation cases as a control variable.

3.5.1.2   Firm Sales

I measured Firm sales by Net Sales or Revenue per Employee, where the sales measure is divided by the number of employees of a firm to avoid absolute revenue measurement (Rudy and Black, 2015). Sales is an especially important measurement in the context of patent litigation. It does not only include increased market sales due to possible injunctions against infringers selling similar products, but it also sometimes contains penalty payments that are directly linked to patent infringement lawsuits. For example, the Apple Annual Data Report (2017) states: "During the first quarter of 2016, the Company received $548 million from Samsung Electronics Co., Ltd. related to its patent infringement lawsuit, which was recorded as licensing net sales within services" (p.25). According to IFRS standards, those licensing payments are included on the income statement within Net Sales or Revenue, however, according to GAAP, they are only included if they possess stand-alone value. Thus, irregularities in reporting occur. However, by measuring net sales vital payments as outcomes from patent infringement lawsuits are considered if reported.

3.5.1.3 Firm Profitability

I measured profitability on Return on Sales (ROS) which is the operating profit margin, or net income (operating profit) before interest and tax divided by net sales. Past scholarship indicated that profitability is an appropriate indicator for firm performance and relied on several measurements of profitability to capture performance (De Carolis, 2003; Markman et al., 2004). ROS is a particularly important measure in this study as it accounts for sales as well as operative and administrative expenses. ROS allows the measurement of firm profitability and thereby considers the scale of a firm's operations (Kafouros and Aliyev, 2016a).

3.5.2 Independent Variable

3.5.2.1 Strategic Patent Litigation

Up until now, litigation literature followed different approaches on how to measure strategic patent litigation endeavours (Lanjouw and Schankerman, 2001; Agarwal et al., 2009; Rudy and Black, 2015). Thereby, the underlying theoretical concept of strategic patent litigation as a main factor for firm performance was previously measured in only one study in the field, which operationalized the concept by counting the number of plaintiff actions initiated against infringers in a patent infringement lawsuit (Rudy and Black, 2015). However, simple count measures of plaintiff actions in infringement lawsuits do not consider, that the strategic litigation action is dependent on the unique IP portfolio of the firm. Therefore, a mere count measure (as operationalized by Rudy and Black, 2015) does not account for the size of a firm's patent portfolio, and hence, does not account for the actual intensity of litigation that a firm puts forward. Therefore, I suggest normalising the count of a plaintiff's infringement lawsuits by size.

To align the measurement with the theoretical concept, it is necessary to look at the litigation action in the context of the firm. Firms with large patent portfolios have numerous options to file for infringement, simply because they hold multiple patents that may be infringed. At the same time, firms with more extensive patent portfolios are most likely more equipped to initiate infringement lawsuits because of, inter alia, experience or financial possibilities. By normalizing the measure, the strategic choice to litigate and hence, litigiousness, can be compared the different sizes of companies. Consequently, I look at the count of a firm's litigation cases in the context of its patent portfolio. As the sample of firms in this dissertation differs considerably between firms with small and large IP portfolios, the measurement of the litigious action has to be relative to IP portfolio size. Hence, the measure of intangible assets,

is used to relativize case count. Intangible assets is a close proxy for patent portfolio size, as it predominantly includes the size of the underlying patent stock of a firm. Previous research utilized this measure to capture both, current and accumulated intangibles of a firm (Griliches, 1981; Chang et al., 2013; Kafouros and Aliyev, 2016b). Therefore, strategic litigation is measured as the number of patent infringement suits of a plaintiff per year divided by its stock of intangibles per year. Thereby, litigation is expressed as a measure of intensity, rather than a count, as intangible assets built over time are increasing a company's ability to frequent litigation. Because of this reasons and to further develop the usage of suitable litigation measures, I proceeded with the measure of litigation counts normalized by IP portfolio size.

3.5.3 Control Variables

I considered several control variables for inclusion in the study to control for external validity. Previous litigation literature controlled for Firm Age in years since the founding (Agarwal et al., 2009; Rudy and Black, 2015). This is necessary, because older firms could, inter alia, have a larger patent stock or stick to unique procedures which could lead to inertia that influences their litigation strategies (De Carolis, 2003; Balasubramanian and Lee, 2008; Rudy and Black, 2015), hence, I incorporated the variable in the analysis and measured it on the count of years since the founding date, starting with one in the founding year.

Firm size can be an important measure in depicting the performance of a firm. Thus, in line with previous patent and litigation studies, I controlled for the Size of the Firm (Hall and Ziedonis, 2001; Somaya et al., 2007; Rudy and Black, 2015), measured by the possession of assets as a scale and size measurement of a company (Markman et al., 2004).

In line with previous literature, I included R&D Investment as a measure for the firm's innovativeness to control for the effect of R&D expenditures on performance (De Carolis, 2003; Markman et al., 2004; Somaya et al., 2007; Ceccagnoli, 2009; Rudy and Black, 2015). Firms with higher R&D investments are expected to be able to be more innovative (De Carolis, 2003). R&D is measured on annual R&D investment rather than a cumulative measure over the years because showing a significant effect of multiple-year R&D investment on patenting is considered difficult due to intra-firm correlations and additional other effects (Somaya et al., 2007). This logic is adapted for the litigation context, and it is expected that measuring same year R&D effects on profitability are as (or more) accurate. Similar to De Carolis (2003), I used the TOB R&D measure, which is divided by net sales or revenues and depicts normalised R&D expenditures.

I address the possible effects of the financial position of a firm by controlling for Organisational Slack, as done by previous studies (Rudy and Black, 2015). Organisational slack can alter a company's patent litigation behaviour as patent litigation is very cost-intensive and often requires thorough asset utilisation for the company to have enough resources to fund innovation and litigation. I measure slack intensity by a firm's total asset turnover, which measures the value of a company's sales or revenues generated relative to the value of its assets. This measure indicates how efficient the company is in creating revenue per dollar of asset.

Some lawsuits last longer than others and, therefore, the impact of a single case might vary when it comes to costs and revenues. Hence, I controlled for the average Litigation Duration measured on the time period a firm is litigating each year across its cases. I computed the measure by dividing the days per year of each case of a plaintiff in proactive patent litigation by the total number of proactive patent litigation cases of a plaintiff firm in that year.

Finally, I included Year Dummies to incorporate time effects that might influence profitability. The dummy variable for the year 2000 was omitted due to multicollinearity because of inclusion of a Hackman analysis explained in the next section.

3.6 Research Ethics

Ethics is of widespread and multilayered importance for academic researchers and their work (Cowton, 1998; Kalleberg et al., 2006). Thereby, it comprises the academic conduct of the researcher as well as ethical research guidelines. The following sections examine both aspects and their importance for the present research closely.

Ethical academic conduct is not a virtue but a necessity. Research ethics standards have to be followed by practising honesty, objectivity and openness in scientific discourse, whereby the ethical researcher follows the moral standards of society (Kalleberg et al., 2006). In addition, the ethical researcher is bound to scientific integrity to represent a high level of ethical standards within the academic community. The truth should always be followed while respecting the intellectual property of peers. More precisely, honest and ethical research as well as refraining from plagiarism are indispensable (Kalleberg et al., 2006).

For this quantitative research dissertation, following ethical research guidelines for statistical practice and data management were equally important as ethical academic conduct mentioned above. Besides being ethical in one's ethical principles and morals, ethical issues with the quantitative data analysis are to be diminished. Thereby, the goal is to "produce valid,

interpretable, and reproducible results" (American Statistical Association, 2018, p.2). Thus, the ethical use of databases and analysis needs to be considered.

On the one hand, collecting data from available databases diminishes some of the more common ethical issues that have to do with the researchers own biases and the protection of personal data of respondents. This can be beneficial for the study as sometimes more time can be devoted to the research gaps and theoretical goals of the thesis as well as the preparation and analysis of the data to strengthen the link between theory and data, a common ethical issue (Hakim, 1982; Cowton, 1998).

On the other hand, collecting data from databases comes with its own ethical challenges due to non-involvement of the researcher in the composition of the database. This requires additional thoroughness of the researcher to familiarise with the structure, organisation, collection and accumulation of the data[11].

In general, the data analysis should follow statistical tests and reporting research findings should occur comprehensively, following ethical guidelines (Creswell, 2013). Such guidelines comprise those presented by the American Statistical Association (ASA) (2018) which were followed closely during the preparation of this dissertation.

First, the ASA ethical guidelines promote, inter alia, an appropriate pairing of methods and hypotheses, while choosing appropriate data that is handled ethically. Most importantly, the structure and content of the database(s) used should not influence the research project and its theoretical direction (Cowton, 1998). However, the data has to be transformed or further prepared to be suitable for the research problem at hand (Cowton, 1998). Hence, the present dissertation provides, a very thorough explanation of the data collection and cleaning process and followed common research practice closely to ensure, that the methods used were suitable and reproducible. Furthermore, I refrained from additional cleaning procedures that could have improved the matching process but were difficult to reproduce.

Second, the presentation of the data should follow in a non-misleading, unskewed or non-manipulated style without limiting or holding back results to present more favourable findings (Kalleberg et al., 2006). This ensures, that it is not focused solely on data for the purpose to prove or refute one's own hypotheses (Creswell, 2013). Furthermore, to allow informed peer

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[11] During data collection of this dissertation, some of those difficulties were experienced. For example, a close communication with the support team from Thomson One Banker highlighted inconsistencies that derived from their use of secondary data providers. Furthermore, structural issues with the provided data led to Thomson One Banker setting up a special team to work on a clear distinction of corporate governance issues, however, these issues could not be resolved on the providers side until today.

review, findings should then be presented in such a way that the credibility of the study can be determined by the examiner(s) themselves (Neuman, 2014). Notwithstanding, the research should present sample, limitations or imputations of the data and clearly assess its implications. If any mistakes are detected, they should be immediately corrected (American Statistical Association, 2018). Furthermore, it needs to be ensured that data obtained from the database is not unethically disclosed or shared with third parties and handled in such a way that it is kept from misappropriation (Creswell, 2013) at all time.

The ethical guidelines aim to promote accountability by informing those who rely on a statistical analysis of the standards they should expect, to ensure, that ethical research and academic integrity are practised. Hence, I closely followed the ethical guidelines illustrated above and the ethical requirements from the Leeds University Business School concerning academic conduct and data management.

4 RQ 1: The Influence of Strategic Patent Litigation on Firm Performance

This chapter investigates the relationships of strategic patent enforcement and two measures of firm performance as well as firm costs. Thereby, empirical chapter 1 establishes a link between inimitability of assets and strategic patent litigation which impacts firm costs, sales and profitability.

4.1 Introduction

There is a vast body of scholarly work that tries to understand the link between innovation, patenting and firm performance with respects to the resource-based view of the firm (Teece, 1986; Barney, 1991; Cohen et al., 2000; De Carolis, 2003; Pisano, 2006; Rudy and Black, 2015). However, when building on the RBVs premise of inimitability and its link to firm performance, the influence of strategic patent litigation has been widely neglected. The main question is if firms can capture value from their patents by strategically engaging in litigation?

In the past decade, litigation increased significantly (Leychkis, 2006; Bessen and Meurer, 2008a) and companies, on average, tend to litigate more than previously. Thereby, one of the reasons for increases in patent litigation might be that companies try to capture profit from their innovations by protecting themselves from imitation. Previous work in the patent litigation field has looked at the influence of patent litigation on the outsourcing of related patent filings (Reitzig and Wagner, 2010), on university licensing activities (Shane and Somaya, 2007), knowledge spillovers from human capital (Agarwal et al., 2009) and the influence of patent litigation strategies on firm sales (Rudy and Black, 2015). Studies on patents as isolating mechanisms against imitability found conflicting results, postulating a positive effect (Markman et al., 2004) and a negative effect (De Carolis, 2003) of inimitability on performance. Whereas the relationship between patent-based inimitability and performance is more frequently researched in the past literature (De Carolis, 2003; Markman et al., 2004), scholarship on patent enforcement-based inimitability and performance is only seen in more recent work (Rudy and Black, 2015). However, also this recent work only scratched the surface of the litigation - performance relationship by not incorporating costs as well as measures of performance such as sales and profitability.

The purpose of this chapter is to investigate strategic patent enforcement and its influence on firm performance in multiple industries. By doing so, it is built on the RBV by suggesting that

to reach or maintain competitive advantage, firms use patent litigation to secure inimitability of assets. This inimitability is expected to pose a certain trade-off on the firm, between administrative costs of strategic litigation and benefits from a favourable market position. Even though this trade-off is often mentioned in previous literature (Lanjouw and Schankerman, 2001; Somaya, 2003) it has not yet been utilised in a study to investigate performance outcomes of strategic patent litigation.

To dive deeper into this trade-off and the contribution that can be made, it is necessary to look at the litigating landscape. In practice, strategic litigation is not always successful in its protection against imitation because its costs can exceed the potential benefits significantly. Bessen and Meurer (2008a) show in their research that litigation can cost companies millions of dollars according to case length. Leychkis (2006) quotes a study from the American Intellectual Property Lawyers Association, which illustrates that patent litigation involves substantial investments, averaging at 2.000.000 USD for a single lawsuit. Bhagat et al. (1994) and Lerner (1995) argue in their research, that firms involved in litigation experience an average drop in their market-adjusted value of up to 3.1%, which translates to shareholder investment losses way past the 20-million-dollar mark (Chen et al., 2016). Not including the negative effect this loss can have on the future funding of business operations and innovations. Whereas all three authors include the remark that settlement can reduce those costs, companies are not expected to refrain from pursuing litigation proceedings in court.

When firms have to take such costs into account, why do so many still engage in strategic litigation? Researchers concentrated on this questions and found that, in some industries, litigation also has a positive effect on firm sales (Rudy and Black, 2015) or that inimitability does positively influence a firm's profits (De Carolis, 2003). Furthermore, Shapiro (2010) argues, that the plaintiff in successful infringement suits, can be awarded damages to compensate for the loss of sales or the loss of royalties they could have had received from the infringer for a licensing agreement. Other studies concentrated on non-financial outcomes of patent litigation, such as inter alia, R&D effectiveness (Lanjouw and Schankerman, 2001) executive turnover (Aharony et al., 2015), knowledge spillovers (Agarwal et al., 2009) or its influence on licensing activities (Shane and Somaya, 2007).

However, even when subsuming the previous literature on strategic patent litigation, there is still a research gap on the actual influence of strategic patent enforcement on performance, especially when taking the trade-off between costs and sales benefits into account. From a theoretical perspective, strategic patent litigation plays a critical role in the RBV to protect

intellectual property. Nevertheless, the tripod of its performance implications has been overlooked. This chapter imposes a contribution to the patent litigation field by investigating the effect of strategic patent litigation on costs, sales and profitability.

The remainder of this chapter is organised as follows. First, the link between strategic patent enforcement and potential implications for financial performance are discussed while refining theory on the resource-based view of the firm. Then, the three hypotheses on the influence of strategic patent litigation on costs, sales and profitability are developed. Lastly, data and methods are presented, and the results are discussed. The chapter closes with a discussion of the findings and a link to the integrative framework *Table1* as well as the next chapter, which will refine knowledge on patent litigation and firm performance even further.

4.2 Theoretical Background and Literature Review

The link between strategic patenting and performance is widely researched in past scholarship (for example, see: (Ceccagnoli, 2009)). When it is assumed that a strong appropriability from patents, by the strategic use of patent protection, can lead to superior economic performance, litigation must be viewed as a powerful tool in order to generate rents from innovations. After all, according to the RBV successful barriers to imitation lead, to above normal overall profits (Barney, 1991). By deterring competitors from imitating innovation and appropriating commercial value from said imitation of intellectual property, firms can establish a competitive advantage in the form of profitability (De Carolis, 2003). Consequently, inimitability of assets was titled the most important postulate of the resource-based view of the firm (Barney, 2001; De Carolis, 2003). Arguably because it concentrates inherently on the strategic aspect of resource protection, rather than the value and rareness of them. This chapter argues that protecting from imitation is also one of the main drivers of economic profit when engaging in strategic patent litigation. Thereby, it anticipates establishing a theoretical link between strategic patent enforcement and firm performance by using patent litigation as a guarding tool that can foster inimitability of assets.

When engaging in strategic litigation, companies have to carefully consider the short term and long-term consequences of their actions. This often requires finding a trade-off between immediate benefits and future losses or vice versa (Polidoro and Toh, 2011). However, to date, there has been little agreement and even fewer findings of the influence of strategic patent litigation on firm performance that considers both potential costs and benefits and especially, profits.

On the one hand, scholars found that litigation can increase the worth of a patent and its economic value significantly (Sherry and Teece, 2004). Hence, and in line with the general argument of the importance of patent litigation as one of the inimitability premises of the resource-based view, especially "proven-valid-and-infringed" patents, that means patents that have been disputed in litigation have an extraordinary economic value (see (Sherry and Teece, 2004)). Rudy and Black (2015) show that litigation strategies, in some industries, can positively influence performance outcomes in terms of market share. They found, for example, that being the plaintiff in a declaratory judgement lawsuit in the semiconductor industries can enhance firm performance compared to competitors not employing this strategy. However, this could not be proved for other litigation strategies, such as proprietary litigation.

On the other hand, literature has indicated that the market value of firms involved in litigation on average decreases after the initiation of a patent suit (Lerner, 1995; Somaya, 2003). That is in part to be explained by the fact that the benefits of litigation can be harmed by the often substantial financial requirements of the IP right enforcement process (Lerner, 1995; Linden and Somaya, 2003; Lumineau and Oxley, 2012). This past argument illustrates the conundrum between economic benefits and detriments of litigation in the literature. At the bottom of the debate lies the dichotomy of strategic patent litigation decisions as a two-sided coin. Despite potential benefits of patent litigation, infringement is difficult to detect, and patent enforcement can be extremely costly, disruptive, time-consuming and unpredictable (Shane and Somaya, 2007). In the following, it will be elaborated on the influence of strategic patent litigation on costs, sales and, therefore, profitability to contribute to the debate by incorporating two measures of performance while establishing a framework of mechanisms that are influencing them.

Costs

Despite possible sales increases of strategic patent litigation, there are substantial costs involved diminishing its positive influence on performance (Lerner, 1995; Shane and Somaya, 2007; Lumineau and Oxley, 2012). High sales and revenue generation due to successful patent litigation strategies need to compensate for the overall organisational costs involved. Litigation can cost millions of dollars (Lanjouw & Schankerman, 2001; Rudy & Black, 2015; Somaya, 2003, 2012). Between 1984 and 2009, costs of litigation reached 385 billion dollars (Bessen et al., 2018) whereby firms in the smartphone industry alone spend 20 billion dollars in 2011 and 2012 on patents and patent litigation (Duhigg and Lohr, 2012). Previous research states, that

litigation can involve up to twenty-five percent of a firms R&D expenditures (Llobet, 2003), which might have increased significantly in the past ten years.

Legal proceedings and trial preparation are costly. Monitoring and detecting infringement as well as strategically drafting strategies for litigation involves substantial costs (Lanjouw and Schankerman, 2001; Somaya, 2012; James et al., 2013) but is necessary in order to be prepared for trial. Afterwards, expensive court proceedings involve direct costs such as legal fees and fees for suit filing (Lumineau and Oxley, 2012; Chen et al., 2016). Legal fees, although substantial to begin with, might be further increased by unexpected disruptions during the litigation process or particularly lengthy trials. Therefore, litigation is not always profitable due to costly trials (Somaya, 2003; Somaya, 2012) and other financial burdens. However, total litigation costs exceed legal fees (Bessen and Meurer, 2008b). Litigation is especially costly because the majority of costs stems from executives' and attorneys' salaries. The efforts and working hours of management, legal personnel and scientific or technological experts are indirect costs that have to be covered (Chen et al., 2016). Hence, top-management team and personnel involvement are a major cost factor of litigation (Somaya, 2003; Chen et al., 2015), as companies often hire expensive law firms or invest in in-house legal departments to guide their legal proceedings (Somaya et al., 2007). Thereby, the legal fees are increased even further.

Sales

Strategic litigation can be a means to extract returns and increase sales from patented innovations, whereby stronger patent protection was often found to lead to higher economic performance (Lanjouw and Lerner, 2001; Ceccagnoli, 2009; Rudy and Black, 2015). With regards to patenting, previous literature found, that often-cited patents are positively related to increased sales (Bloom and Van Reenen, 2002). Given that the utilisation of real options is a choice to protect the inimitability of assets, and therefore, competitive advantage, patent litigation might have a similar effect. To secure competitive advantage, firms can revert to strategic patent litigation. Hence, to understand sales as the measure of interest the hypotheses are built on the following four assumptions:

First, patents often protect a technology which is part of one product (Markman et al., 2004) or multiple products. By litigation, an increase in sales can be realised for multiple products that contain the technology protected by the litigated patent (Markman et al., 2004). Furthermore, infringing products containing this technology can be excluded from the market.[12] Due to the

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[12] It is also possible that patents which do not protect a valuable technology per se, are litigated strategically to protect other patents that do so.

costs of litigation, firms might litigate important patents that make up for a substantial part of their sales. This strategy was already proposed for the accumulation of patents (Somaya et al., 2011) and scholarship agrees, that for many firms the main revenue generation derives from just few technologies within the patent portfolio (Lerner, 1995; Markman et al., 2004). Hence, the plaintiff firm might increase sales by strategic patent litigation because even if only a portion of revenue can be protected, this protection can be substantial[13]. Hence, because it is a strategic decision to proceed against infringement, it is assumed that firms predominantly strategically litigate important patents that make up for substantial shares of their total sales.

Second, even in the early proceedings, the plaintiff can achieve an injunction, ordering the competitor to stop commercialising the product, which can positively affect sales (Shapiro, 2010). Hence, it is assumed that firms are utilising this option and try to push injunctions whenever possible.

Third, a verdict (or a trial) is not necessary to capture benefits from strategic litigation (Marco, 2005). If firms settle out of court, they might still negotiate an outcome that is beneficial for firm sales. Thereby, it is assumed that companies act accordingly and try to negotiate in such a way that they reach a beneficial outcome which protects their sales income.

Fourth, an incentive for firms to engage in strategic patent litigation can be monetary compensation in terms of royalties (Somaya, 2012) or licensing fees. Interestingly, while damages are booked as income and become more relevant when measuring profitability, the American accounting system (Generally Accepted Accounting Principles: GAAP) does leave the option to firms to book royalties and licensing fees as "net sales including royalties/ licensing net sales" or "licensing net sales within services" (see for example: Apple Annual Data Report, 2017) if they have stand-alone value. Consequently, even non-sales-related monetary compensation of strategic patent litigation will eventually be present at the income statement sheet and incorporated in the annual sales measure. Hence, it is assumed that firms follow GAAP and use this option.

It is important to note, that there might be other benefits to litigation utilised by firms that can be linked to increased sales, for instance, companies can reduce knowledge spillovers by strategic litigation, keeping valuable employees from departing (Agarwal et al., 2009). However, other activities such as licensing could potentially be neglected with increasing

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[13] However, if patents are infringed in multiple countries, it could also be the case, that firms are not able to increase their sales outside the country, as lawsuit outcomes are jurisdiction bound (Beukel and Zhao, 2018).

litigation pressures, decreasing sales (Shane and Somaya, 2007). Nevertheless, the high costs of strategic litigation could even out the positive effects presented in this paragraph.

Profitability

Especially in the context of patent litigation, it is important to focus on the marginal effects of firm revenue and costs to examine profitability as a measure of performance. Based on the facts that patent enforcement can increase sales and increase costs at the same time, the question arises, if it is, in general, profitable for companies or not? This central question can be pictured as a pair of scales, in one bowl sales, in the other costs. The heavier one decides about the profit implications. If there are more sales benefits than costs, then being the plaintiff in infringement suits will eventually be profitable. Are costs the bigger burden, outweighing sales, then being the plaintiff in infringement suits will not be profitable. Bessen and Meurer (2008b) discuss this trade-off in the context of innovation incentives. The authors argue (but do not test) that innovators have to balance the estimated costs of litigation with the estimated benefits and thereby determine an ex-post tax on their innovative effort. Eventually not litigating if the tax is too high. Hence, by investigating the trade-off between sales and costs, it can be determined if litigation is, in most cases, profitable or not.

Arguably, firms that expect higher sales returns than costs after filing an infringement case also might be the only ones inclined to do so. However, although companies determine the benefits of litigation in advance, often expecting that increased sales will outweigh costs, litigation is not always profitable. This is because litigation includes, in most cases, a significant amount of risk. Despite strategic patent litigation being a decision, the risks that are involved and especially costs, result in uncertain performance outcomes. Somaya (2003) argued that strategic litigation can protect other valuable strategic stakes or secure access to the patent-"usage"-rights with mutual hold-up. Thus, litigation can be a tightrope walk trying to balance the protection of strategic stakes and patents while being exposed to numerous risks. The main risk being ruled against or receiving fewer royalties than expected. However, risks during litigation can be as profound as a loss of perspective during a lawsuit, a scratched ego, rivalry, avarice, or overconfidence, for example, in legal advice (Somaya, 2003). Risk can also derive from higher-level concerns, such as the fear of loss of reputation, including the negative effects it can have on a business (Agarwal et al., 2009). Despite those risks, or because of them, firms follow through with litigation in court, and the question remains if strategic litigation is beneficial for a firm's profitability?

Actively defending against infringement could influence profitability by strategically litigating patents to increase sales and weighing out the costs at the same time. However, it needs to be determined if the risks and costs involved in litigation contribute to an overall negative effect on firm performance, or if they are neutralised by the positive benefits of litigation. Incorporating the trade-off between benefits and costs ultimately highlights the three facets: sales, costs and therewith, profitability. Therefore, costs and monetary losses, as well as potential sales generation, have to be considered equally to investigate the effectiveness of patent litigation strategies in increasing overall post-patent litigation firm profitability.

As described above, recent research is inconclusive about the influence of patent litigation strategies on firm performance. Thereby, profitability is the most important measure to picture financial sales generation efficiency while taking costs into account, hence, the ability of the firm to earn a profit.

4.3 Hypotheses

Engaging in a proprietary patent strategy is especially necessary for firms that want to bring their innovations to the market themselves instead of licensing it (Teece, 1986). Proactive strategic patent litigation is the key to secure competitive advantage as it is functioning as the intermediary step between the patent and the actual protection from intellectual property imitation. Thereby, patent litigation is aimed to discourage infringers from using patented technology and oftentimes to extract monetary reparation from them (Reitzig et al., 2007; Rudy and Black, 2015).

The financial benefits of the patent holder can often exceed sheer compensation of losses, increasing performance outcomes (Rudy and Black, 2015). Nevertheless, litigation is costly, and often it is unclear if sales losses can be compensated with litigation. The following mechanisms will show how securing inimitability of assets with strategic patent litigation can lead to enhanced performance. Thereby, a special focus is placed on the influence of strategic patent litigation on sales, costs and profitability.

Costs

Firm sales only make up a fraction of a firm's profit generation. Despite possible sales benefits due to successful employment of strategic patent litigation, there are substantial costs involved in patent litigation (Lerner, 1995; Shane and Somaya, 2007; Lumineau and Oxley, 2012). Costs

mainly arise in three areas: management time commitment, disruption of organisational processes and monitoring.

First, research showed that litigation requires executive time which demands that resources are allocated towards management, and thus, can create substantial costs for litigation (Somaya, 2003; Chen et al., 2015; Chen et al., 2016). Patent litigation can require multiple strategic decisions and time-intensive involvements of personnel to direct its course. Consequently, costs might increase because of the time commitment that has to be made by top-management and legal personnel.

Second, litigation poses indirect financial burdens due to disruption that conditions inefficiencies and increased workloads, especially during initiation and discovery. At first, firms have to evaluate the scope of patent infringement violations and other firm's patent rights. Then, during discovery, the plaintiff has to gather documents and evidence and has to handle public relations (Chen et al., 2015). Further losses can occur, for example, due to delays in court (Bebchuk, 1984; Lumineau and Oxley, 2012) that distract from other business activities. Strategic patent litigation can result in other business processes to be disrupted. For example, Shane and Somaya (2007), found that licensing activities were negatively affected when Universities litigated increasingly. Hence, disruption of organisational processes can increase expenditures due to patent litigation.

Third, monitoring infringement actions of competitors involves substantial costs (Lanjouw and Schankerman, 2001; Somaya, 2012; James et al., 2013). However, not only the competitors have to be monitored. Litigation strategies and their execution have to be monitored and adjusted during the process. Furthermore, in order to avoid mistakes, firms have to invest in controlling transactions made by employees and transaction partners, such as lawyers (Foster 1986). These expenses contribute significantly to the overall costs of litigation and, hence, litigation might increase administrative costs substantially.

Besides, if the litigated patent makes up a significant portion of the firm's revenues, unexpected failures in court can decrease the finances of a firm significantly beyond trial and executive costs (Markman et al., 2004). Hence, I hypothesise that:

Hypothesis 1: Strategic patent litigation has a positive influence on administrative costs.

Sales

Strategic patent litigation can influence firm sales by two mechanisms: avoiding loss of revenue by excluding competition and increasing the value creation effect of patents and other effects, such as signalling, injunctions, settlement or licensing fees.

In strategic patent litigation, the infringer can be excluded from commercialising the patented technologies so that the infringers can no longer offer its products for sale. Fewer choices of a specific product type on the market will eventually result in limited choices for consumers. This can ultimately benefit the sales position of the plaintiff party because customers will not be able to buy a competing product anymore (Rudy and Black, 2015) and have to resort to the patent holders product. Less competition due to patent protection also means that the patentee can achieve higher prices on the market, increasing sales with higher sales margins. For example, in the United States, the HIV drug PrEP is commercialised by Gilead for approximately 2000 USD while it is sold for approximately 30 USD in Australia. This price difference is due to patent protection in the United States.

Patent enforcement might also be used to block related technology from being patented or litigated by signalling enforcement rigour. This might, in turn, lead to increased sales as the signalling effect of toughness in patent litigation can discourage competitors from imitation or future litigation endeavours (Linden and Somaya, 2003; Rudy and Black, 2015). Thereby, even if a filed lawsuit is settled out of court, the signalling effect of toughness or validity is prevalent (Marco, 2005). Agarwal et al. (2009) found that litigiousness can also prevent skilful employees from resigning, potentially securing future sales on products involving their knowledge. Hence, the signalling effect can increase sales sustainably.

Sales generation by strategic patent litigation is not only possible after a successful court proceeding. During the early stages of litigation, plaintiffs can try to achieve an injunctive relief against their infringers, urging them to stop with the commercialization and production of a product until patent rights are disputed (Bessen and Meurer, 2008a; Shapiro, 2010). Even though constrained to a certain timeframe, such an injunction will have the same effect on sales as proposed after successful patent litigation.

Another factor that is supposed to increase the gains from patent litigation in the form of infringement suits for the plaintiff is that they are on the one hand, more frequent than patent challenges and on the other hand, unlike declaratory judgement suits, they are not primarily

benefitting other firms on the market (Lanjouw and Lerner, 2001). Hence the plaintiff will solely benefit from sales generated from excluding competitors.

Lastly, settlement and licensing fees are an important aspect of why firm sales might be positively influenced by strategic patent litigation. When licensing fees have to be paid, the infringer usually pays a proportion of their revenues to the patentee for the usage right of the patented invention in their products. Licensing fees are often negotiated between the parties and serve the same purpose while being paid as a one-off or reoccurring payment of the negotiated amount. Royalties and licensing fees can be included in the income statement sheet and incorporated in the annual sales measure as "net sales including royalties and licensing net sales", hence, they are counted as sales benefits for the firm.

All the above arguments imply that firm sales increase if the firm utilises strategic patent litigation to protect their patents, hence:

Hypothesis 2: Strategic patent litigation has a positive influence on firm sales.

Profitability

Strategic patent litigation can pose a barrier for imitation for potential infringers, deterring them from commercialising the patented technologies. Consequently, companies which employ litigation can protect their revenues and benefit from a competitive advantage. Furthermore, firms might be able to offer their products at higher prices. However, as elaborated in the previous paragraphs, the sole measurement of sales benefits neglects the possible detrimental effect of litigation costs. Hence, patent litigation strategies that are aimed to contemplate potential sales and costs might facilitate the litigation process and increase profitability in cases where the positive effect on firm sales is stronger than on firm costs. The ratio of sales and costs then decides about the overall profitability outcomes. Therefore, the effect of patent litigation strategies on profitability is expectedly dependent on the magnitude of sales and cost.

Because strategic patent litigation is actively pursued by firms to protect or secure IP rights and competitive advantage, firms most likely carefully prepare and assess risks and outcomes of legal proceeding. Hence, companies might predominantly litigate in the case that they can increase their profitability from such proceedings. However, such assessments are imperfect, as firms often fail to strategically protect their patented technologies, for example, due to unexpected circumstances and risks during the trial. Furthermore, filing a lawsuit can increase

the bargaining power of a firm to positively influence benefits from negotiations during settlement.

In line with the above-mentioned arguments concerning costs, sales and profitability of patent litigation, I hypothesise that:

Hypothesis 3a: If increasing sales exceed increasing costs, strategic patent litigation has a positive influence on firm profitability.

Hypothesis 3b: If increasing costs exceed increasing sales, strategic patent litigation has a negative influence on firm profitability.

4.4 Data and Methods

4.4.1 Sample

The sample to test the Hypotheses contains active and inactive publicly traded and private U.S. companies. The data is unbalanced panel data ranging over 16 years, from 2000 to 2015. The sample concentrates on manufacturing firms (SIC codes 20 to 39), excluding firms with the Sic code 39, other manufacturing industries (see: Cohen et al., 2000). I used litigation data from the PLD provided by USPTO and merged it with financial data from the TOB dataset. The data contains filings reported to the PTO, which entails filed cases that settle and cases that go to trial (Marco, 2005). In line with Leeuw (1998), I excluded industries with less than 5 firm-year observations to ensure at least 5 individual-level observations in each hierarchy. The data used for the analysis then includes 726 firms that litigate at least once between 2000-2015 as a plaintiff in an infringement suit. When including the firms that do not litigate, the final sample for the analysis comprises 3,269 firms, from 278 industries and 21,745 observations, hence, approximately 22,2% firms in the dataset litigate. The observations further categorise to an average of 78.2 individual-level observations per industry and 6.7 observations per firm.

In *Figure 5* it can be seen that the average number of litigation lawsuits per firm and year ranges in the lower half of ten. There is a slight drop in the average number of litigation cases per firm in 2010 and 2011. While firms were litigating less before 2005 the average number of litigation lawsuits rose after that.

Figure 5 Average Number of Litigation Lawsuits per Firm and Year
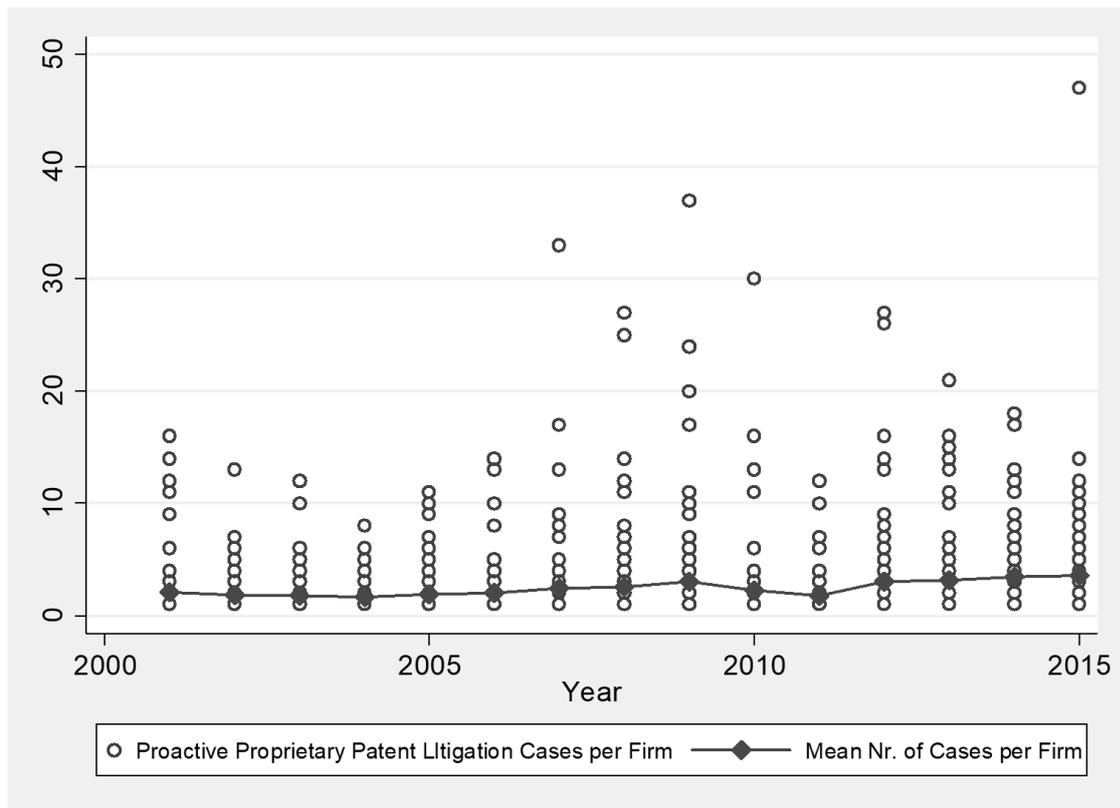
4.5 Analysis

This dissertation uses multilevel mixed model analysis (also called hierarchical or mixed linear modeling) (Ozkaya et al., 2013; Hair and Fávero, 2019; Peterson et al., 2020) to test the proposed hypotheses of each of the four chapters. In the field of IB, strategy and management, multilevel mixed model analysis was used previously to investigate firm performance on the firm and industry level (for an overview see: Hair and Favéro, 2019) .

The multilevel aspect of the analysis is necessary as it structures the data into nested hierarchies, categorising the variables to capture complex relationships and dependencies across levels (Hofmann, 1997; Ozkaya et al., 2013). This means that the observations are considered according to hierarchies, meaning, the industry level as well as the company to which they belong. The first level is the industry, followed by the second level, the company itself. Thus, in order to capture the true effects of the predictor variables on the dependent variables, I specified the data in such hierarchies.

The mixed effect aspect of this type of analysis is suitable because of the underlying panel structure of the data, measuring within-firm variability over the years and intra-firm variability

over the years. Whereby the mixed implies that both, fixed and random effects are included (Hair and Fávero, 2019), which assures correct analysis of unbalanced datasets (Bamiatzi et al., 2016). Furthermore, multilevel mixed model analysis in a panel data structured setting is a suitable method of analysis to prevent interference from causality issues. Theoretical support for multilevel mixed model analysis is given due to the nested structure of differences between industries and firms. The estimates of the intraclass correlation coefficients (ICCs) reported in the results, provide further justification of the use of the multilevel mixed model analysis (Ozkaya et al., 2013).

I analysed the hypotheses by using hierarchical regression, where successive models are built adding control variables first, followed by predictors and, lastly, moderation variables if applicable (see Chapters RQ2 – RQ4).

Survival bias

Patent litigation may contribute to a firm being deprived of its most vital core businesses, even to that point where firms are unable to survive or go bankrupt (Rudy and Black, 2015). In data analysis, this survival bias needs to be considered. As the data of the analysis range across many years, from 2000 to 2015, the possibility of firms exiting from the sample is high. Hence I added a two-step Heckman correction (Heckman, 1976), called Heckman Exit, to the analysis.

In previous literature, Heckman correction is used as a method to deal with survival bias (Rudy and Black, 2015), to avoid bias in the sample (Greve, 1999). Hence, I calculated a dummy variable for exit from the data, indicating the first year a company disappeared from the dataset during 2001 and 2015 with 1, any other years with 0. I used the exit variable as the dependent variable in the following multilevel mixed probit model estimation. To estimate the likelihood of exit, I proceeded similar to Rudy and Black (2015), using independent variables that are predictors of firm survival (Kafouros and Aliyev, 2016a). I included a count of the cases per year each company was listed as a defendant, as being sued increases the financial burden of a company and the risk of getting bankrupt. Furthermore, I added a one-year lag of firm size measured on the number of employees, as the size of the firm can be the reason why a firm can recover after litigation or influence the likelihood for the firm of being sued (Lanjouw and Schankerman, 2004). Moreover, I included a one-year lag of a firm's total capital because the total investment in a company can be highly important for survival. Lastly, I incorporated a one-year lag of a company's cash and equivalents to current assets which shows the long-term ratio between cash and liabilities, to include the effect of liquidity and well-being of a company which is important during litigation to be able to raise necessary funds (Lanjouw and Lerner,

1996). Following the probit model, I calculated the inverse mills ratio based on the previous estimates. I then integrated the resulting inverse mills ratio into the mixed methods model as a control variable named *Heckman Exit*.

4.6 Descriptives

In *Table 5*, the means, standard deviations and correlations are illustrated.

Table 5 Descriptive Statistics and Correlations: RQ1

Variable	Mean	S.d.	1	2	3	4	5	6	7	8	9
1 Costs[1]	0.159	0.221									
2 Sales[1]	12.881	1.108	-0.05 ***								
3 ROS[1]	-0.238	4.095	-0.49 ***	0.59 ***							
4 Firm Age[1]	3.177	0.600	-0.17 ***	0.27 ***	0.37 ***						
5 Firm Size[1]	5.921	2.605	-0.30 ***	0.42 ***	0.60 ***	0.45 ***					
6 R&D Intensity[1]	2.533	2.070	0.52 ***	-0.46 ***	-0.64 ***	-0.20 ***	-0.31 ***				
7 Organisational Slack[1]	0.799	0.449	-0.30 ***	0.37 ***	0.37 ***	0.12 ***	-0.05 ***	-0.54 ***			
8 Litigation Duration[1]	0.042	0.154	0.01 **	0.08 ***	0.10 ***	0.07 ***	0.14 ***	0.03 ***	-0.04 ***		
9 Heckman Exit	0.315	0.232	-0.08 ***	0.13 ***	0.18 ***	0.19 ***	0.33 ***	-0.04 ***	0.01	0.15 ***	
10 Patent Litigation	0.001	0.022	0.07 ***	0.02 **	-0.02 ***	0.00	-0.02 ***	0.04 ***	-0.02 **	0.16 ***	0.00

Number of Observations=21.745 ; ***p<0.01; **p<0.05; *p<0.1. [1]Variable is IHS-transformed.

The correlation matrix shows acceptable values among the independent variables. However, the values of (-0.54) between Organisational Slack and R&D intensity as well as (0.45) between Firm Age and Firm Size indicate a stronger correlation. This was expected given that older firms tend to be bigger and R&D intensity can make a company more efficient in using its assets to generate sales and vice versa. To rule out multicollinearity issues, the variance inflation factors (VIFs) for each variable were calculated using the "collin" command in Stata. The mean VIF showed 1.35, with ranging scores between 1.02 for Patent Litigation and 1.73 for R&D intensity. These VIFs are well below 10, which is the cut off value defined by Myers (1990). Even though this test suggests that multicollinearity is not an issue for this analysis, I performed a robustness check to rule out multicollinearity. As expected, excluding R&D intensity did not distort the results from the main model.

4.7 Results

The results are presented in Table 6. All Prob>χ2 were significant at the 0.001 level.

Table 6 Multilevel Mixed Method Analysis: RQ1

	Model [1]	Model [2]	Model [3]	Model [4]	Model [5]	Model [6]
	Litigation Costs:		Firm Performance:			
Dependent Variable:	**Costs**[1]	**Costs**[1]	**Sales**[1]	**Sales**[1]	**ROS**[1]	**ROS**[1]
	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
Control Variables	[SE]	[SE]	[SE]	[SE]	[SE]	[SE]
Firm Age[1]	0.00	0.0001	0.008	0.008	0.168***	0.167***
	[0.004]	[0.004]	[0.019]	[0.019]	[0.054]	[0.054]
Firm Size[1]	-0.021***	-0.021***	0.210***	0.210***	0.884***	0.884***
	[0.001]	[0.001]	[0.005]	[0.005]	[0.014]	[0.014]
R&D Intensity[1]	0.032***	0.032***	-0.323***	-0.323***	-0.858***	-0.858***
	[0.001]	[0.001]	[0.004]	[0.004]	[0.014]	[0.014]
Organisational Slack[1]	0.00	-0.0001	0.670***	0.670***	1.796***	1.796***
	[0.004]	[0.004]	[0.014]	[0.014]	[0.048]	[0.048]
Litigation Duration[1]	0.025***	0.022***	0.038	0.033	0.077	0.045
	[0.007]	[0.007]	[0.028]	[0.028]	[0.098]	[0.099]
Heckman Exit	0.006	0.006	-0.055***	-0.055***	-0.154**	-0.152**
	[0.005]	[0.005]	[0.019]	[0.019]	[0.067]	[0.067]
Independent Variable						
Patent Litigation		0.113**		0.221		1.208**
		[0.044]		[0.170]		[0.598]
Constant	0.238***	0.238***	11.609***	11.608***	-6.059***	-6.062***
	[0.017]	[0.016]	[0.082]	[0.082]	[0.219]	[0.219]
Year Controls	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.

Number of Observations=21.745 [3.269 Firms] ; ***p<0.01; **p<0.05; *p<0.1.

[1]Variable is IHS-transformed.

Table 6 shows the results from the multilevel analysis. I ran three independent Models to illustrate the influence of strategic patent litigation on costs as well as the performance measures sales and profitability.

Hypotheses 1 suggested that strategic patent litigation has a positive influence on firm costs. From the results, it can be seen that patent litigation has a positive and significant influence on firm costs (coefficient = 0.113, p< 0.05), showing that firms who actively engage in patent litigation experience higher organisational costs than other firms as every unit increase in litigation intensity influences costs by 11,6%. Therefore, Hypothesis 1 is supported.

Hypotheses 2 suggested that strategic patent litigation has a positive influence on firm sales. From the results, we can see that patent litigation has a positive but insignificant effect on firm sales (coefficient = 0.221, p> .1). Thus, Hypothesis 2 is not supported. The insignificant influence might be explained by effects that relativise the positive effect on sales, such as increased awareness of the consumer to carefully assess the purchase of products that are disputed by litigation. This is because future complementary investments or product maintenance might be insecure due to the possibility, that the invention will be withdrawn (Bessen and Meurer, 2008a).

Hypothesis 3a suggested, if increasing sales exceed increasing costs, strategic patent litigation has a positive influence on firm profitability. It can be seen from the results that patent litigation has a positive and significant influence on firm performance (coefficient =1.208, p< 0.05). Hence, Hypothesis 3a is partly supported. However, sales are not significantly increased due to patent litigation, whereas costs are.

Hypothesis 3b suggested that if increasing costs exceed increasing sales, strategic patent litigation has a negative influence on firm profitability. Although the influence of patent litigation is positive and significant on firm costs, a negative effect on ROS could not be determined. Therefore, Hypothesis 3b is not supported.

These results show that strategic patent litigation is increasing costs and profitability but that it is not significantly influencing sales. However, the overall positive effect on profitability gives room for suspecting that patent litigation might be beneficial for certain firms in specific circumstances, while it may be detrimental for others. To get a better picture of the actual effect of intensive litigation on performance, I refined the analysis by drawing predictive margins at different levels of patent litigation intensity. Therefore, I transformed the IHS values back to their original scale and calculated the predictive margins. The results show the effect of different levels of litigation intensity (ranging from 0 to 1.4, case counts divided by intangible assets) on performance.

In *Figure 6*, the predictive margins show that the positive effect of litigation on sales increases the more a company is litigating in patent litigation. These results provide additional support for Hypothesis 2.

Figure 6 Predictive Margins Sales per Employee: RQ1
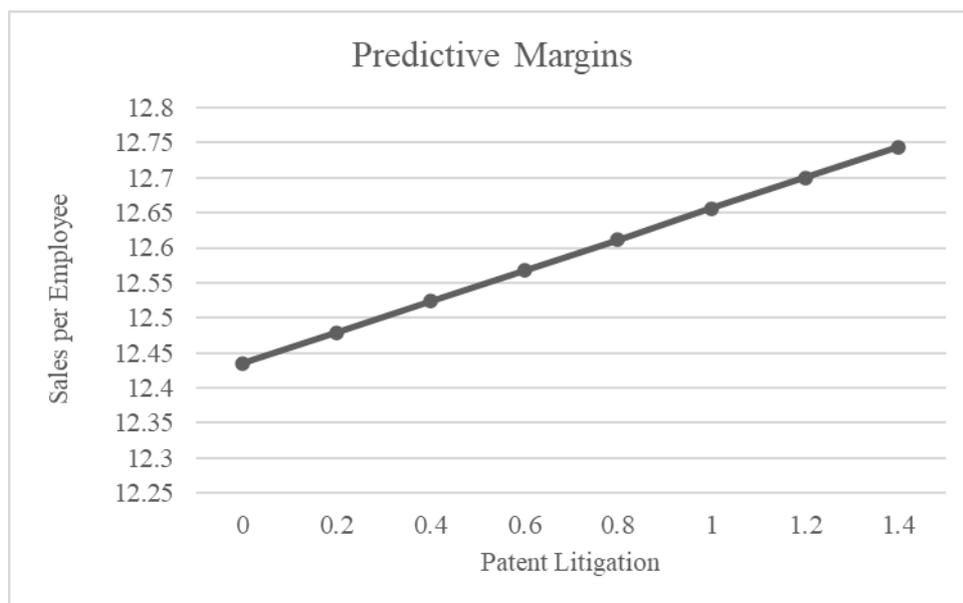
Figure 7 shows that with increasing litigation intensity, the predicted marginal effect on ROS becomes positive (between .6 and .8) and grows. Hence, firms that litigate more intensively experience a positive effect on ROS while a low litigation intensity negatively influences profitability.

Figure 7 Predictive Margins ROS: RQ1
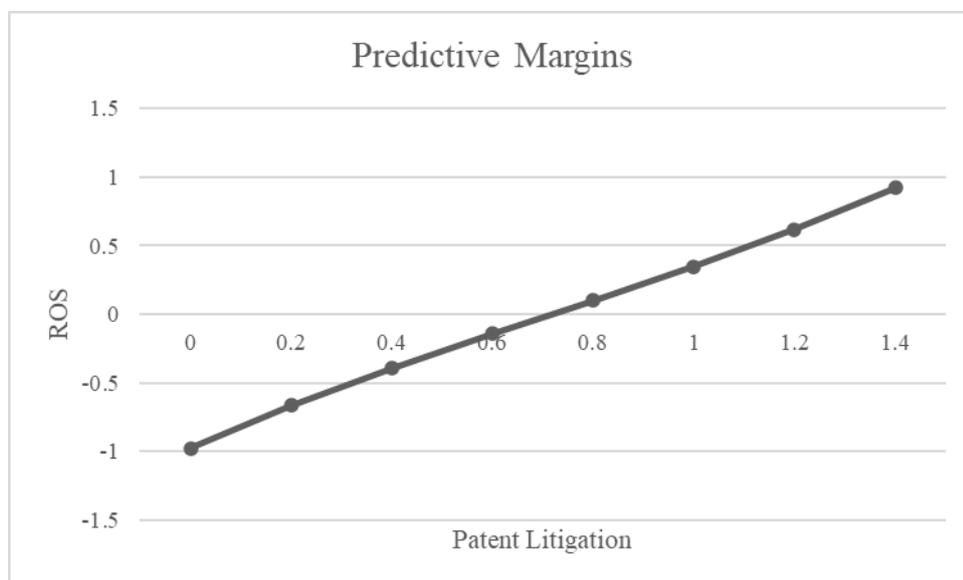
This section investigated the influence of strategic patent litigation on firm performance, measured on sales and profitability. Set out as a baseline investigation to clarify the role of strategic patent litigation in firm performance and its abilities to protect firms from imitation. It was found that in general, litigation does have a positive effect on firm profitability. Nevertheless, this study also sheds light on firm-level costs. What was speculated by research

but rarely tested has been confirmed by the results: strategic patent litigation increases the expenses of a firm significantly. However, the multilevel analysis revealed that although patent litigation is costly, the sales benefits are less pronounced. Whereby strategic patent litigation still allows the firm to profit from intellectual property.

4.7.1 Magnitude of the Effects

The sample of this dissertation contains litigating and non-litigating firms. Furthermore, many firms do not litigate every year. As a result, Patent Litigation is highly skewed. Because the mean and the standard deviation do not adequately represent such distribution, I show the magnitude of the effects from the 90th-99.9^{th} percentile to discuss how increasing patent litigation intensity affects firm sales and profitability when taking the sample distribution into account. This is necessary because the observable variation within the dependent variable actually occurs at the top 10% of the firms in the dataset. As a unit increment in patent litigation intensity is rather difficult to grasp, I report the effect of the 90th, 99th-99.6^{th} (in .2 increments) and the 99.9^{th} percentile. In order to represent magnitudes of effects realistically, in calculating predicted margins I remained conservative and included the magnitudes at up to the 99.9^{th} percentile of the independent variables. Including the maximum values or even the 99.99^{th} percentiles sharply increases the predicted values in all cases. To account for the means of the random effects, in addition to the fixed effects means, I included them in the calculations.

Keeping everything else equal with increased number of cases from the 90th to the 99.9^{th} percentile the predicted sales per employee increase from 196,267.7 to 205,122.9, hence litigation intensity accounts for a variation in sales per employee of 8,855.2. Between the 90th and 99.9^{th} percentile, the predicted ROS increases from -0.2415 to 0.0023 which translates to an increase of 0.24 percentage points. The results can be examined in *Table 7*.

Table 7 Magnitude of the Effects RQ1

Percentile	Patent Litigation Value	Predicted Sales per Employee	Predicted ROS
90.0	0	196,267.7	-0.2415
99.0	0.0008	196,299.1	-0.2405
99.2	0.0021	196,358.0	-0.2390
99.4	0.0083	196,629.1	-0.2312
99.6	0.1	200,647.5	-0.1187
99.9	0.2	205,122.9	0.0023

4.7.2 Additional Tests

4.7.2.1   The Intraclass Correlation Coefficients

I calculated the intraclass correlation coefficients (ICCs) (Koch, 2006) for the three models. A high ICC suggests that the observations within a group are more similar than observations between different groups, as the means of the first level variables are predicted by the level two variables (Peterson et al., 2020). Thus, a multilevel mixed model is particularly beneficial in those cases. Examining the ICC helps to determine how much of the overall variation in the observations is stemming from the defined groups. The ICCs from the analysis was 0.05 at the industry level and 0.66 at the firm level for costs, 0.20 at the industry level and 0.82 at the firm level for sales and 0.12 at the industry level and 0.63 at the firm level for return on sales. This shows the correlation between two firms in the same industry and two observations from the same company in one industry. Hence, 5% of the variation in firm costs appears to stem from the industry and 85% of the variation is attributed to the firm itself. For sales, 20% of the variation in firm sales can be attributed to the industry and 82% of the variation in firm sales can be attributed to the company itself (including the industry). For profitability, 12% of the variation can be attributed to the industry and 63% to the firm.

Interestingly, these results give room to believe that when assessing the outcome of litigation, it is necessary to examine firm-specific and industrial differences, especially when looking at the influence of patent litigation on sales and return on sales. This is because the ICC suggests a high similarity in values for firms within the same industry for firm sales. When looking at costs, however, unique firm characteristics might be more important than industrial differences, as the ICC suggests that firms within the same industry might still experience great differences in costs. This is in line with previous research on firm, industry and country effects that state that firm-specific variations and their influence on performance are more distinct (Rumelt, 1991; Mauri and Michaels, 1998; Brush et al., 1999; Short et al., 2007; Bamiatzi et al., 2016), especially in manufacturing industries (McGahan and Porter, 1997). However, differences in measurement can reveal contrary results showing the relative importance of industry effects (McGahan and Porter, 1997), promoting industry differences as superior for core strategies (for example, technology or marketing) (Mauri and Michaels, 1998) and for firms which are neither leaders nor losers within an Industry (Hawawini et al., 2003). These controversies in the debate further show the necessity of including firm and industry effects in the analysis.

4.7.2.2 The Koyck Distributed Lag Model

To determine the long-term influence of strategic patent litigation on firm performance exceeding the year of case settlement, a Koyck distributed lag model (Koyck, 1954) was estimated for the sample. Litigious activities of a company may have longer term impacts on sales and profitability. As litigation cases differ in their scope, some cases might influence non-immediate performance more significantly than others with an abating effect over time. Additionally, firms can build a reputation for toughness in litigation (Agarwal et al., 2009) which can persistently influence their operations and performance in the future. Not least because it curbs knowledge spillover effects. Hence, to calculate the persistence of the performance effects of patent litigation, I followed past literature (Palda, 1965; Mulchandani et al., 2019) and estimated a Koyck distributed lag model. It is a dynamic lag model that allows the limitation of infinite coefficients by specifying the decrease of coefficients with increase of lags.

The Koyck distributed lag formula (Palda, 1965),

(1) $Y_t = a + b_0 X_t + b_0 \lambda\ X_{t-1} + b_2 \lambda^2\ X_{t-2} + \ldots + b_k\ \lambda^k\ X_{t-k} + u_t,$

is transformed into:

(2) $Y_t = (1 - \lambda)\ a + b_0 X_t + \lambda Y_{t-1} + u_t - \lambda\ u_{t-1}$

where the estimation process involves incorporating the lagged dependent variable into the estimation model as an independent variable. The coefficient of the lagged dependent variable (λ) represents the speed of adjustment of the lagged effects (Palda, 1965; Dekimpe and Hanssens, 2000).

I calculated the effects using the method by Mulchandani et al. (2019), based on the formula:

(3) $b'_k = b_0\ \lambda^k$

To show the prolonged effects of patent litigation explicitly, I calculated lagged effects following equation (3) for up to 5 years of lagged effects. In the ROS model, the lag effect declines from 1.93 in time k to 0.03 in time k-5, with λ=.43. For the sales model, the lag effect declines from 0.34 in time k, to 0.0008 in time k-5, with λ=.43.

Although the effect of litigation on firm performance drops quickly in the first five years, there is a prolonged effect, stressing the importance of strategic patent litigation for firm performance. *Figures 8 and 9* illustrate the drop rate of the lag effects:

Figure 8 Koyck Distributed Lags for ROS
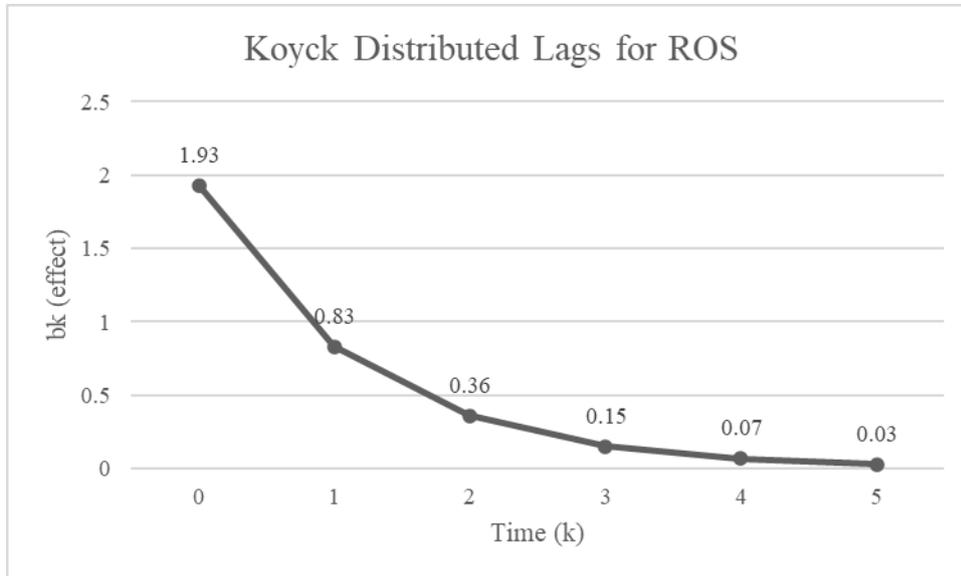
Figure 9 Koyck Distributed Lags for Firm Sales
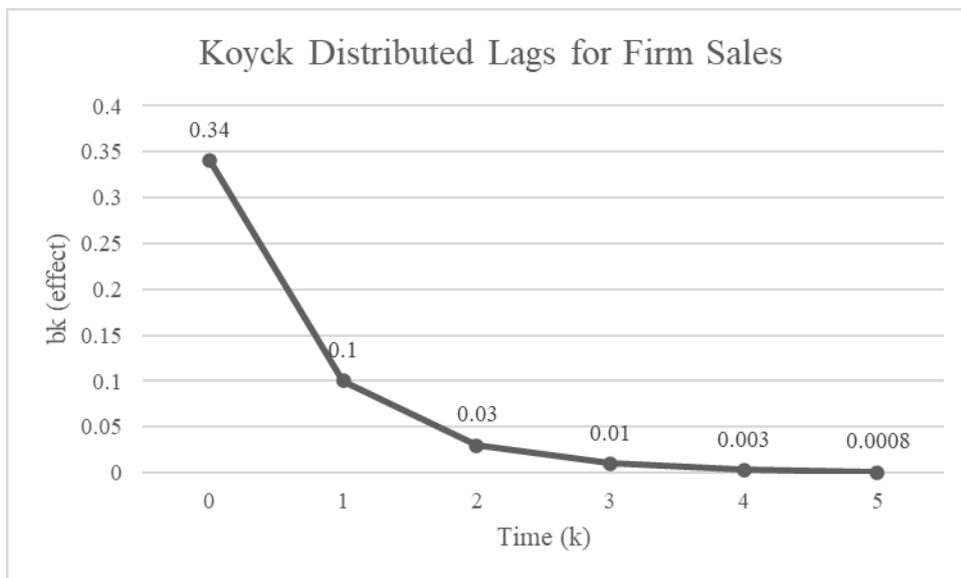
Table 8 and 9 show the calculations of the Koyck lagged effects.

Table 8 Distributed Lag Effects of Patent Litigation on ROS

k (lag)	λ^k	$b_0 \lambda^k$	b'_k (effect)	95% Confidence Interval (lower)	95% Confidence Interval (upper)
0	0.43^0 = 1	1.93 * 1	1.93	0.709	3.145
1	0.43^1=0.43	1.93 * 0.43	0.83	0.305	1.352
2	0.43^2=0.185	1.93 * 0.185	0.36	0.130	0.582
3	0.43^3=0.079	1.93 * 0.079	0.15	0.055	0.248
4	0.43^4=0.034	1.93 * 0.034	0.07	0.024	0.106
5	0.43^5=0.015	1.93 * 0.015	0.03	0.010	0.047

$\lambda=.43$

Table 9 Distributed Lag Effects of Patent Litigation on Firm Sales

k (lag)	λ^k	$b_0 \lambda^k$	b'_k (effect)	95% Confidence Interval (lower)	95% Confidence Interval (upper)
0	0.30^0=1	0.34 * 1	0.34	0.0203	0.666
1	0.30^1=0.30	0.34 * 0.30	0.10	0.0061	.1999
2	0.30^2=0.09	0.34 * 0.09	0.03	0.0019	.0599
3	0.30^3=0.027	0.34 * 0.027	0.01	0.0005	.0179
4	0.30^4=0.008	0.34 * 0.008	0.003	0.00005	.0053
5	0.30^5=0.002	0.34 * 0.002	0.0008	0.00005	.0016

$\lambda=.30$

4.7.2.3 Non-Linearity

In order to explore non-linearity of the relationship between patent litigation and firm performance, I followed previous studies (Jones, 2003; Laursen and Salter, 2006) and tested for an inverted U-shape relationship. Inverted-U-shaped relationships are characterised by an initially increasing dependent variable (with increasing values of the independent variable) to reach a maximum from which it decreases again (Haans et al., 2016). Theoretically, it can be expected, that the performance effect of patent litigation might be increasing with the number of cases, as it takes thorough consideration for the firm to file an infringement suit which mostly may be directed at a rise in performance. As litigators often closely determine which cases they initiate, the signalling effect of a few well-placed lawsuits might be additionally positively influencing performance. Thereby, one patent litigation case can not only deter competitors from infringing a patent, it can also positively affect employees (Agarwal et al., 2009). However, if companies do not capitalize on these effects, continuing to litigate relentlessly, the positive influence of litigation on performance might wear off. As Somaya (2003) point out, this might be especially the case if irrational behaviour (e.g. subjective behaviour of executives)

is surfacing or unbeneficial legal advice is followed. However, it could also happen if the firm limits particular structural or legal capabilities to efficiently direct litigation endeavours or if litigating against several competitors did not lead to a beneficial outcome.

To provide evidence for a U-shaped relationship, I regressed the dependent variable Y on the independent variable X and its square, following Haans et al. (2016):

$$(1) \quad Y = \beta_0 + \beta_1 X + \beta_2 X^2$$

The results in *Table 10* for the firm sales model show a significant and negative β_2 indicating an inverted U-shaped relationship. The results for the ROS model show an insignificant effect of β_2.

Table 10 Results for Non-Linearity

	Model [1]	Model [2]	Model [3]	Model [4]
	Firm Performance:			
Dependent Variable:	**Sales[1]**	**Sales[1]**	**ROS[1]**	**ROS[1]**
Control Variables	Coef. [SE]	Coef. [SE]	Coef. [SE]	Coef. [SE]
Firm Age[1]	0.008	0.008	0.168***	0.167***
	[0.019]	[0.019]	[0.054]	[0.054]
Firm Size[1]	0.210***	0.210***	0.884***	0.884***
	[0.005]	[0.005]	[0.014]	[0.014]
R&D Intensity[1]	-0.323***	-0.323***	-0.858***	-0.858***
	[0.004]	[0.004]	[0.014]	[0.014]
Organisational Slack[1]	0.670***	0.670***	1.796***	1.796***
	[0.014]	[0.014]	[0.048]	[0.048]
Litigation Duration[1]	0.038	0.022	0.077	0.062
	[0.028]	[0.029]	[0.098]	[0.100]
Heckman Exit	-0.055***	-0.055***	-0.154**	-0.152**
	[0.019]	[0.019]	[0.067]	[0.067]
Independent Variable				
Patent Litigation		1.063***		-0.089
		[0.412]		[1.445]
Patent Litigation Squared		-0.884**		1.374
		[0.394]		[1.394]
Constant	11.609***	11.607***	-6.059***	-6.060***
	[0.082]	[0.082]	[0.219]	[0.219]
Year Controls	Incl.	Incl.	Incl.	Incl.

Number of Observations=21.745 [3.269 Firms] ; ***p<0.01; **p<0.05; *p<0.1. [1]Variable is IHS-transformed.

These findings support the logic that the influence of patent litigation on firm sales is increasing positively at first but continues to decrease with overly high levels of patent litigation. Hence, when it comes to litigation, a few strategically targeted cases might be worth more than suing multiple infringers in an array of lawsuits. Additionally, I found similar inverted U-shape effects for the influence of patent litigation on firm costs, providing a foundation for the rationale of economies of scale in patent litigation. However, a u-shaped relationship could not be found for the effect of patent litigation on ROS, the effect may be linear which explains the insignificant coefficients. One explanations for the non-linear relationship that can be found in sales but not ROS is that the rate of decline in firm sales is less steep than the rate of decline in costs. Hence, the trade-off between the potential sales and organisational costs of patent litigation results in a linear positive effect on profitability.

4.7.2.4   The Role of Local Patent Litigation for Firm Performance

Patent protection is local (Beukel and Zhao, 2018). A patent that is issued in the United States is only valid and defendable for the United States market. Hence, the possible realised sales and profits might occur mainly locally. However, previous litigation literature did not distinguish sales and profitability from U.S. sales and the profitability of U.S. operations (Rudy and Black, 2015). Two main arguments can underline why this is not the case. First, scholars are confident, that U.S. based litigation is often influencing patent-litigation related profits outside the U.S. market (Bessen and Meurer, 2008a). As Beukel and Zhao (2018) show, companies try to litigate in a few, strong markets that signal to other countries. Hence, U.S. based litigation endeavours can decide on sales and profits that are globally realised.

Second, and perhaps more importantly, the U.S. is a very strong and big market. This also explains the strong signalling effect U.S. based litigation can have on foreign markets. At firms often decide to litigate only in few countries (due to the costs involved) they tend to choose the market with the biggest purchasing power and promising signalling effect. Hence, for strategic patent litigation, domestic as well as foreign firm performance might both be determined on litigious activities of the firm in the United States. Whereby litigating in the U.S. by itself is an indicator that the U.S. is an important market for the firms in the sample.

To nevertheless control for the importance of U.S. business in the total operations of the plaintiff, I added the control variable internationalization. The degree of internationalization of the company determines if it is conducting business more locally or internationally. Firms that are having their predominant business operations in the U.S. might be influenced by U.S. litigation more significantly. To measure the degree of internationalization, I followed previous

literature (Grant, 1987; Tallman and Li, 1996; Kafouros et al., 2008; Denicolai et al., 2014) and used the ratio of foreign sales to total sales. The results can be examined in *Table 11*.

Table 11 The Influence of Patent Litigation on Firm Performance Controlling for Internationalization

	Model [1]	Model [2]	Model [3]	Model [4]
	Firm Performance:			
Dependent Variable:	**Sales**[1]	**Sales**[1]	**ROS**[1]	**ROS**[1]
Control Variables	Coef. [SE]	Coef. [SE]	Coef. [SE]	Coef. [SE]
Firm Age[1]	0.009	0.009	0.166***	0.166***
	[0.019]	[0.019]	[0.054]	[0.054]
Firm Size[1]	0.211***	0.211***	0.881***	0.881***
	[0.005]	[0.005]	[0.015]	[0.015]
R&D Intensity[1]	-0.323***	-0.323***	-0.858***	-0.858***
	[0.004]	[0.004]	[0.014]	[0.014]
Organisational Slack[1]	0.671***	0.671***	1.793***	1.794***
	[0.014]	[0.014]	[0.048]	[0.048]
Litigation Duration[1]	0.039	0.033	0.076	0.045
	[0.028]	[0.028]	[0.098]	[0.099]
Heckman Exit	-0.055***	-0.055***	-0.154**	-0.153**
	[0.019]	[0.019]	[0.067]	[0.067]
Internationalization	-0.037**	-0.037*	0.077	0.079
	[0.019]	[0.019]	[0.064]	[0.064]
Independent Variable				
Patent Litigation		0.217		1.216**
		[0.170]		[0.598]
Constant	11.619***	11.619***	-6.055***	-6.059***
	[0.082]	[0.082]	[0.219]	[0.219]
Year Controls	Incl.	Incl.	Incl.	Incl.

Number of Observations=21.745 [3.269 Firms]; ***p<0.01; **p<0.05; *p<0.1.

[1]Variable is IHS-transformed.

The results from the main model were robust to including internationalization as a control variable. Based on the reasons outline above, it does not seem that there is a significant difference between domestic and foreign effects of patent litigation for the firms in the sample of this dissertation.

I calculated the Akaike (AIC) (Akaikei, 1973) and Bayes (BIC) (Schwarz, 1978) information criteria to assess if the model benefits from including the control variable internationalization. The AIC and BIC of the model for sales not including internationalization were (36825.23 and 37024.91). These AIC values are only slightly bigger than the model including internationalization (36823.4 and 37031.07). This is supported by marginal information loss of

$\triangle_i = 1.83 < 2$ if internationalization is not included, calculated from the formula of Burnham and Anderson (2004) $\triangle_i = AIC_i - AIC_{min}$, which allows the interpretation of AIC scales. The ROS shows a better fit for the model without internationalization (89506.65 and 89722.3), than with internationalization (89547.3 89754.96) and a delta difference of $\triangle_i = 40,65 > 2$. Because the control variable of internationalization does not seem to add additional value to the model fit for the main performance variable ROS, I did not further integrate it in the main models.

To test the influence of strategic patent litigation on U.S. firm performance only, I used the measures foreign sales and foreign operating income reported on the income statement of the sampled firms. I collected this variables from the Thomson One Banker database and estimated U.S. sales and U.S ROS by deducting the foreign measures from total sales and total operating income. However, especially for the measure of to foreign operating income, data availability issues diminished the sample size from the original analysis significantly with only 14.109 observations (hence, 7.785 missing observations). When assuming the missing values of the foreign operating income to be 0, the resulting creation of U.S. ROS requires utilizing foreign sales which also has missing values for 2.076 observations. The results of the model without imputing the missing values for foreign sales shows a strongly positive and significant effect on U.S. ROS, however, when imputing the missing values, this effect is no longer visible. Yet, this is an indicator, that patent litigation influences local profitability significantly. As the difference between the results when modelling U.S. based profitability and the global measure, might be explained by the differences in sample size. The model might lose significance due to a reduced sample size and the simultaneous loss of degrees of freedom. The effect of patent litigation on U.S. sales shows positive but insignificant results as well as the main model.

The role of patent litigation for local performance and global performance could be a valuable route for future research. Whereas research on the relationship of patents and patent litigation in the United States and firm performance mostly utilizes global based performance measures (see: De Carolis, 2003; Markman et al., 2004 and Rudy and Black 2015), recent scholarship on litigation shifted the focus on location (see: Beukel an Zhao, 2018) leaving room for further investigations in this area.

4.7.2.5 Market Concentration

In more concentrated industries, the effects of patent litigation could be more pronounced, as less competition might increase the importance of stopping infringement of a key competitor. However, in industries that consist of a small numbers of key players without considerable competition, companies can often only sue against a few competitors, whereby the remaining market share (that can be captured by litigation) decreases with market concentration. Furthermore, market concentration could also account for the number and outcome of patent litigation cases filed in an industry. In addition, market concentration could influence the signalling effect because litigating in less concentrated markets against one or a few key competitors might deter other firms from infringing on the litigated patent (Agarwal, 2009). Hence, firms can hinder a cohort of competing firms from imitating their products without litigating multiple times. However, in less concentrated markets, these effects might not come to pass. Therefore, it might be necessary to control for market concentration in the main model to account for such effects.

In order to test if adding a control variable for market concentration improves the final model, I followed previous research in the field (Beukel and Zhao, 2018) and calculated the Herfindahl Index (Herfindahl, 1950; Kelly, 1981). As a measure of market concentration, the Herfindahl Index is a sum of all squared market shares within an industry. Whereby a higher value of the Index (from 0-1) indicates a lower degree of competition in a market and, hence, hints to more monopolistic markets, and vice versa (Boyd, 1995). Controlling for market concentration, shows that market concentration does not influence the main results. The results can be viewed in *Table 12*.

Table 12 The Influence of Patent Litigation on Firm Performance Controlling for Market Concentration

Dependent Variable:	Model [1]	Model [2]	Model [3]	Model [4]
		Firm Performance:		
	Sales[1]	Sales[1]	ROS[1]	ROS[1]
Control Variables	Coef. [SE]	Coef. [SE]	Coef. [SE]	Coef. [SE]
Firm Age[1]	0.008	0.008	0.169***	0.168***
	[0.019]	[0.019]	[0.054]	[0.054]
Firm Size[1]	0.212***	0.212***	0.886***	0.886***
	[0.005]	[0.005]	[0.014]	[0.014]
R&D Intensity[1]	-0.323***	-0.323***	-0.858***	-0.858***
	[0.004]	[0.004]	[0.014]	[0.014]
Organisational Slack[1]	0.672***	0.672***	1.797***	1.797***
	[0.014]	[0.014]	[0.048]	[0.048]
Litigation Duration[1]	0.039	0.034	0.077	0.046
	[0.028]	[0.028]	[0.098]	[0.099]
Heckman Exit	-0.053***	-0.053***	-0.152**	-0.151**
	[0.019]	[0.019]	[0.067]	[0.067]
Market Concentration	-0.144***	-0.144***	-0.117	-0.116
	[0.041]	[0.041]	[0.136]	[0.136]
Independent Variable				
Patent Litigation		0.218		1.205**
		[0.170]		[0.598]
Constant	11.619***	11.619***	-6.055***	-6.059***
	[0.082]	[0.082]	[0.219]	[0.219]
Year Controls	Incl.	Incl.	Incl.	Incl.

Number of Observations=21.745 [3.269 Firms] ; ***p<0.01; **p<0.05; *p<0.1.

[1]Variable is IHS-transformed.

I calculated the Akaike (AIC) (Akaikei, 1973) and Bayes (BIC) (Schwarz, 1978) information criteria to assess if the model benefits from including the control variable market concentration. The AIC and BIC of the model for sales without market concentration are (36825,23 and 37024,91). These values are higher than the model including market concentration (36815.04 and 37022.71). This is supported by an information loss of $\triangle_i = 10.19 > 2$ if the control is not included, calculated from the formula of Burnham and Anderson (2004) $\triangle_i= AIC_i – AIC_{min}$, which allows the interpretation of AIC scales. However, the ROS model does not benefit from including the measure of market concentration (89548.07 and 89755.73), showing a better fit of the model without controlling for market concentration with (89506.65 and 89722.3), having a delta difference of $\triangle_i = 41,42 > 2$. Hence, because the main performance model ROS does not benefit from including market concentration as an additional control variable, I did not include it in the main analysis.

4.7.2.6 Robustness Checks

In order to claim validity of the findings. I performed several robustness checks[14] throughout different stages of the analysis.

First, a bigger standard deviation compared to the mean of a variable can be questionable regarding the power of outliers. Therefore, following previous studies (Chang et al., 2013; Kafouros and Aliyev, 2016a), I performed the analysis without extreme values of Return on Sales. I cut off extreme ROS values at the -100% and 100% mark. The alteration reduced the sample size; however, the findings are robust to the changes. Furthermore, I tested Return on Assets (ROA) as an alternative measure of profitability as previous studies relied on ROA as a measure for profitability (De Carolis, 2003; Bamiatzi et al., 2016) and because it highlights the asset protection component of inimitability. The detected influence on ROA is similar to the effects shown in the original analysis on ROS with no change in significance, hence the change did not influence the results.

Second, there exists an inherent bias in the sample of litigating and non-litigating firms which has to be considered when analysing the effect of litigation on performance. The firm itself makes an informed decision on whether it's worth litigating. Consequently, litigating against a potential infringer is a choice, made based on several trade-off decisions. I considered the resulting selection effect that could alter the results based on choices made before litigation with another two-step Heckman correction, using a multilevel mixed probit model estimation, followed by the calculation of a second inverse mills ratio which I then included in the main mixed-methods model. I ran the probit model with several variables. First, the dependent variable constitutes a dummy variable indicating if a company was litigating as a plaintiff in the given year. Then, I included several predictors of litigation. First, assets (intangible and tangible) and total current assets, as the size of the firm, its intangible assets and its financial strength can influence the decision to litigate. As Lanjouw and Schankerman (2001) found, litigation prosecution decisions are more likely for small patentees. Furthermore, I included if a firm was listed as a defendant in a given year. Companies that are sued in court often resort to counter suits to defend against allegations (Rudy and Black, 2015). Lastly, I calculated the cumulative litigation cases of each company in the time period to include experience with litigation cases in the analysis as more experienced firms might be more skilled in assessing the

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[14] I tested the robustness checks presented in this chapter (and the outcomes remain similar) for the current and all consecutive empirical chapters.

need for litigation. Including the measure in the final model revealed similar results, demonstrating the robustness of the findings.

I performed a likelihood ratio test to test the significance of the inverse mills ratio of litigation for the model. The test was not significant at the 0.1939 level. To further rule out, that including the variable does not improve model fit to justify overfitting (i.e. parsimony), I calculated the Akaike (AIC) (Akaikei, 1973) and Bayes (BIC) (Schwarz, 1978) information criteria. The AIC and BIC of the model including the ratio (89546.8 and 89746.47) were only marginally better than without the ratio (89547.11 and 89754.77), concluding that both models are practically equivalent. This is supported by an information loss of $\triangle_i = 0.31 < 2$ calculated from the formula of Burnham and Anderson (2004) $\triangle_i = AIC_i - AIC_{min}$, which allows the interpretation of AIC scales. Hence, to maintain simplicity, I excluded the inverse mills ratio from the model.

Third, I considered the possibility of simultaneity. Here, the dependent variable, ROS might have a simultaneous effect on litigation intensity because companies experiencing high profitability from their operating businesses might be interested in protecting it, while at the same time, are considerably financially equipped to initiate litigation. Hence, I tested if ROS is influencing patent litigation. The influence was statistically insignificant and an issue with simultaneity is, thus, ruled out for this analysis.

Fourth, following Cohen (2000), I additionally ran the analysis on the three-digit SIC code level, the two-digit SIC code level, an accumulated version of SIC-code levels (where all predominant SIC codes of a company were consolidated into the primary group of Industry) and the NAICS code level to counteract precision issues with four-digit Industry assignments.

Sixth, the costs of a lawsuit are underlining the trade-off that companies have to make when initiating patent lawsuits and hence, are part of the mechanisms that determine the profitability of strategic patent litigation. To illustrate how litigation costs can influence firm performance, I estimated two additional models, using organisational costs as an explanatory variable. As expected, high litigation costs influence profitability negatively. This is in line with the narrative, that costly enforcement results in lower profitability for the plaintiff (Bessen and Meurer, 2008). The results are shown in *Table 13:*

Table 13 Litigation Trade-Off

Dependent Variable:	Model [1] ROS[1]	Model [2] ROS[1]
Control Variables	Coef. [SE]	Coef. [SE]
Firm Age[1]	0.167***	0.160***
	[0.054]	[0.051]
Firm Size[1]	0.884***	0.627***
	[0.014]	[0.014]
R&D Intensity[1]	-0.858***	-0.466***
	[0.014]	[0.015]
Organisational Slack[1]	1.796***	1.089***
	[0.048]	[0.048]
Litigation Duration[1]	0.045	0.058
	[0.099]	[0.095]
Heckman Exit	-0.152**	-0.075
	[0.067]	[0.064]
Patent Litigation	1.208**	1.172**
	[0.598]	[0.573]
Independent Variables		
Costs[1]		-2.558***
		[0.094]
Sales[1]		1.048***
		[0.023]
Constant	-6.062***	-17.711***
	[0.219]	[0.328]
Year Controls	Incl.	Incl.

Number of Observations=21.745 [3.269 Firms] ;

***$p<0.001$; **$p<0.01$; *$p<0.05$. [1]Variable is IHS-transformed.

4.8 Discussion and Conclusion

By investigating the influence of patent litigation on firm costs and firm performance, it is now clear, that firms can use strategic litigation to appropriate value from their innovations by shielding their patent rights, from exploitation through imitative behaviour. The findings add to the existing knowledge of the RBV's notion of inimitability by making it more responsive to firm-specific litigation abilities rather than pre-set resource characteristics. This was suggested by previous literature in the field (Liebeskind, 1996; Markman et al., 2004) but not yet tested in the context of RBV and patent litigation. The contribution is of particular value because the RBV notion of inimitability was long time thought to stem from asset characteristics (barney 1991). However, especially for assets that are imitable by nature, or are made imitable through disclosure during patent protection, strategic patent litigation provides firms with the ability to guard their patents against imitation. Furthermore, this protection has positive implications for

firm performance, especially profitability, allowing firms to capture value from strategic patent litigation. Hence by adding to the RBV, what Markman (2004) already similarly postulated for patents is now postulated for strategic patent litigation: it acts as surrogate of inimitability by building isolating mechanisms.

The findings of this chapter are also interesting for practitioners as they illustrate that strategic patent litigation is an important tool to profit from innovation. Rather than focusing solely on patent acquisition and R&D, firms can create significant value from their IP when they skilfully protect it in court. Consequently, firms should focus on their litigation strategies and further develop their patent enforcement strengths, while carefully evaluating the costs of their endeavours. This is because suing against infringers will not always increase sales. The substantial effects on administrative costs must be considered to determine if the potential outcomes are capable of compensating for the investments of key-personnel time and risks of disruption.

The present research, on the one hand, contributes to the RBV by establishing strategic litigation as a vital link between inimitability and performance and, on the other hand, gives room for further research on the appropriation of value from innovation. The positive effect of strategic patent litigation on profitability, while costs are increasing implies, that litigation is only profitable for some firms. This lays an important groundwork for further research on strategic patent litigation and how it can increase the profitability of the firm. Whereby other factors could influence profitability, for example, corporate reputation and the signalling effect deterring other firms from imitation (Agarwal et al., 2009), this study strengthens the idea that there must be litigation specific contextual factors that determine the outcomes of strategic patent litigation. This is also underlined by the results, indicating that litigation can be indeed very costly, while also improving profitability without a clear indicator that firms can register higher sales outcomes. This raises an important question about the mechanisms that make strategic patent litigation an important link between IP rights and competitive advantage of the firm. The abilities of the firm to do so might be bounded to certain contingencies which have to be considered. Although this poses some limitations on the findings, it gives a first indication of the influence of strategic patent litigation on performance in a generalisable fashion.

Increased profitability without significant findings on the influence of strategic patent litigation on firm sales proposes three things: 1. strategic patent litigation influences firms sales only in some cases and not in others, 2. specific circumstances allow firms to save costs of litigation so that it becomes profitable and 3. strategic patent litigation might influence other non-financial

outcomes that can reflect in increases profitability of firms as, for example, reputation or strategic litigation to protect other patents within the portfolio. Further research should elaborate on the contingencies that act as mechanisms which link strategic patent litigation and profitability. Also, the role of the firm and its strategies should not be neglected. De Carolis (2003) underlines the need for further research focused on *how* firms try to secure inimitability of assets. These knowledge gaps provide the opportunity for the next chapters to determine important contingencies that need to be integrated into patent litigation research. These contingencies will eventually highlight when and how firms can profit from patent enforcement. To move the debate forward, a better understanding of these contingencies and their influence on the effect of strategic patent ligation and performance needs to be developed.

5 RQ 2: The Role of the Repeated Use of the Same Attorneys in Strategic Patent Litigation

This section discusses why and how the present study intends to incorporate firm-specific factors that can influence the relationship between patent litigation and firm performance. In particular, empirical Chapter 2 illustrates the firm-specific factor by looking at the role of the repeated use of the same attorneys in strategic patent litigation. The chapter sheds light on the inter-firm differences with regards to repeated legal relationships and, hence, the strategy of rehiring that can shape a firm's litigation success.

5.1 Introduction

Firms engage in strategic patent litigation to secure inimitability of assets and increased rents (*see Chapter 1*). Although this makes strategic patent litigation a powerful and widely utilised tool, it is unclear why some firms are better in enforcing their intellectual property to capture value from their innovations and secure economic rents than others? In a surge to answer this question, previous literature focused on patent-based value capture strategies from innovation and recognised, that firm-specific abilities can influence costs and benefits. It was suggested that strong appropriability competences can be determined endogenously by firms (Liebeskind, 1996; Pisano, 2006) and increase the chance of profitability (De Carolis, 2003). Hence, firm-specific efficiencies of strategic litigation might vary because of inter-firm differences in value capture endeavours.

To capture rent from their innovations, firm resort to protection mechanisms shielding them from imitational behaviour of their competitors. Therefore, patent protection and firm performance are of prevalent interest within the broad research field of innovation. In order to establish the role of the firm in the relationship of patents and performance, scholars already recognised the importance of a firm's size, its ability to manage R&D and the patenting process, (James et al., 2013) as well as its legal capabilities involved in corporate strategy and patent enforcement (Shanley and Peteraf, 2004; Somaya and McDaniel, 2012; Beukel and Zhao, 2018). Few scholars also looked at the role of the top management teams (Somaya, 2003; Chen et al., 2015), as well as in-house and external attorneys (Lerner, 1995; Somaya et al., 2007). Furthermore, to detect infringement and enforce patents, scholarship recognised the necessity of patent law experience of legal teams and decision making in patent filing with regards to anticipated profits (Somaya et al., 2007). In addition, previous literature also concentrated on

asymmetric information in top executive levels to explain strategic litigation decisions and stressed the role of legal astuteness in litigation (Chen et al., 2015). Other non-patent related research looked at learning by hiring (Song et al., 2003), the role of social and intellectual capital for competitive advantage (Nahapiet and Ghoshal, 1998) and learning and the creation of capabilities, whereby operating routines are viewed as competencies (Zollo and Winter, 2002).

However, the role of firm differences with regards to their ability to build on their reoccurring relationships with attorneys in strategic patent litigation is often ignored. Legal literature rightfully criticised economic scholarship (where litigation has been a topic of interest because of its game-theoretic facets) for ignoring the role of attorneys in litigation (Gilson and Mnookin, 1994). Hence, although there is a growing interest in the role of strategic patent litigation as a main driver of firm performance and lawyers can be crucial for litigation (McGuire, 1995), the role of reoccurring relationships between the firm and attorneys, especially in patent litigation, has been neglected.

The purpose of this chapter is to shift the focus on variations in a firm's specific abilities to appropriate rents from their patents by building on knowledge creation from repeated experience with the same attorneys. Thereby, the repeated use of the same attorneys may influence the effect of strategic patent litigation on firm performance. Thereby, knowledge creation from repeated experience refers to the accumulation of information on the firm, its technologies and processes by the legal team, internal or external, that conduct strategic litigation. The repetition in relations, keeping the same attorneys repetitively on the case and other cases, might stem from the firm's ability to manage its strategic litigation endeavour and transaction costs to answer to the trade-off between costs and benefits inherent to patent litigation. Moreover, repetition might build efficiencies from managing the firm's internal and external resources that ultimately build a competitive position.

This shift is contributing to our knowledge on strategic patent litigation as an endogenously built isolating mechanism for imitable assets by emphasising the role of the repeated use of the same attorneys (and the knowledge on the firm accumulated by the attorney) during patent enforcement. Furthermore, this offers a contribution to the firm-specific contingencies that influence the relationship of strategic litigation on costs, sales and profitability which can be reviewed in the integrative framework (*Table 1*).

The remainder of this chapter is organised as follows. First, it is built on the RBV to increase understanding of the role of repeated use of the same attorneys in patent litigation with respects

to inimitability of assets and competitive advantage. Second, three hypotheses are developed that take a closer look at the repeated use of the same legal personnel and its influence on the strategic litigation - performance relationship. Third, the sample and variables are provided, followed by the analysis and the discussion of the results. Lastly, the chapter closes with presenting the contribution and implications with a link to the integrative framework *Table 1*.

5.2 Theoretical Background and Literature Review

Building on competitive advantage and the RBV, technical expertise or superior assets alone do not determine performance. Asset protection and ex-post limits to imitability are important to achieve sustained competitive advantage (Peteraf, 1993). But, traditional isolating mechanisms, such as patents, require active protection to shield inventions from imitation. Firms must resort to legal mechanisms to protect their profits from imitation (Teece, 1986; De Carolis, 2003). In a similar vein, it is unlikely, that firm-specific competencies in the strategic patenting field, are always enough to achieve appropriability from inventions (Teece, 1986). To reach effective patent protection, previous scholarship postulated, that firms have to have special abilities that enable them to build the necessary legal protection (Cohen et al., 2000). Such abilities can be to keep repeated ties with good attorneys (Somaya et al., 2011) by employing them for multiple litigation cases. This is because reoccurring interactions between a company and skilful contractors can shape the competitive position of firms (Reitzig and Puranam, 2009). Hence, this chapter argues that some firms perform better in protecting their patents to appropriate value from their inventions than other firms, due to firm-specific efficiency building with legal means, such as representation by attorneys.

To achieve a competitive advantage, prior research suggested capabilities in strategy, management, and the development of competence, especially with regards to human resources as well as fruitful dealership with external institutions (Prahalad and Hamel, 1990; De Carolis, 2003). Furthermore, Teece (1986) postulated, that especially capabilities of complementary nature, for example, co-specialisation, might be key to benefit from innovation. Liebeskind (1996) stated that the employment organisation of a company itself can be the source of such capabilities. When it comes to litigation research involving the resource-based view of the firm, knowledge of firm-specific legal assets is scarce. Rudy and Black (2015) suggested that further research on patent litigation strategies could investigate the effect of legal representation in the context of litigation. They argue that litigation capabilities could be measured by looking at the legal representation within firms. In a previous research project, Somaya et al. (2007) found

that in-house patent law expertise combined with R&D influences a firm's patenting performance measured on granted patents. In their study, the authors looked at unique patenting knowledge of in-house patent attorneys and agents opposed to services of external patent law firms. Thereby, they managed to integrate complementary capabilities with the RBV further. Even the scarce information from those studies suggests that legal representation plays a central role in patent litigation and it becomes clear that relationships with legal personnel are a missing link between establishing inimitability of assets with litigation and performance.

When initiating an infringement lawsuit, the performance outcomes can differ significantly among firms. To refine knowledge on firm-specific abilities in patent enforcement, this chapter argues that if firms are able to successfully define and employ litigation strategies as well as navigate litigation endeavours against competitors, the positive influence of strategic litigation on sales and profitability will increase, while costs can be controlled. Building on this suggests, that appropriability from patents depends on firm-level patent enforcement experience created by strategic transactions with legal employees as well as contractors.

Not surprisingly, in a study on attorney experience in the Supreme Court from 1977 to 1982, McGuire (1995), found that experienced attorneys can contribute to but not guarantee successful litigation. Furthermore, Somaya (2003) pointed out, that insufficient advice by legal councils influences outcomes of litigation, and Somaya et al. (2007) showed that internal legal expertise influences patenting performance. Somaya et al. (2011) mention the importance of a firm to keep its skilled attorneys to increase patent litigation efficiency. And legal and political literature states that attorneys are likely to be repeated players in litigation and not seldom establish reputations (Gilson and Mnookin, 1994; McGuire, 1995). However, little is known from the literature on the role of attorneys in patent litigation.

To understand why companies might prefer to repeatedly work with the same legal teams, it is necessary to look at the workload involved to gather firm related knowledge in patent litigation. Attorneys have to be educated on particular technological circumstances and must undergo intensive training on firm-specific procedures. Thereby, they not only learn how to coordinate within the firm, but they also familiarise with involved laws, competitors and technological matters unique to the firm and the industry of operation. Therefore, it is valuable for companies to hire the same attorneys repeatedly, to avoid the frequent need for education on such matters (Hricik, 2004). Hence, whereby pure legal expertise is indeed important for the outcome and often the success of patent litigation, firms might be able to increase the efficiency of patent litigation to improve firm-specific value appropriation from patents. Previous research from

Huckman and Pisano (2006) found, that firm-specific benefits can be derived from the contractor's familiarity with the assets of a firm, for example, networks, structures or routines. Thereby, the value of such firm-specific experiences is not transferrable to other firms. Thus, superior performance is not solely attributed to experience, power or seniority of the contractors themselves. In light of these unique findings, it is striking, that the existent litigation research has not explored the influence of the repeated use of the same attorneys on firm performance in the context of strategic patent litigation, yet.

When attorneys build engage in repeated transactions with the same firm, two main sources of experience building need to be distinguished: generic knowledge accumulation, hence, experience growth versus firm-specific knowledge accumulation in the form of asset specificity. The basic knowledge, to practise as an attorney is not firm-specific it is acquired through obtaining a law degree. Therefore, attorneys are relatively free in their choice of employment and might negotiate their salary or fees. However, whereby their experience and knowledge on the legal side are indeed transferrable, the gained experiences with the firm-specific organisation, personal relations, technology, management and litigation history, are not. When in-house or external attorneys are transferring to another company, the previous employer and the attorney themselves can no longer build on attorney experience with firm-specific litigation. The main argument here is that whereby skill and gained legal experience through working on litigation are transferrable, firm-specific specialised, complementary assets are not (and hence, performance is not fully transferrable).

Hereby, the notion of *firm-specific* legal expertise is vital. This is because it can hardly be transferred to other companies. Williamson (1981), clearly distinguishes between transferrable and non-transferable skills. Repeated transactions of the same lawyers on the litigation cases of the same company build transferrable but also non-transferable skills. Whereby job experience solely increases skills through practice, the special knowledge of firm specificities is not. The more often an Attorney works on a case for a specific company, her or his knowledge become more specialised to the particular firm. Hence, when attorneys not only increase their knowledge on attorney related skills but also on, for example, internal practices of a firm when it comes to patenting and enforcement, the firm is repeatedly benefitting from it, creating value from reoccurring utilisation of the same lawyers in litigation cases. For example, with their (2006) study, Huckman and Pisano, built on RBV and TCE thoughts in the context of surgical freelancing, and found, that performance of surgeons at cardiac surgery at the hospital increased if they were rehired for multiple procedures by the same hospital but did not increase if surgeons were repeatedly performing procedures for other hospitals, implying that performance is

dependent on the specific hospital-surgeon complementary assets, and not experience alone. Contrary to the belief that firm-contractor relationships are at odds with the RBV, especially the inherent opportunities to build specialised experiences (complimentary assets) with each other act as rent appropriability mechanism to benefit sustained competitive advantage ultimately. In the present case, those parties are represented by the litigating firm and an entity that is providing legal expertise while conducting strategic patent litigation. Independently of attorney skill-level, this implies that performance can not only improve through general knowledge accumulation and experience, it is also influenced by the employing firm. Therefore, with rehiring the same contractors, flexibility decreases, and co-dependency increases as performance becomes firm-specific, developed from familiarity with assets (Huckman and Pisano, 2006).

Thus, when in-house or external attorneys are assigned to lawsuits of a certain firm over and over again, this allows the attorneys to build firm-specific experience. The firm then can capitalise on this same experience. This is because specialised knowledge through recurring transactions will benefit the firm as it diminishes transaction costs and risks over time (Williamson, 1979; Williamson, 1981) which makes the firm more reluctant to turn to other legal representatives. Furthermore, the parties can develop a bilateral dependency described by Williamson (1979; 1981), due to firm-attorney recurring relationships. For example, hiring the same attorney(s) will increase the fit between the attorney'(s) and the internal requirements of the firm. This, in turn, benefits the company as the transactions become more vertically integrated. Furthermore, it also benefits the attorney(s) as they are frequently hired by the same company and are able to build upon and create experience. Furthermore, the legal teams benefit from a stable assignment situation and gain confidence in negotiating salaries; bearing in mind that looking for clients comes with transaction costs itself. Therefore, the firm and the attorney build an idiosyncratic relationship which is supposed to benefit both transaction partners.

One important element of firm-specific experience needs to be discussed. Patent enforcement has a very unique characteristic that makes the interplay between RBV and TCE thoughts more pronounced. Attorneys usually work together with managers and in-house departments regularly, so that personal relationships can be built. Hence, there might be another layer of co-specialisation in many cases. Previous literature looked at the relationship of in-house counsel and external legal expertise (Fox, 1998; Somaya et al., 2007) as well as the relationship between general management and external attorneys (Foster, 1986). While getting to know firm characteristics, Attorneys form relationships with employees (in the legal department or other divisions of the firm) and managers, building networks. Complementarity of human resources

is the key to develop firm-specific assets from legal representation. Familiarity manifests itself in a substantial network-specific human capital, often crucial in the business context, and bound to the firm-contractor relationship which is not transferable to other firms (Mailath and Postlewaite, 1990; Huckman and Pisano, 2006). When the attorneys begin to work in a bilateral exchange relationship, they get dependent on these specific transactions up to a certain degree (Williamson, 1981). Furthermore, co-specialisation might emerge from relationships between the two (Somaya et al., 2007).

It must be noted that the involvement of external attorneys is not always by choice, as many cases require the involvement of outside counsel to protect competitive knowledge. In-house counsel is not allowed to receive certain insider information about competitors[15]. Whereby, some small firms resort to outside counsel more heavily (Somaya et al., 2007), Lerner (1995) argues, that in-house and external attorney costs do not diverge significantly and that managing the interplay of both fosters learning and efficiency. Moreover, past literature suggests that an outside counsel is always supported by an in-house attorney (Foster, 1986). By repeating the assignment of the same lawyers to infringement cases, in-house or on a contract basis, these lawyers can develop firm-specific legal expertise and networks. Just as in alliances, both agents might benefit from interfirm trust and learning developed by repeated ties (Gulati, 1995). Furthermore, Beukel and Zhao (2018), presented, that prior ties with attorneys are also a critical aspect for firms when of choosing a place for litigation, as the local legal structures and relationships are already in place. Hence, knowledge accumulation on the firm and relationship-building can be a very time-intensive but necessary endeavour, therefore, firms might be inclined to stick to hiring plaintiffs who are already familiar with the firm and its legal teams.

To investigate the performance outcomes of the repeated use of the same legal personnel, the next chapter develops hypotheses, that enrich the resource-based view of the firm with knowledge from transaction cost economics to explain how reoccurring transactions with the same attorneys built a bridge between strategic patent litigation and firm performance. Thereby, some firms might perform better than others concerning profitability of strategic patent enforcement because their legal partners develop firm-specific experiences from repeated representation on litigation cases.

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[15] "A prosecuting-litigator can also be disqualified by the advocate-as-witness rule, and can also face efforts by the accused infringer to prevent that lawyer from having access to "trade secrets" disclosed by the infringer-ostensibly to prevent the lawyer from misusing those secrets to the benefit of the lawyer's client's prosecution activities" Hricik (2004, p.423).

5.3 Hypotheses

Over time, attorneys might create knowledge and networks due to their repeated experience with litigation for one firm. By building on previous experiences with the firm, attorneys might be more successful in implementing strategic litigation, improving the firm's possibilities to benefit from it. Reitzig (2004a) presents the work of an attorney in litigation as a decision-making position under risky conditions. Thereby, each decision can enrich their knowledge of the company and its competitors, increasing their decision-making skills. Building on this experience will, in turn, improve their future work, for example, by perfecting their decisions in strategic litigation to achieve competitive advantage. Such firm-specific knowledge can benefit the organisation in two ways: by decreasing costs of strategic patent litigation due to transaction costs savings and by increasing the effectiveness of patent litigation and, hence, sales.

Costs

Patent litigation is a complicated process that requires legal experience and legal support from attorneys. Firms can hire in-house or external legal representation. Independently from the mode of employment, each involvement of an attorney represents a transaction. When a company is compensating for the legal representation, it is paying for in-house as well as external law firms, whereby, each transaction carries costs with it. Attorney fees are an important component of the direct financial requirements of litigation (Lumineau and Oxley, 2012). Such costs might not only comprise the direct compensation but also hiring activities, monitoring and checking the performance of the attorneys as well as managerial costs inherent to the relational maintenance (Williamson, 1979; Huckman and Pisano, 2006; Bessen and Meurer, 2008b; Bessen and Meurer, 2008a). Such managerial costs can cause business disruption, when too much time is allocated to the litigation process, away from other business activities (Bessen and Meurer, 2008a). Setting work expectations and monitoring lawyers and their time commitment to specific tasks can save costs of litigation, especially because lawyers usually do not keep their focus on the financial investments for litigation (Foster, 1986). If the relationship is reoccurring, such controlling and monitoring costs can be decreased, while keeping the efficiency and time commitment at an equal level. Following alliance research for the second time, repeated relationships may decrease transaction costs due to the formation of trust, an important addition to TCE knowledge (Gulati, 1995).

Companies increasingly choose to litigate their patents in a court of law, resulting in increased numbers of patent cases per firm every year. While those firms try to cope with the demanding processes, they also have to control the financial aspect of IP protection. Presumably, such cost savings might result from the repeated interactions with attorneys. Whereas expensive legal representation can increase the overall costs, attorney fees could be diminished if a firm's legal representation is repeatedly consulted. Legal representation, in-house or external, requires indirect costs due to time commitments and salaries and fees of attorneys (Lerner, 1995; Chen et al., 2016). However, if lawyers already possess experience with a firm, they might be familiar with its history and litigation procedures. Hence, they might be able to reduce preparation time and administrative tasks that might otherwise be a cost-intensive duty for a lawyer that represents a firm on just one occasion. During all cases, independently of the structure of employment, attorneys may internalise firm-specific organisational und structural contingencies, for example, which entity to contact for certain information, how processes are managed, or the social networks. Huckman and Pisano (2006) also state that company-specific assets, inter alia, the local facilities, stock of tools provided or expertise of managers impact outcomes independently from individual knowledge. Therefore, each transaction might reduce the administrative costs for the firm. Hence, asset specificity will benefit the firm and this benefit can grow from case to case whereby firms obtain economies of scale the more cases the attorneys are operating.

Experience with patent litigation might also ultimately decrease the costs involved for the firm for developing and executing strategies. As Lerner (1995) argued that the knowledge accumulation of repeated patent litigation increases the firm's ability to direct in-house and external legal personnel creating a "learning curve". When decreasing the organisational burden for attorneys to get to know the internal structures, technologies and human resources of a company, they might be able to direct their focus on the lawsuit and save preparation time in advance or during the litigation process. When firms are litigating against multiple firms or in several lawsuits, these advantages could be even more pronounced, saving time and money for the plaintiff. One example of costs benefits when repeatedly using the same attorneys is their unique abilities to arbitrate. For example, Lumineau and Oxley (2012) found that involvement of legal personal often resulted in a private settlement because of objective decision-making skills even after filing a lawsuit. According to the authors, these settlement skills prevent high legal costs and lengthy lawsuits. When arguing in the case of strategic patent litigation, repeated ties with such attorneys might foster their arbitration abilities even further to be in line with the company's expectations.

Lawyers that have experience with one firm are more likely to be the familiar with the patents, the technology and the firm's litigation strategy, which could lead to time savings when it comes to the familiarisation with the litigation case. Such attorneys probably need less time to get familiar with relevant patents and litigation strategies and have to overcome fewer communication barriers to receive needed information from other departments. Therefore, the experience of one lawyer with the same firm repeatedly might reduce the firm's costs associated with litigation strategies by freeing up the time of key personnel which otherwise would be needed to educate and explain firm-specific technologies and processes. Hence, the higher the Attorneys' knowledge of the firm, the more costs are saved due to higher productivity and accelerated proceedings as well as their independence from management. Furthermore, attorney experience might be useful when minimising disruption from strategic patent litigation. Ultimately, repeated interactions will minimise the transaction costs of the exchanges outside the organisation and maximise the productivity and precision externally during patent litigation. Therefore, I hypothesise:

Hypothesis 1: If a plaintiff is hiring legal personnel repeatedly, the positive influence of strategic patent litigation on firm costs is decreased.

Sales

Lawyers that are repeatedly employed by the same firm can familiarise with its technologies. Familiarity with the organisation's technological background can help attorneys to understand the firm-specific patents to apply this knowledge during the lawsuit. Repeated experience does not only involve intricate background knowledge on technological matters, but it also comprises the sheer task of reading through extensive materials often provided by companies to illustrate the patenting history or accumulated by the USPTO for documenting complex patent cases (Hricik, 2004). Hence, based on this knowledge, lawyers can speed up the process and secure important sales at a crucial time of commercialization, the early stages. Hence, a lawyer gaining familiarity with the firm builds "economies of scale" for the next case. By being already familiarised with the often-complex technological backgrounds of patents, the attorney has past experience with technological details to draw upon when hired repeatedly. This might make the attorney better equipped to help the firm to exclude products using the same patented technologies from the market, increasing firm sales.

Sales advantages are also anticipated to result from networks built from the repeated interactions between attorneys and the plaintiff firm. Transactional experience makes bureaucratic hurdles easier to tackle and reduces the effort of communicating within different divisions and layers within the organisation. Somaya et al. (2007), argued that in-house attorneys often have a better picture of the company, facilitated access to information and relationships to other departments. Extending this argument to lawyers familiarised with a particular firm due to repeated litigation experience on the firm's litigation cases, it may be that such experienced lawyers have an increased level of access to information and other departments due to relational network building. Hence, the repeated representation of the firm by the same lawyers means that those lawyers can become more familiar with their client and the jurisdictional environment they are operating in.

When litigating, firms might be able to refer to legal teams that are familiar with the organisation's litigation procedures and processes at specific courts from previous litigation cases. This allows the legal representatives to identify relevant local information needed for lawsuits and litigation strategy formation. Which, for example, improves the access and ease of initiation of court proceedings at locations that were previously litigated in with the same legal teams (Beukel and Zhao, 2018). Furthermore, familiarity with the litigation history of a firm in specific venues can increase potential success, inter alia, because the court receives tailored documents and can be more satisfied with the provided information (McGuire, 1995). Hence, firms with repeated use of the same legal representation can take advantage of their attorneys' experience with the firm-specific legal environment and procedures and, therefore, are more equipped to navigate cost-intensive and challenging litigation procedures in a satisfactory and controllable way. This enhances the firm efficiency of handling patent litigation and excluding others from commercialising imitative products. Both factors likely lead to increased sales possibilities due to declining competition on the market.

Patent litigation strategies may be more accurately constructed and implemented, and infringement detected more easily if the attorneys had the chance to accumulate knowledge on the firm and the market it is operating in. James et al. (2013) found that attorneys familiar with the firm are more likely better skilled in detecting infringement. Identifying infringement is an integral part of patent litigation strategies. If infringement is detected, the possibility to prevent imitation increases and opportunities occur to restrict competition and increase sales.

Moreover, it might be that Attorneys that accumulated firm-specific litigation knowledge are more familiar with the general litigation strategy stance of the firm and its favoured positioning

within the industry. Litigation experience at the same firm allows them to sufficiently perform litigation according to the strategic direction of the firm, thereby, deter imitation to defend against competitors and secure sales. Ultimately, firms with repeated legal representation by the same attorneys might record higher sales than firms that lack this continuity in their legal representation. This is can also reflect in the negotiations of settlement conditions, like licenses. Increased experience with the firm and its competitors might place the attorney in a unique bargaining position, able to draw upon past knowledge to achieve favourable sales improvements. Hence,

Hypothesis 2: If a plaintiff is hiring legal personnel repeatedly, the positive influence of strategic patent litigation on firm sales is increased.

Profitability

From the literature, we know that attorney experience often decides about litigation success (McGuire, 1995) and Somaya et al. (2007) found that internal patent law expertise, which is tied with R&D, significantly influences firm-patenting performance. Whereas the authors focus on patenting-performance, the same result is expected for to repeated use of the same attorneys, may it be internal or external personnel. If attorneys work for the same firms over and over again, they get to know their unique technologies, product portfolios, networks and procedures as well as industrial and institutional peculiarities. Hence, they accumulate insights about the company-specific structures and ultimately become specialists in firm-specific litigation, increasing the sales possibilities and decreasing the costs involved. This eventually leads to value appropriation in from innovation which positively reflects in higher profitability.

In sum, attorneys learn from all the firms on the case, not just the one that he or she is representing. Hence, the Attorney creates firm, technology, patent, process, court, competitor and industry-specific knowledge. Firms with repeated use of the same lawyers may increase the positive influence of patent litigation strategies on sales and lessen the costs involved in the process so that post-litigation profitability is higher. Therefore, I hypothesise:

Hypothesis 3: If a plaintiff is hiring legal personnel repeatedly, the positive influence of strategic patent litigation on firm profitability is increased.

5.4 Data and Methods

5.4.1 Sample

To create attorney specific measurements, the attorney dataset from the USPTO needed to be consolidated with USPTO litigation data. In the first step, I excluded duplicates within the attorney data (i.e. when the same attorney was listed for the same case number several times). From the data, it can be distinguished between attorneys on the defendant side and attorneys on the plaintiff side in infringement suit. The next step was to exclude all party types that proved to be redundant for the analysis. Again, I distinguished the party types between original defendants, original plaintiffs, additional defendants and additional plaintiffs and selected and separated the attorneys for the plaintiff side. Then, I added attorneys for each case number in wide format.

Before the case numbers from the attorney dataset and the USPTO dataset could be merged, the attorney names had to be cleaned. Many attorney names were duplicated due to abbreviation issues, for example, "John Doe Williams" also showed as "John D Williams". Merely removing the abbreviated middle name was not a right solution because it could have caused problems with other names, for example, "John D Williams" and "John E G Williams". Hence, I abbreviated the middle name for all attorneys, meaning that, for example, "John Doe Williams" changed to "John D Williams" but is different from "John E G Williams". I also cleaned the attorney names of any punctuation, brackets, slashes, quotations marks, mathematical signs, numbers, addresses, company names, at-sign or name-additions (for example na, phd, van, de, la ,von, not sworn, dba dbd, company, re de). At first, the Attorney database contained more than six million attorney-year observations, which is why I handled the database separately to create the needed firm-year specific variables which I then merged with the final dataset.

The sample to test the provided Hypotheses contains active and inactive publicly traded and private U.S. companies. The data is unbalanced panel data ranging over 16 years, from 2000 to 2015. The sample concentrates on manufacturing firms (SIC codes 20 to 39). Litigation and attorney data was used from the PLD provided by USPTO and merged with financial data from the TOB dataset. Whereby attorney data accumulated for 3,269 firms in 278 industries, which reflects in 21,745 firm-year observations, 711 firms from 726 litigating firms provided information on the involved attorneys.

5.4.2 Additional Independent Variable

Repeated Use of the Same Legal Personnel

In order to operationalize the measure of repeated use of legal personnel, I estimated a measurement that reflects current and past reoccurring assignment of the same attorney(s) of a plaintiff. To capture repeated relationships between a firm and its individual attorneys over the years, I followed a comparable logic from corporate governance and alliance literature (Goerzen, 2007; Field and Mkrtchyan, 2017). The following comparisons are operationalized because, up to my knowledge, there has not yet been a similar firm level measure in the context of strategic litigation and attorneys.

From consulting Field and Mkrtchyan (2017) and Goerzen (2007), I identified two important similarities. First, similar to the repeated use of attorneys, the repeated relationships between firms in an alliance network or the repeated experience of directors are individually occurring associations, which are then accumulated to the firm-level. Second, these past relationships are directly linked to current firm performance. Hence, similar to the authors, I progress with measurement operationalization by using past individual attorney data to form a firm-level variable. As operationalized in previous research (Goerzen, 2007; Field and Mkrtchyan, 2017), I created the firm-year specific variable by counting the repeated use of the individual attorneys and created a cumulative variable dividing the total number of initial and repeated assignments by the number of attorneys on infringement lawsuits of each individual firm in each year.

(1) Total number of prior and current case assignments (NA) of a single attorney (i) for each firm and year, summed for the total number of attorneys (D) of the firm in each year $= \sum_{i=1}^{D} \text{NAi}$

I decided to choose a ratio measure to account for difference in size of legal teams, avoiding a simple count measure, as legal teams can differ significantly in size and reliance on legal personnel is very variable over time (Coates et al., 2011). Thereby, transferring the count measure of past attorney assignment into a firm-specific ratio measure follows the same pattern as Field and Mkrtchyan's (2017) approach of transferring past individual directors' acquisition counts to a firm-specific ratio. As this dissertation deals with panel data, I calculated the ratio for each year.

(2) Ratio of repeated use of the same legal personnel (per firm-year) $= \frac{\sum_{i=1}^{D} \text{NAi}}{D}$

As I focus on the previous ties of attorneys and the firm and, hence, the effects of repeated relationships, I incorporated each year of the attorney-company relationship to account for the size differences of cases and the unique firm-specific ties that can be built over time (Somaya and McDaniel, 2012). This is also necessary, as legal teams may change over the course of a case. However, to investigate if attorney experience is increasing solely from case to case, I tested an alternative measure that only captures cases once at the time of entering an infringement lawsuit. I used this measure to run a robustness test of the findings. The results from the robustness test can be examined in *5.6.2 Additional Tests.*

Furthermore, concentrating on the repeated use of the same legal personnel does not account for experience that attorneys can gain by working on declaratory judgement cases or cases for other firms. However, it can be argued that such cases are less relevant for the firms in the sample because ties with other firms do not deter gaining familiarity with the focal firm. Moreover, as technologies, patents and cases diverge significantly, defence cases are considered less common and structurally different from infringement cases. Hence, the alternative operationalization did not fit the proposed theoretical concept properly.

Additionally, I created a moderator variable with patent litigation using standardised measures.

5.5 Descriptives

Table 14 Descriptive Statistics and Correlations: RQ2

Variable	Mean	S.d.	1	2	3	4	5	6	7	8	9	10
1 Costs[1]	0.159	0.221										
2 Sales[1]	12.881	1.108	-0.05 ***									
3 ROS[1]	-0.238	4.095	-0.49 ***	0.59 ***								
4 Firm Age[1]	3.177	0.600	-0.17 ***	0.27 ***	0.37 ***							
5 Firm Size[1]	5.921	2.605	-0.30 ***	0.42 ***	0.60 ***	0.45 ***						
6 R&D Intensity[1]	2.533	2.070	0.52 ***	-0.46 ***	-0.64 ***	-0.20 ***	-0.31 ***					
7 Organisational Slack[1]	0.799	0.449	-0.30 ***	0.37 ***	0.37 ***	0.12 ***	-0.05 ***	-0.54 ***				
8 Litigation Duration[1]	0.042	0.154	0.01 **	0.08 ***	0.10 ***	0.07 ***	0.14 ***	0.03 ***	-0.04 ***			
9 Heckman Exit	0.315	0.232	-0.08 ***	0.13 ***	0.18 ***	0.19 ***	0.33 ***	-0.04 ***	0.01	0.15 ***		
10 Patent Litigation	0.001	0.022	0.07 ***	0.02 **	-0.02 ***	0.00	-0.02 ***	0.04 ***	-0.02 **	0.16 ***	0.00	
11 Repeated Use Legal Personnel	0.249	1.330	0.02 ***	0.07 ***	0.08 ***	0.07 ***	0.12 ***	0.02 ***	-0.03 ***	0.68 ***	0.13 ***	0.22 ***

Number of Observations=21.745 ; ***p<0.01; **p<0.05; *p<0.1. [1]Variable is IHS-transformed.

Table 14 illustrates the means, standard deviations and the correlations. The correlation matrix shows acceptable values among the independent variables. However, it is striking that repeated use of the same attorneys is correlating with the duration of the litigation cases measured on days with (0.68). This is not surprising, because the repeated use of the same attorneys is incorporating case duration by counting each case year as a separate experience as well as each

case in each year as a separate experience. However, I conducted a robustness test to test the robustness of the findings when using a case experience measure that does not take case-length into account. The outcomes of this test are presented at the end of the results section.

To rule out multicollinearity issues, I calculated the variance inflation factors (VIFs) for each variable using the "collin" command in Stata. The mean VIF for the full model was 1.53, with ranging scores between 1.05 for Patent Litigation and 1.73 for R&D intensity. These VIFs are below 10, which is the cut off value defined by Myers (1990). Even though the test suggests that multicollinearity is not an issue for the analysis, I performed a robustness check to rule out any multicollinearity issues. Excluding R&D intensity, showed that the measure does not distort the results from the main model. To further curb multicollinearity issues, I mean centred the attorney variable of the respective moderator interaction term (Aiken et al., 1991).

5.6 Results

The results from the moderation model can be examined in *Table 15*. Model 1, 4 and *7* show the results of the model including only control variables. Model 2, 5 and 8 include the independent variables for patent litigation and the repeated use of the same attorneys. Model 3, 6 and 9 then represent the full model, including the interaction term.

Table 15 Multilevel Mixed Method Analysis: RQ2

	Model [1]	Model [2]	Model [3]	Model [4]	Model [5]	Model [6]	Model [7]	Model [8]	Model [9]
		Litigation Costs:				Firm Performance:			
Dependent Variable:	Costs[1]	Costs[1]	Costs[1]	Sales[1]	Sales[1]	Sales[1]	ROS[1]	ROS[1]	ROS[1]
	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
Control Variables	[SE]	[SE]	[SE]	[SE]	[SE]	[SE]	[SE]	[SE]	[SE]
Firm Age[1]	0.000	0.000	0.000	0.008	0.008	0.007	0.168***	0.167***	0.166***
	[0.004]	[0.004]	[0.004]	[0.019]	[0.019]	[0.019]	[0.054]	[0.054]	[0.054]
Firm Size[1]	-0.021***	-0.021***	-0.021***	0.210***	0.210***	0.210***	0.884***	0.885***	0.885***
	[0.001]	[0.001]	[0.001]	[0.005]	[0.005]	[0.005]	[0.014]	[0.014]	[0.014]
R&D Intensity[1]	0.032***	0.032***	0.032***	-0.323***	-0.323***	-0.323***	-0.858***	-0.858***	-0.858***
	[0.001]	[0.001]	[0.001]	[0.004]	[0.004]	[0.004]	[0.014]	[0.014]	[0.014]
Organisational Slack[1]	-0.000	-0.000	-0.000	0.670***	0.670***	0.670***	1.796***	1.796***	1.797***
	[0.004]	[0.004]	[0.004]	[0.014]	[0.014]	[0.014]	[0.048]	[0.048]	[0.048]
Litigation Duration[1]	0.025***	0.016*	0.010	0.038	0.044	0.020	0.077	0.050	-0.015
	[0.007]	[0.009]	[0.009]	[0.028]	[0.034]	[0.035]	[0.098]	[0.120]	[0.123]
Heckman Exit	0.006	0.006	0.006	-0.055***	-0.055***	-0.055***	-0.154**	-0.152**	-0.154**
	[0.005]	[0.005]	[0.005]	[0.019]	[0.019]	[0.019]	[0.067]	[0.067]	[0.067]
Independent Variable									
Patent Litigation		0.002**	0.006***		0.005	0.019***		0.027**	0.064***
		[0.001]	[0.001]		[0.004]	[0.006]		[0.014]	[0.020]
Repeated Use Legal Personnel		0.002	0.003*		-0.003	0.002		-0.001	0.012
		[0.001]	[0.001]		[0.006]	[0.006]		[0.019]	[0.020]
Interaction effects									
Patent Litigation x Repeated Use Legal Personnel			-0.019***			-0.070***			-0.190**
			[0.005]			[0.021]			[0.075]
Constant	0.238***	0.238***	0.238***	11.609***	11.608***	11.608***	-6.059***	-6.061***	-6.059***
	[0.017]	[0.017]	[0.016]	[0.082]	[0.082]	[0.082]	[0.219]	[0.219]	[0.219]
Year Controls	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.

Number of Observations=21.745 [3.269 Firms] ; ***p<0.01; **p<0.05; *p<0.1 [1]Variable is IHS-transformed.

Hypotheses 1 suggested, that if a plaintiff is hiring legal personnel repeatedly for representation in infringement lawsuits the positive influence of strategic patent litigation on firm costs is decreased compared to plaintiffs that do not rehire attorneys. The results show that the positive and significant influence of strategic patent litigation on firm costs is turned negative when a firm is repeatedly using the same attorneys. This does not mean, that litigating more frequently results in fewer overall costs, however, it shows that if firms repeatedly use the same attorneys, they save more costs than firms who do not rely on transactions with the same attorneys. Hence, for firms that have a high litigation intensity and repeated use of the same legal personnel, the influence on costs is negative and significant (coefficient = -0.019, p< .01). Therefore, Hypothesis 1 is supported.

Hypothesis 2 suggested that if a plaintiff is hiring legal personnel repeatedly for representation in infringement lawsuits, the positive influence of strategic patent litigation on firm sales is increased compared to plaintiffs that do not rehire attorneys. The results show that the influence of strategic patent litigation on firm sales is positive and insignificant, whereas the relationship between the repeated use of the same legal personnel and firm sales is negative and insignificant. When looking at the moderator, hence, patent litigation and attorney experience, the influence is shifting to a negative and significant influence on firm sales.

Surprisingly, the results show that the positive influence of strategic patent litigation on firm sales is diminished when the firm is repeatedly using the same attorneys (coefficient = -0.070, p< .01). Therefore, Hypothesis 2 is not supported.

Hypothesis 3 proposed that if a plaintiff is hiring legal personnel repeatedly for representation in infringement lawsuits the positive influence of strategic patent litigation strategies on firm profitability is increased compared to plaintiffs that do not rehire attorneys. Surprisingly, the results show that the positive and significant effect of patent litigation on firm profitability is turned negative and significant if the firm repeatedly uses the same legal personnel. The analysis shows that patent litigation and the repeated use of the same attorneys have a negative and significant influence on ROS (coefficient = -0.190, p< .05). Hence, with every one standard deviation increase of the moderator, the dependent variable ROS decreases by 19%. Hence, Hypothesis 3 is not supported.

To further examine the effect of intensive litigation while using the same attorneys repeatedly on firm sales, costs and profitability, I refined the analysis by drawing predictive margins at different levels of patent litigation. To do so, I transformed the IHS values back to their original scale.

Figure 10 shows the predictive margins illustrating the divergence of the effect of repeated representation of the firm by the same lawyers at different levels of litigation intensity. It is visible, that although increased levels of litigation can lead to higher sales outcomes, this is only the case if the company is not relying on the same teams of attorneys repeatedly. A higher rate of repetition, thus, leads to diminishing effects on firm sales. This could mean, that the plaintiff firm often does not benefit from attorneys' firm-specific knowledge and specialisation when it comes to firm sales.

Figure 10 Predictive Margins Sales per Employee: RQ2
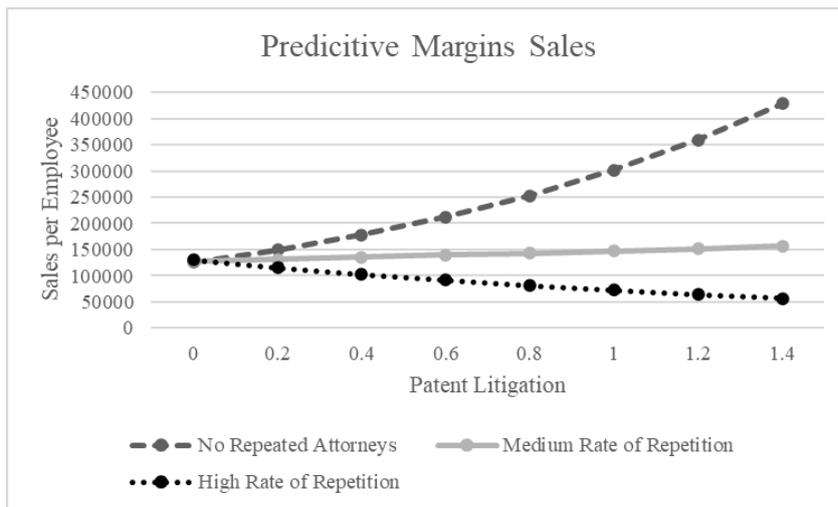
Figure 11 shows the effect of litigation intensity and repeated use of attorneys on ROS. Here, it can be examined, that when litigating only a small number of cases the effect of patent litigation is negative on ROS. With an increased number of cases, the influence of litigation intensity without the repeated use of the same attorneys on ROS becomes positive, whereas it stays and grows negative when attorneys are hired repeatedly. This phenomenon may be explained by the accumulation of trust between the parties, however, trust-building and cost-saving might negatively affect monitoring and critical evaluation of the attorneys' work and hence, its effectiveness.

Figure 11 Predictive Margins ROS: RQ2
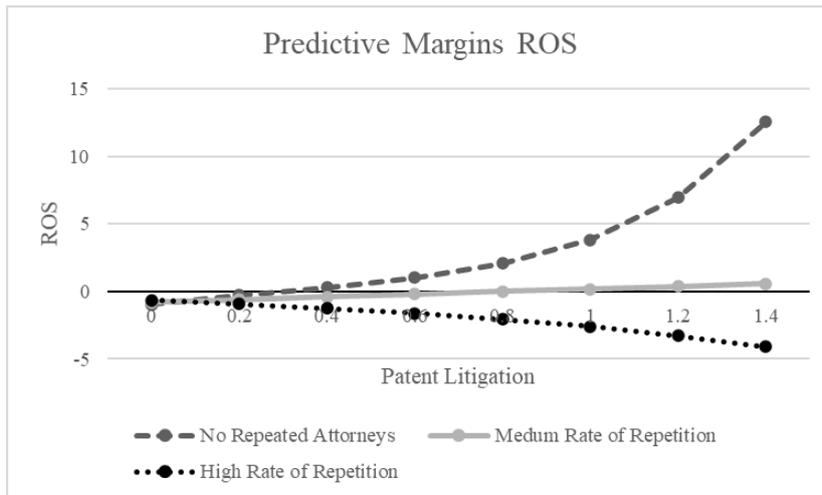
The main goal of the current study was to determine if the repeated use of the same legal personnel influences the effect of patent litigation on firm performance. Legal representation is a vital part of strategic patent litigation and set out to be crucial when appropriating rents from patents. However, the results of this study indicate that employing the same attorneys over the years has negative implications for firms with a high patent litigation intensity when it comes to firm sales and profit accumulation.

5.6.1 Magnitude of the Effects RQ2

Keeping everything else equal and adjusted for random effects and mean centring, with a higher litigation intensity from the 90th to the 99.9th percentile, predicted sales per employee increase from 196,142.4 to 233,693.6, thus varying by 37,551.2 if the plaintiff is not relying on the repeated use of the same attorneys. For the medium rate of repetition in the legal team attorneys, the effect does not increase as steep, it varies by 23,681.7 increasing from 197,603.2 to 221,284.9. Whereas it decreases by 562.2 from 200,365.0 to 199,802.8 if the company has a high rate of repeated attorneys. Between the 90th and 99.9th percentile, the predicted ROS increases from -0.2447 to 0.3493 which translates to an increase of 0.59 percentage points for firms that do not rely on the repeated use of the same legal teams. For firms with a medium reliance on repeated attorneys the effect ranges from -0.1900 to 0.2289, hence, 0.42 percentage points. For a high rate of repetition, the effect is increasing from -0.0890 to 0.0105, thus, litigation intensity accounts for a variation in with a variance in ROS of 0.1 percentage points for companies that do rely heavily on the repeated use of the same attorneys. The results can be viewed in *Table 16 and 17*.

Table 16 Magnitude of the Effects for Sales per Employee: RQ2

Percentile	Patent Litigation	Predicted Sales per Employee		
	Value	No Repeated Attorneys (90th Percentile)	Medium Rate of Repetition (99th Percentile)	High Rate of Repetition (99.9th Percentile)
90.0	0	196,142.4	197,603.2	200,365.0
99.0	0.0008	196,271.9	197,686.2	200,363.0
99.2	0.0021	196,501.7	197,834.5	200,359.0
99.4	0.0083	197,579.5	198,536.1	200,341.0
99.6	0.1	214,095.2	209,108.0	200,082.7
99.9	0.2	233,693.6	221,284.9	199,802.8

Table 17 Magnitude of the Effects for ROS: RQ2

Percentile	Patent Litigation	Predicted ROS		
	Value	No Repeated Attorneys (90th Percentile)	Medium Rate of Repetition (99th Percentile)	High Rate of Repetition (99.9th Percentile)
90.0	0	-0.2447	-0.1900	-0.0890
99.0	0.0008	-0.2424	-0.1884	-0.0887
99.2	0.0021	-0.2384	-0.1856	-0.0880
99.4	0.0083	-0.2196	-0.1724	-0.0849
99.6	0.1	0.0501	0.0190	-0.0392
99.9	0.2	0.3493	0.2289	0.0105

5.6.2 Additional Tests

I calculated the model fit criteria using the Akaike (AIC) (Akaikei, 1973) and Bayes (BIC) (Schwarz, 1978) information criteria. The AIC and BIC of the model for sales not including the predictors and the moderator variable were (36825.23 and 37024.91). These values are higher than the full model with (36817.94 and 37033.6). This is supported by an information loss of $\triangle_i = 7.29 > 2$, if the predictor and the moderator are not included, calculated from the formula of Burnham and Anderson (2004) $\triangle_i = AIC_i - AIC_{min}$, which allows the interpretation of AIC scales. Therefore, the full model is significantly better fitting than the control model which justifies the additional complexity of the model. The cost model showed similar findings, where the full model with (-23646.66 and -23431.01) is better than the control model with (-23638.07 and -23438.39) showing a $\triangle_i = 8,59 > 2$. The ROS model behaves similar showing a better fit for the inclusion of the predictor variables with (89544.31 and 89759.96), than without (89546.8 and 89746.47) and a delta difference of $\triangle_i = 2,49 > 2$.

To test the robustness of the findings, I created another measure for the repeated use of the same legal personnel. The measure is not incorporating the year-per case into the analysis but solely incorporates each case once. Hence, this measure is incorporating repeated use only if an

attorney is listed on a different case for the same company. This does not pose a problem when looking at firm costs, as the majority of the costs are often at the beginning of the case, however, it could be the case, that sales and profits do not follow in the same year if a case lasts for several years. This might explain why the results show that while the negative influence on costs and sales is still significant, the influence on profitability is not. Thus, regardless of the differences, the results are considered robust.

Table 18 shows the results from the robustness test:

Table 18 Multilevel Mixed Method Analysis Robustness: RQ2

	Model [1]	Model [2]	Model [3]	Model [4]	Model [5]	Model [6]	Model [7]	Model [8]	Model [9]
	Litigation Costs:			Firm Performance:					
Dependent Variable:	**Costs**[1]	**Costs**[1]	**Costs**[1]	**Sales**[1]	**Sales**[1]	**Sales**[1]	**ROS**[1]	**ROS**[1]	**ROS**[1]
Control Variables	Coef. [SE]	Coef. [SE]	Coef. [SE]	Coef. [SE]	Coef. [SE]	Coef. [SE]	Coef. [SE]	Coef. [SE]	Coef. [SE]
Firm Age[1]	0.0002	0.0001	0.0001	0.008	0.008	0.008	0.168***	0.167***	0.167***
	[0.004]	[0.004]	[0.004]	[0.019]	[0.019]	[0.019]	[0.054]	[0.054]	[0.054]
Firm Size[1]	-0.021***	-0.021***	-0.021***	0.210***	0.210***	0.210***	0.884***	0.884***	0.884***
	[0.001]	[0.001]	[0.001]	[0.005]	[0.005]	[0.005]	[0.014]	[0.014]	[0.014]
R&D Intensity[1]	0.032***	0.032***	0.032***	-0.323***	-0.323***	-0.323***	-0.858***	-0.858***	-0.858***
	[0.001]	[0.001]	[0.001]	[0.004]	[0.004]	[0.004]	[0.014]	[0.014]	[0.014]
Organisational Slack[1]	-0.0002	-0.0002	-0.0003	0.670***	0.670***	0.670***	1.796***	1.796***	1.795***
	[0.004]	[0.004]	[0.004]	[0.014]	[0.014]	[0.014]	[0.048]	[0.048]	[0.048]
Litigation Duration[1]	0.025***	0.020***	0.017**	0.038	0.046	0.038	0.077	0.031	0.020
	[0.007]	[0.008]	[0.008]	[0.028]	[0.030]	[0.030]	[0.098]	[0.104]	[0.105]
Heckman Exit	0.006	0.006	0.006	-0.055***	-0.055***	-0.055***	-0.154**	-0.153**	-0.153**
	[0.005]	[0.005]	[0.005]	[0.019]	[0.019]	[0.019]	[0.067]	[0.067]	[0.067]
Independent Variable									
Patent Litigation		0.002**	0.005***		0.006	0.013**		0.026*	0.036*
		[0.001]	[0.001]		[0.004]	[0.005]		[0.014]	[0.019]
Repeated Use Legal Personnel (Excluding Case Duration)		0.001	0.001		-0.007	-0.005		0.007	0.009
		[0.001]	[0.001]		[0.005]	[0.005]		[0.016]	[0.017]
Interaction effects									
Patent Litigation x Repeated Use Legal Personnel (Excluding Case Duration)			-0.0003**			-0.001*			-0.001
			[0.0001]			[0.0005]			[0.002]
Constant	0.238***	0.238***	0.238***	11.609***	11.608***	11.608***	-6.059***	-6.061***	-6.060***
	[0.017]	[0.016]	[0.016]	[0.082]	[0.082]	[0.082]	[0.219]	[0.219]	[0.219]
Year Controls	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.

Number of Observations=21.745 [3.269 Firms] ; ***p<0.01; **p<0.05; *p<0.1. [1]Variable is IHS-transformed.

5.7 Discussion and Conclusion

To contribute to the current litigation literature by answering the research question: *"How does the influence of strategic patent litigation on firm performance vary according to the repeated use of the same legal personnel? (Table 1)",* this chapter set out to investigate litigation as a

means to create inimitability of assets. It showed that firms can take action to isolate their intellectual property against imitation by strategically litigating, however, that some are more capable of doing so. It is also shown that firm-specific contingencies of legal representation are a significant mechanism to clarify such inequalities.

The relevance of firm-specific contingencies, such as legal representation, is supported by the current findings. They pose an overlooked linked between strategic patent litigation and performance and show that repeated attorney hiring practices can be detrimental for the plaintiff in terms of firm sales and profitability. The unexpected findings could be explained by arguing that firms which repeatedly rely on the same attorneys fail to integrate the contracted market relationships sufficiently with their internal processes and procedures. This could mean, that the plaintiff firm often does not benefit from attorneys' firm-specific knowledge and specialisation when it comes to firm sales. Firms that hire the same attorneys repeatedly also might not be able to profit from their litigiousness because they develop an "inertia to change" whereby they stick to the same legal representation teams out of convenience and scale economy advantages due to familiarity. As De Carolis (2003) suggested, sticking to the same knowledge sets might enable firms to get trapped in rigid systems. When the relationship between the firm, its employees and attorneys gains on trust, the repeated transactions might lead to lower administrative costs due to fewer control mechanisms, similar to what can be examined in other forms of firm networks (Powell, 1990; Gulati, 1995; Gulati and Singh, 1998), however, the same trust and costs saving can negatively affect monitoring and critical evaluation of the attorneys' work and hence, firm sales. Alternatively, even the argument that firms might allocate to many cases to the same team of attorneys, increasing workload is important to consider.

A particularly interesting finding stemmed from the incorporation of TCE, suggesting that repeated transactions with the same lawyers can reduce strategic litigation effects on costs. Firms that litigate more frequently with the same attorney teams can lower their administrative costs significantly. This practice might enable the firm to build economies of scales, minimising managerial costs and disruptive activity, especially when attorneys are able to draw from unique firm-specific experience. Hence, the strategic use of attorneys can influence the costs of strategic patent litigation.

However, the cost-saving benefits of the repeated use of the same attorneys in strategic litigation seem to be outweighed by the negative effects of the same practice on sales. Thereby, the trade-off between the two implies what the results could confirm: negative profitability for

firms that litigate repeatedly with the same attorney teams. This contributes to previous knowledge on the inimitability of assets in suggesting unique mechanisms that can alter the patent litigation-performance relationship. Nahapiet and Ghoshal (1998), found in their study, that transaction costs can be reduced by building on social capital to diminish coordination complexity and increase knowledge accumulation. Nevertheless, they contribute to RBV by proposing the unique interplay of tangible, human and organisational resources as roots of competitive advantage. This thinking can be transferred to the contribution of the present research, where the relational and organisational efficiencies constitute firm behaviour and abilities to create value, or in most cases, reduce value of strategic patent litigation endeavours. Hence, firms must be capable of efficiently manage their legal representational relationships to reach inimitability of assets that leads to superior firm performance. Therefore, this chapter has implications for strategic infringement research by implying that although firms are efficient in diminishing their transactional costs by building economies of scale, they are not capable of managing relationships in a value-creating manor.

De Carolis (2003), find that building on firm-specific knowledge is not enough to profit and establish a competitive advantage in the long term. Similarly, this chapter showed that competencies build from the experience gained from the repeated use of the same attorneys show an inverse effect on firm performance and sales the more a company is litigating. This is quite an interesting contribution as it appears that not only the RBVs notion of inimitability of assets and patents as isolating mechanism of such are essential to gain and maintain a competitive advantage. Also, the unique competencies of the firm to manage the litigation process are vital. This implies, that companies have to make sure that they do not become impeded by existing relational patterns and closely assess if saving transaction costs is also benefitting their overall litigation profitability.

The principal implication of this study is that although organisational coordination of legal personnel and patent enforcement do link to firm performance, value appropriation is not secured per se by repeatedly employing the same attorneys. This finding will be of interest to researchers and practitioners that are concerned with firm-specific contingencies in the context of strategic patent litigation. Especially practitioners might find it useful to reassess the pitfalls of rehiring the same attorneys for multiple cases. Hence, managers need to stay flexible in the strategic patent litigation process as the risks associated with reoccurring transactions cannot be ignored. Especially in before repeatedly litigating with the same legal teams, it should be invested in building efficiencies that can be leveraged later to save costs, then the focus should be on the sales generation aspect of strategic patent litigation.

Attorneys as a human resource, can (and often will) assert their bargaining power of experience and fast work in negotiations. Whereby the plaintiff firm can benefit from attorneys knowledge and specialisation, they also need to value it to obviate hold-up, a common problem of TCE and economies of scale (Reitzig and Wagner, 2010). Whereby Reitzig and Wagner (2010) proclaim the problem as solely given for outsourcing legal work, it is also predominant for in-house legal departments and the attorneys employed by the firm itself. The basic knowledge, to practise as an attorney is not firm-specific, the lawyer acquires it by obtaining a law degree. Consequently, attorneys are relatively free in their choice of employment, and thus, might negotiate their salary or fees. However, as Liebeskind (1996) noted, firms do have more power to control the actions of their workers, than their contractees. Although this study offered many exciting contributions, it was not possible to measure if attorneys were in-house attorneys or hired from an external law firm; therefore, it would be valuable for future research to investigate if such a distinction would conclude with similar results. Especially, the complementarities between in-house and outside counsel provide a fruitful research opportunity, as this relationship is especially prone to organisation, control and agency issues (Foster, 1986). In addition, the mechanisms underlying experience building, for example, network building, seniority, internal structures or learning curves can add to our understanding of the role of attorneys in strategic patent enforcement.

Another limitation of this study is that it was not assessable who the defendant parties were and if they had litigated against the same firm with the same legal team in the past. Attorneys can accumulate knowledge on technologies and competitors so that it gets easier to defend against previous defendants of the firm because attorneys do not only gain experience on their employer, they also can gain experience on the defendants. Although the study does not offer such a distinction, the findings suggest that knowledge accumulation of attorneys is a fruitful area for future research as they constitute the missing link between the knowledge on the work of attorneys and strategic patent litigation abilities that influence performance.

A natural progression of this work is to analyse other firm-specific contingencies bearing the same characteristics as well as conducting detailed research on legal representation in the context of the RBV and TCE. This would be useful to understand further why some firms are better in managing their reoccurring relationships with attorneys and what capabilities a firm needs and how they are built to do so.

6 RQ 3: The Role of the Industrial Environment in Strategic Patent Litigation

Following the chapter on firm-specific contingencies that influence the strategic litigation and performance relationship, the next chapter focuses on industry contingencies that influence the strategic value of patent litigation. Such value can stem from certain appropriability regimes, which can be exogenously given (Cohen et al., 2000; James et al., 2013). This chapter argues that strategic patent litigation value depends on industry-specific contingencies in multi invention and single invention industries.

6.1 Introduction

When looking at litigation, it is inevitable to incorporate details on the nature of the industry of operation. Industry factors can influence the relationship of strategic asset protection against inimitability in court. Thereby, "industry" is defined as the primary industry type a firm belongs to, for example, the pharmaceutical industry. In the literature, it is widely acknowledged that strategic patenting and litigation are industry-dependent (Cohen et al., 2000; Reitzig and Wagner, 2010; Rudy and Black, 2015). What is striking is that with regards to strategic patenting and litigation, some industries are considered more similar to each other than others. In litigation research, a distinction is often made between the pharmaceutical and the semiconductor industry (Agarwal et al., 2009; Rudy and Black, 2015), arguably because these are very patent-intensive industries. However, scholars already called for investigations of inimitability and performance that cut across multiple industries (De Carolis, 2003).

Strategic patent litigation as a surrogate for inimitability has unique outcomes that should be examined in the context of industrial contingencies. The most prominent distinction in the litigation literature among industries is between multi invention industries, such as the semiconductor industry, (Hall and Ziedonis, 2001; Somaya et al., 2012; Rudy and Black, 2015) and industries such as the pharmaceutical industry, which I categorised as " single invention" industries in the following chapter. Multi invention industries are predominantly defined by two different components: fragmentation of patentable elements of an innovation and fragmentation of ownership of patents (Hall and Ziedonis, 2001; Somaya et al., 2011; Somaya et al., 2012; Rudy and Black, 2015). The concept of many separable patentable elements is based on the "complex" technology categorisation from Cohen et al. (2000). In single invention industries, the product does not contain various patentable elements but rather, for a drastic example, one

coherent technology protectable by one single patent which is owned by a single company. Therefore, single invention industries are based on the "discrete" technology categorisation from Cohen et al. (2000).

The nature of the industry is distinguished by multi invention or single invention to investigate the differences both settings can have on the influence of strategic patent litigation on costs sales, and profitability. Beukel and Zhao (2018) argue that IP protection possibilities against infringement are industry-dependent, as IP is a useful appropriation tool in some industries but not in others (Levin et al., 1987; Cohen et al., 2000). Historically, patents are considered more useful against imitation (or used) in the pharmaceutical industries but elsewhere (Beukel and Zhao, 2018). Early research stressed different inclinations to apply for patents in different industries (Levin et al., 1987; Cohen et al., 2000; Hall and Ziedonis, 2001; James et al., 2013) and the purpose of accumulating patent portfolios was found to be different between industries (Cohen et al., 2000; Reitzig, 2004b). However, the possibility of the use or threatened use of litigation was found to be the reason for patenting uniformly across multi and single invention industries, independent of the quality of the invention and its protection (Cohen et al., 2000; Reitzig, 2004b).

More recent literature on the matter of strategic patent litigation controlled for different industry effects (Somaya et al., 2007; Reitzig and Wagner, 2010) and distinguished between the semiconductor and the pharmaceutical industry to find that proprietary litigation strategies are more likely to be found in the former and defensive litigation strategies are more likely followed by firms within the latter (Rudy and Black, 2015). However, little is known about the effect of strategic litigation on performance in different industries.

One study by Agarwal (2009) found that increased strategic patent litigation activity can reduce information disclosure in the semiconductor industry and Rudy and Black (2015) did find empirical evidence that firms employing defensive strategies within the semiconductor industry enjoy higher sales. Nevertheless, the same effect could not be found for strategic patent litigation in pharmaceutical industries. Building on these few findings, it is necessary to look at how firms can benefit from their innovations by employing strategic patent litigation and how this relationship is influenced by the external industrial environment. This will fill the gap in the knowledge on industry contingencies that benefit or deter value appropriation from patent litigation.

Looking at business today, litigation is becoming more and more widespread and utilised in multiple industries. Hence, if companies are filing lawsuits against imitators, does it actually improve performance in some industries more than it does in other industries?

The following chapter shows why and how industrial contingencies are central to the study. Furthermore, the importance of the focus on strategic patent protection to reach inimitability in the context of different industry characteristics is discussed and the unique differences of multi invention and single invention industries are presented. Then, the hypotheses are developed, and the results are presented. Lastly, the chapter closes with a discussion of the findings and a link to the integrative framework *Table 1*.

6.2 Theoretical Background and Literature Review

In patent litigation, intellectual property rights are proactively enforced to stop imitative behaviour in order to gain a competitive advantage (Granstrand, 2000; Agarwal et al., 2009; Polidoro and Toh, 2011; Rudy and Black, 2015). Thereby, RBV criticism has stressed the role of contingencies that influence the effectiveness of efforts to curb imitability, emphasising market differences as one of them (Priem and Butler, 2001; Peng et al., 2009). Industrial contingencies can impact the litigation strategies that firms employ (Rudy and Black, 2015). Moreover, industry conditions do not only impact the choice of value appropriation strategy but also, the performance outcomes of such (Kusonaki et al., 1998; James et al., 2013; Rudy and Black, 2015). Hence, even when relying on the same strategies, firms from different industries can realise different financial outcomes. This can be explained by the unique nature of an industry that influences the litigation - performance relationship. To develop an integrative industry classification, I identified the fragmentation of patents and technology from innovation and isolating mechanism research as the main distinguishing industry characteristics.

Previous scholarship on patenting concentrated on the distinction between discrete and complex inventions (Cohen et al., 2000), discrete and cumulative inventions (Levin et al., 1987; Merges and Nelson, 1990), simple and complex technologies (Kash and Kingston, 2001), material-based, system-based (Kusonaki et al., 1998) or systems products industries (Somaya, 2003).

Table 19 shows the different concepts including its descriptions and industrial categorisations derived from the literature.

Table 19 Industry Classification in the Literature

Category	Description	Industry/Industries	Author, Year, Page
Single Invention			
Discrete product industries	"New, commercializable product or process is comprised [..] of few separately patentable elements. [..] typically are comprised of a relatively discrete number of patentable elements."	New drugs or chemicals Food Textiles Chemicals Drugs Metals and Metal Products	Cohen et al., 2000, p.19
Discrete inventions	"Easy to patent because the structure of the molecule of each product is unique. Easy to invent around because it is often possible to create a discrete but structurally similar product with similar properties."	Chemical Products	Levin et al., 1987, p.830
Discrete inventions	"[..] do not typically incorporate a large number of interrelated components; they stand more or less alone.[..] tend not to comprise integral components of some larger product or system they therefore do not enable the development of a wide array of ancillary products."	Pharmaceuticals Consumer goods Packaging Toys	Merges and Nelson, 1990, p.881
Material-based industries	"[..] material-based industries, e.g., chemical and pharmaceutical (Porter, 1990)."	Textile Paper General Chemical Pharmaceuticals Other Chemical Petroleum/Rubber Distilling	Kusonaki et al., 1998, p.703
Simple technologies	"A formula developed in the laboratory is comprehensible to all trained chemists and remains the same through patenting, regulatory agency approval, and manufacture."	Chemicals Pharmaceuticals	Kash and Kingston, 2001, p.12
Discrete innovations	"Innovations have fewer patentable elements that are owned or controlled be fewer or even a single firm."	Pharmaceuticals	James et al., 2013, p.1131

Multi Invention			
Complex product industries	"New, commercializable product or process is comprised of numerous separately patentable elements [..]. [..] electronic products tend to be comprised of a larger number—often hundreds--of patentable elements."	Electronics Machinery Computers Electrical equipment Electronic components Instruments Transportation equipment	Cohen et al., 2000, p.19
Cumulative inventions	"The innovation process is cumulative, with each invention built very distinctly on the previous one. The role patents play is to define the property rights [..] so that the proceeds of this cumulative process can be shared, and innovation can be encouraged."	Semiconductors	Levin et al., 1987, p.830
Cumulative inventions	"Advance is cumulative, in the sense that today's advances build on and interact with many other features of existing technology."	Automobiles Aircraft Electric light systems, Semiconductors Computer	Merges and Nelson, 1990, p.881
System-based industries	"system-based industries where products consist of a number of subsystems."	Machinery Electronics Automobiles Other Transportation Machines Precision Machinery	Kusonaki et al., 1998, p.706
Complex technologies	"The quantity of knowledge is too large and diverse; and some of the knowledge is tacit [..]. A complex technology [..] contains diverse explicit and tacit knowledge as well as syntheses of that knowledge." "If any of the components is patented, and a firm cannot obtain a license for it, this creates a severe competitive disadvantage, [..]"	Computer	Kash and Kingston, 2001, p.12 & 16
Complex innovations	"Larger number of patentable elements that are owned or controlled by a greater number of firms."	Communications Equipment	James et al., 2013, p.1131
Systems-products industries	"[they] combine multiple inventions in end-products, mutually blocking patent rights can encourage settlement in patent litigation due to the threat of counter suits by rivals using their own patents. Numerous patented inventions, which may in turn be owned by many different firms."	Computers	Somaya et al., 2003. p.18

It is striking that although definitions diverge in detail, two main factors are differentiating the nature of industries. These are the fragmentation of the technology, or the number of parts needed to assemble an innovative end product, and the fragmentation of patents attached to those parts. Cohen (2000) set out the same distinction naming them complex versus discrete products, however, the authors acknowledged that this distinction is historically mainly driven by the technology of the products rather than the fragmentation of patent rights. More recent work on innovation and IP rights by Somaya et al. (2011), therefore introduced a new categorical designation for industries dominated by complex innovation, multi invention industries. According to the authors, the termination includes systemic innovative activity but also complex systems which allows for the integration of industries where firms manufacture systems products (i.e. combining systems of different innovations in one end-product (Somaya, 2003) and those that do not. Rudy and Black (2015) adopted the term multi invention industries to categorise between industries and is now utilised for the present work in order to refer to industries, that are characterised by putting out technological inventions that are highly fragmented, hence, assembled by many different innovations that are at the same time patented by many different firms. In multi invention contexts, firms are often specialised in parts and components that can be combined with other technologies to create an innovative end product, thus, the fragmentation of the patentable elements of a product in the industry is high. Most firms in these industries utilise multiple inventions from within the company as well as from external sources (Ziedonis, 2004; Rudy and Black, 2015). That means that the fragmentation of patent ownership is equally high because the patentable elements are often patented by various companies (James et al., 2013).

To consolidate recent industry categorisations into a clear distinction for innovation and patenting research, discrete simple and material-based innovations are combined under the umbrella term of " single invention industries". This not only clarifies the terminology used in this dissertation, but it also ensures that a distinction is made on the industry level, not the technology level, as it is important to include the fragmentation of property right structures to understand the effects of strategic patenting and patent litigation. An industry-based distinction is also valuable for the present research as this study is not only looking at industries which widely researched in the context of patents and patent litigation but at multiple diverse industries. Therefore, single invention industries are in the following referring to industries, that are characterised by putting out technological inventions that are not highly fragmented, hence, In single invention contexts, the product does not contain various patentable elements but rather, for a drastic example, one coherent technology protectable by one single patent which

is owned by a single company or a only a few firms. This concept of few separable patentable elements is based on the "discrete" technology categorisation from Cohen et al. (2000).

It is necessary to understand, that such a distinction is driven by the technological advancements of the twentieth century. Somaya et al. (2011) state that although previous innovation was also fragmented, the fragmentation was not even close to being as high as in multi invention industries today, where technology and patent rights are extremely dispersed and complex (for a more thorough comparison see Somaya et al., 2011). For example, more than 150 different technologies with fragmented patent rights can be found in one single IBM notebook (Jurgens-Kowal, 2010).

The present study intends to integrate the characteristics inherent to the specific nature of an industry while focusing on patent litigation strategies, rather than patents themselves. Many previous studies suggest that patenting and patent value is dependent on industry characteristics (Arundel and Kabla, 1998; Schankerman, 1998; De Carolis, 2003; Ziedonis, 2004) and according to the RBV, successful imitation of technological competence is most likely to restrict the sustainability of competitive advantage and firm performance. De Carolis (2003) empirically tested and confirmed this effect in the context of the pharmaceutical industry by finding a negative effect of inimitability on performance. However, the author concentrates on patent citations as a proxy for imitability, thus, does not attempt to give sufficient consideration to the importance of patent protection, rather than patents, to reach inimitability.

Rudy and Black (2015), on the contrary, succeed to capture the unique power of patent protection and present a direct link between patent litigation and higher performance. Looking at the pharmaceutical and semiconductor industry, the authors indicate that the adoption of a particular patent litigation strategy and its link to firm sales is dependent on the industry. In the semiconductor industry, the authors can confirm the positive effect of proactive defensive patent litigation on firm performance. However, similarly, to De Carolis (2003), Rudy and Black (2015) also focus on the pharmaceutical industry but find that the positive relationship between strategic patent litigation and sales improvements cannot be confirmed. Although the mentioned literature has demonstrated that the power of patents and strategic patent litigation is different in certain industries, together, both studies remain narrow in their industry focus which indicates that little is known about the importance of the nature of an industry and its underlying characteristics. Ultimately, the conflicting findings lead to the question if strategic patent litigation as a surrogate for asset inimitability can lead to higher firm performance and under which industry-specific conditions it is able to do so?

As firms use similar strategic patent litigation endeavours to respond to certain appropriability regimes, this will shed light on how industry-specifics influence the outcome of strategic patent litigation employed by firms within different industries. It is now necessary to shift the attention to industry characteristics that might influence the outcomes of patent enforcement.

Industrial Contingencies

The present study also intends to approach the integration of characteristics inherent to the specific nature of an industry rather than investigating a phenomenon within one industry. Industry characteristics are defined as several factors that describe the nature of the industry, for example, the predominant fragmentation of technology or patent rights. Industry factors comprised in previous literature, such as the intensity of competition, product differentiation and cumulative innovation within an industry (James et al., 2013) are considered as well. It is a common theme in recent research that the effectiveness of patents as an imitation barrier is industry-dependent (Mansfield, 1985; Levin et al., 1987; Cohen et al., 2000; James et al., 2013). In the literature, industry factors were found to influence patent licensing of firms within an industry (Hill, 1992) or suit settlement in the pharmaceutical and computer industry (Somaya, 2003). Although a cohort of research investigated patents in the context of particular industries (Arundel and Kabla, 1998; Schankerman, 1998; De Carolis, 2003; Rudy and Black, 2015), most of the mentioned studies have focused on specific industries themselves rather than industry factors. The present study explicitly investigates this research gap by concentrating on a particular industry factor rather than the whole industry to spotlight the "cause" and not the "symptom". This approach helps to redirect the research attention from the usually spotlighted pharmaceutical and semiconductor industry to new until now unrecognised industries of equal importance.

As indicated in the last two paragraphs, it needs to be concentrated on the nature of industries rather than industries themselves. Also, the focus is on patent litigation, rather than patents, as a successful means of imitation deterrence and valid means of appropriability. The nature of industries with its underlying characteristics might provoke or diminish positive performance outcomes of strategic patent litigation due to differences in the facilitation of imitation restrictions. The present study argues that specific industry characteristics facilitate or impede patent protection based on patent protection strategies and influence their profitability implications. However, the usual extreme effect hypothesised in the pharmaceutical or semiconductor industry might be more moderate in other industries with similar underlying

characteristics. Thereby, light can be shed on the generalisability of the influence of proactive proprietary patent litigation strategies on costs as well as firm sales and profitability.

Table 20, presents industrial characteristics that are proposed to impact the effectiveness of strategic patent litigation:

Table 20 Industry-Specific Characteristics

Industry Nature: Characteristics:	Multi invention industries Patent ownership is fragmented & technology is fragmented	Single invention industries Patent ownership is concentrated & technology is concentrated	Author, Year
Patent portfolios	Thickets for exchange	Fences to exclude	Cohen et al. 2000, Ziedonis 2004, Reitzig 2004b
Countersuits	More likely	Less likely	James et al. 2013
Cross-licensing	More important due to patent pools	Less important	Cohen et al. 2000, James et al. 2013
Substitutes	More often possible	Less often possible	Cohen et al. 2000, Reitzig 2004b
Infringement Intensity	Many infringers raise costs of suing	Few infringers lower costs of suing	James et al. 2013
Infringement Detection	Harder	Easier	James et al. 2013

In multi invention industries, if fragmentation is high, firms are often interdependent on each other's technologies and need to be able to have access to a broad range of patents (Cohen et al., 2000; Somaya, 2003). Furthermore, if proprietary control of technologies is considerably fragmented (i.e. patent rights are distributed), it is more likely the case that firms develop technologies that interfere with existing patented technologies from competitors and do not have full control over their own technologies. Which means that they have to build patent pools to increase their bargaining power (Somaya, 2003; Rudy and Black, 2015). Thereby, patent thickets might be used to access and exchange competitors innovations (Reitzig, 2004b). Due to these thickets, infringement detection becomes more difficult and litigation gets more costly because the firm needs to assess patent rights (Cohen et al., 2000). Patent right dispersion in multi invention industries fosters a climate of, inter-firm dependencies, negotiations, cross-licensing and countersuits (Cohen et al., 2000; Ziedonis, 2004; Rudy and Black, 2015).

In single invention industries, like the pharmaceutical industry, firms are increasingly concerned to create a unique market position by fostering R&D (Rudy and Black, 2015). Here, patent pools are more likely used to pose as fences, guarding against imitative behaviour

(Reitzig, 2004b), or the patenting of similar technology (Cohen et al., 2000). Without extensive patent pools due to high fragmentation of technology and patent rights, it gets easier to assess the number of infringers and defend against them (James et al., 2013). Moreover, countersuits become less likely which in turn increases litigation ease (Cohen et al., 2000; Reitzig, 2004b). Although the difference in enforcement behaviour is often in the focus of research, multiple studies stress that strategic patent litigation is practised across industries[16] and that unique industry characteristics can influence the patent litigation – performance relationship.

6.3 Hypotheses

If a firm is initiating patent infringement lawsuits in multi invention industries the influence on sales and costs might diverge from single invention industries because of the following reasons.

Multi Invention Industries

Costs

If multiple patents overlap with each other, it can create so-called patent thickets, which in turn can lead to an intra-industry tax on inventions (Shapiro, 2001). In high-technology industries, technologies often incorporate many different constituents, and firms often devote monetary stakes to their business incentives before patent ownership of competitors is quantifiable (Somaya, 2012). The patent thicket can aggravate a firm's inability to timely predict the patents potentially held by competitors on the market. Hence, because of the fragmented technology and patent ownership, detecting infringement becomes more time-intensive, increasing costs for personnel. Multiple lengthy court proceedings in multi invention industries might increase the involvement of top management resources. Whereby managers might need to coordinate and monitor several infringement suits involving uncertain patent rights at the same time. This does not only affect indirect legal costs but also increases the disruption resulting from strategic patent litigation on other organisational processes.

Filing infringement suits and the direct legal costs involved might increase because countersuits and multiple infringements result in increased legal fees due to attorney and legal personnel salaries even further (Chen et al., 2015). In addition, firms might experience increased monetary burdens during the discovery phase because IP right ownership has to be proven in court which

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[16] Contrary to the arguments in existent literature that the firms in the pharmaceutical industry rely more heavily on infringement litigation, in the used dataset, 36,13% of the proactive proprietary patent litigation suits are located in the single invention industries, whereas 63,87% are filed in multi invention industries.

can be time-consuming and difficult in multi invention contexts (James et al., 2013). Thereby the organisational effort and the monitoring of the litigation process and the resources and partners involved increasing the costs of patent litigation.

Sales

In multi invention industries, countersuits with the aim of mutual hold-up are more often filed than in single invention industries (Somaya, 2003; James et al., 2013). Thereby, because of the fragmented ownership of patents, it might be more difficult for firms to benefit from legal proceedings against infringement in court because other firms might effectively countersue (James et al., 2013) utilising their patent stocks. Counterclaims can also substantially lengthen the strategic patent litigation proceedings, increasing uncertainty and disruption of product development (Chen et al., 2015) and impeding the possibilities of value creation for the firm. Consequently, counterclaims can also block the plaintiff from commercialising the end product and, thus, from conducting or upholding sales. If court proceedings are favourable for the plaintiff, the unique characteristics of multi invention industries could nevertheless impede sales creation. Due to short-product lifecycles in multi invention industries, the technology might be outdated by the end of the proceedings. Hence, it might be increasingly difficult for firms to increase their sales as imitation is more difficult to condemn in the given time frame and the window to commercialise products on high prices is narrow.

Another important factor of high fragmented ownership is that it could increase the possibility of multiple different firms infringing on the patent owners' patent rights (Ziedonis, 2004; James et al., 2013). Therefore, to protect the invention from imitation, the plaintiff might have to sue more than one infringer to block imitation. This is because strategic litigation decisions are patent-dependent. If the plaintiff, for example, has to sue three different firms for infringing on the same patent, three different proceedings have to take place, each time only excluding one of the defendants from commercialising the patented invention. Then, the other defendants would still be able to commercialise the innovation, providing consumers with the option to buy their product. Thereby, the plaintiff's sales are diminished. Arguably, high fragmentation in patent ownership could also increase patent owners' sales, for example, if the plaintiff can successfully exclude multiple firms or receive licensing net sales from them.

Single Invention Industries

Costs

In single invention industries, the costs of strategic patent litigation might be less substantial than in multi invention industries. This is because firms most likely have to sue only one or two infringers due to low infringement practices in those industries (James et al. 2013), that can be traced back to, inter alia, high costs for R&D (Rudy and Black, 2015). Consequently, disruption due to a high number of suits and costly organisation are kept low. Furthermore, because of the discrete technology features and concentrated patent ownership, detecting infringement becomes faster and less costly (James, 2013). If companies only have to litigate against a limited number of infringers, the time commitment of top-management teams is less pronounced, diminishing costs. Furthermore, with fewer competitors involved, monitoring and controlling activities may be reduced, saving administrative costs.

Sales

The effects strategic patent litigation on firm sales might be reversed in industries of single invention nature. In single invention industries, firms have to deal with fewer substitutes due to cost and time-intensive R&D procedures (Cohen et al. 2000, Reitzig 2004b, Rudy and Black, 2015). This enables the firm to better predict the patents potentially held by competitors on the market and detect infringement in time. Hence, infringement lawsuits against competitors can be forecasted more easily and are most likely directed at fewer firms (Rudy and Black, 2015). If fewer competitors have to be stopped from infringing on the plaintiff's product, the options on the market for the consumer are also lower. This, in turn, can increase the sales of the plaintiff by securing a favourable market position. Additionally, the threat of effective countersuits is lower because high stocks of patents in defensive patent portfolios are less likely and they are mostly used as fences rather than "currency" (Cohen et al., 2000; James et al., 2013). Therefore, the product supply on the market is more concentrated on a few firms. Moreover, due to fewer complex fragmentations in patent rights, ownership decisions might derive faster, enabling the plaintiff of successful strategic patent litigation to commercialise the patented product without interruptions from declaratory judgement proceedings.

However, long product -life cycles in single invention industries can also negatively influence strategic patent litigation benefits. In some cases, it is possible, that patents expire before the plaintiff can commercialise the innovative product (Pisano, 1997; De Carolis, 2003; Markman et al., 2004; Liu and La Croix, 2015).

In sum, the effect of a specific patent litigation strategy on costs, sales and profitability is hypothesised to be dependent on the technological and patent characteristics within industries. Thereby, it is distinguished if the specific nature of an industry is multi- or single invention. Because infringement detection and sales generation are more difficult and costly if an industry is characterised by multi invention, compared to single invention industries, I derive that:

Hypothesis 1: in multi invention industries, strategic patent litigation has a more positive effect on firm cost than in single invention industries.

Hypothesis 2: in multi invention industries, strategic patent litigation has a less positive influence on firm sales than in single invention industries.

Hypothesis 3: in multi invention industries, strategic patent litigation has a less positive effect on firm profitability than in single invention industries.

Table 21 depicts these effects for the two industries, illustrating the weakening and strengthening effects of the industrial contingencies.

Table 21 Sales, Costs and Profitability in Multi- and Single Invention Industries

	Litigation Strategy	**Costs**	**Sales**	**Profitability**
Multi invention	Strategic Patent Litigation	++	+	+
Single invention	Strategic Patent Litigation	+	++	++

6.4 Data and Methods

6.4.1 Sample

The sample to test the Hypotheses contains active and inactive publicly traded and private U.S. companies. The data is unbalanced panel data ranging over 16 years, from 2000-2015. The sample concentrates on manufacturing firms (SIC codes 20-39), excluding firms with the Sic code 39, other manufacturing industries (see: Cohen 2000). I used litigation data from the PLD provided by USPTO and merged it with financial data from the TOB dataset. I excluded industries of the 4-digit Sic codes with less than 5 firm-year observations. The final sample for the analysis comprises 3,269 litigating and non-litigating firms from 278 Industries with 21,745 observations.

Table 22 2-Digit Sic code Industry Distribution of Firm-Year Observations

Industry	SIC code groups	Observations
Food and Kindred Products	20	822
Tobacco Products	21	51
Textile Mill Products	22	98
Apparel and Other Finished Products Made From Fabrics And Similar Materials	23	196
Lumber and Wood Products, Except Furniture	24	143
Furniture and Fixtures	25	138
Paper and Allied Products	26	300
Printing, Publishing, and Allied Industries	27	376
Chemicals and Allied Products	28	4,999
Petroleum Refining and Related Industries	29	168
Rubber and Miscellaneous Plastics Products	30	404
Leather and Leather Products	31	96
Stone, Clay, Glass, and Concrete Products	32	204
Primary Metal Industries	33	549
Fabricated Metal Products, Except Machinery and Transportation Equipment	34	593
Industrial and Commercial Machinery and Computer Equipment	35	2,522
Electronic and Other Electrical Equipment and Components, Except Computer Equipment	36	4,726
Transportation Equipment	37	1,138
Measuring, Analyzing, and Controlling Instruments; Photographic, Medical and Optical Goods; Watches and Clocks	38	4,222
Total	19	21,745

Industry analysis (3,269 U.S. Manufacturing Firms, 2000-2015).

Table 22, shows that, as expected, most observations are centred in the Sic codes 28 chemicals and allied products, comprising the pharmaceutical industries and 36 electronic and other electrical equipment, comprising the semiconductor and electronics industry. However, other

industries, such as industrial and commercial machinery and computer equipment, measuring, analysing and controlling, transportation equipment or even food and kindred products also show significant representation which further stresses the importance of inclusive theory development and data analysis.

Figure 12 shows the distribution and means of cases per firm in each of the 2-Digit Sic codes ranging from 20 to 38. It is, again, clear that the pharmaceutical industry (28) and industrial and commercial machinery and computer equipment, measuring, analysing and controlling instruments (38) are both front runner in patent litigation. However, when looking at mean cases per firm, the difference is not as striking. It can be seen, that in other industries, for example, leather and leather products (31), firms litigate with a similar mean number of cases. It is also interesting, that although the electronic industry contains many firm-year observations and was a setting for litigation research before, firms that litigate in these industries litigate with fewer cases than firms in other industries.

Figure 12 Litigation Lawsuits Per Firm and Industry
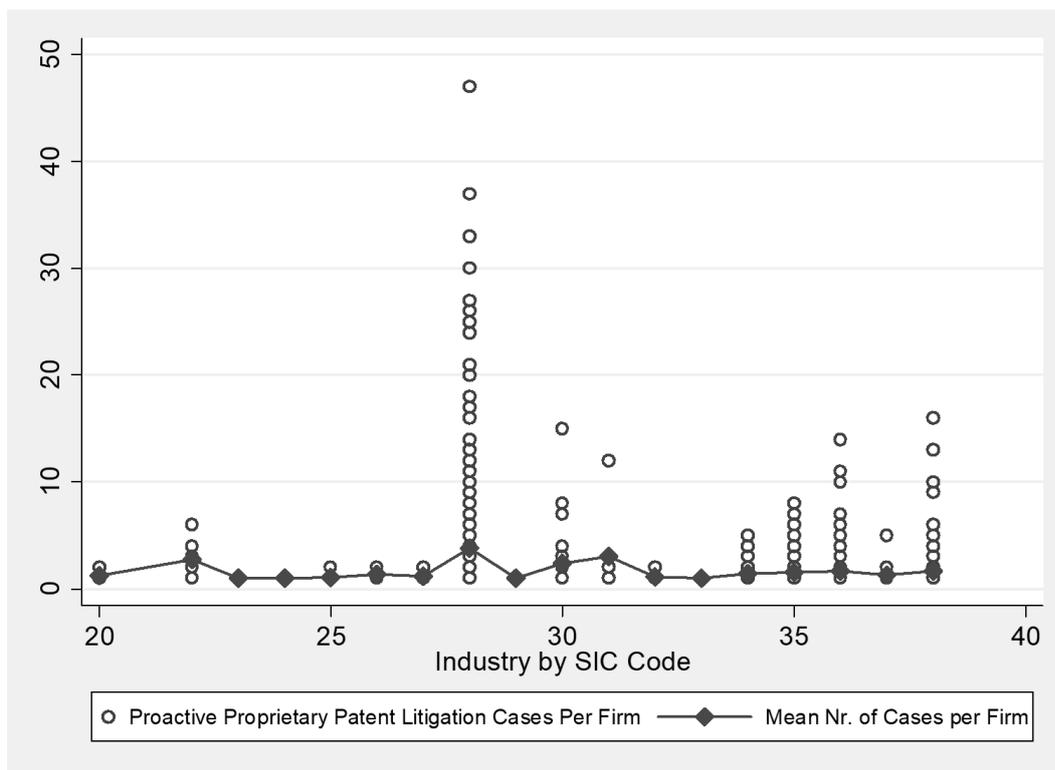
The following *Table 23* shows the percentage of cases from the litigating firms alone. It can be concluded that nearly one-third of all litigation cases are filed in the pharmaceutical industries (28). After that, the semiconductor and electronics industries comprise the second most prominent group of litigators (36). Followed by industrial and commercial machinery and computer equipment, measuring, analysing and controlling instruments (38). In other

industries, such as tobacco products, lumber, wood and furniture (21) and petroleum refining industries (29) litigation is very rare. Collectively, 31% of all cases filed were filed within the single invention industries, while the remaining 69% were filed in the multi invention industries.

Table 23 Frequency of Litigation

| Industry	SIC code groups	Frequency of Litigation (in percent)
Food and Kindred Products	20	1.24%
Tobacco Products	21	0.14%
Textile Mill Products	22	0.41%
Apparel and Other Finished Products Made From Fabrics And Similar Materials	23	0.41%
Lumber and Wood Products, Except Furniture	24	0.28%
Furniture and Fixtures	25	1.1%
Paper and Allied Products	26	0.83%
Printing, Publishing, and Allied Industries	27	1.24%
Chemicals and Allied Products	28	25.07%
Petroleum Refining and Related Industries	29	0.28%
Rubber and Miscellaneous Plastics Products	30	1.65%
Leather and Leather Products	31	0.69%
Stone, Clay, Glass, and Concrete Products	32	0.83%
Primary Metal Industries	33	0.96%
Fabricated Metal Products, Except Machinery and Transportation Equipment	34	2.34%
Industrial and Commercial Machinery and Computer Equipment	35	13.09%
Electronic and Other Electrical Equipment and Components, Except Computer Equipment	36	23.42%
Transportation Equipment	37	3.31%
Measuring, Analyzing, and Controlling Instruments; Photographic, Medical and Optical Goods; Watches and Clocks	38	22.73%
Total	19	100%

Industry analysis (726 U.S. Manufacturing Firms, 2000-2015).

6.4.2 Additional Independent Variable

Multi invention Industries

Multi invention environments might moderate the relationship between strategic patent litigation and firm performance. Therefore, I created a multi invention measure which identifies the industry according to their respective SIC codes. This method has been used in previous studies within the litigation domain (Kusonaki et al., 1998; Cohen et al., 2000; Somaya et al., 2007; Reitzig and Wagner, 2010). The classification of the industries is derived from Cohen (2000), who used ISIC code dummies to distinguish between complex and discrete product

industries. To fit Cohens classification, I adjusted the primary and predominant Sic Code measure according to the ISIC classification system. I matched the SIC codes with the ISIC codes before their revision number three[17]. When the ISIC codes requested a different classification, I performed it by their example.

I achieved the classification of the industries by creating a dummy variable (1: multi invention, 0: single invention), splitting the dataset into SIC codes > 2900 (multi invention) and SIC codes ≤ 2900 (single invention). Sic codes lower than 2900 represent pharmaceutical manufacturing, for instance, chemicals and other allied products as well as food, tobacco, textile, apparel, lumber, furniture, paper, printing and petroleum and coal products. Sic codes higher than 2900 represent, rubber and plastic, leather, stone, clay, glass, primary metal, fabricated metal and industrial machinery products, as well as, electronic and other electric equipment, transportation equipment, instruments and related products as well as miscellaneous manufacturing industries. As suggested by Kreft and De Leeuw (1998), I excluded industries with less than five individual observations from the analysis to ensure sufficient representation for each Industry.

6.5 Descriptives

Table 24 Descriptive Statistics and Correlations: RQ3

Variable	Mean	S.d.	1	2	3	4	5	6	7	8	9	10
1 Costs[1]	0.159	0.221										
2 Sales[1]	12.881	1.108	-0.05 ***									
3 ROS[1]	-0.238	4.095	-0.49 ***	0.59 ***								
4 Firm Age[1]	3.177	0.600	-0.17 ***	0.27 ***	0.37 ***							
5 Firm Size[1]	5.921	2.605	-0.30 ***	0.42 ***	0.60 ***	0.45 ***						
6 R&D Intensity[1]	2.533	2.070	0.52 ***	-0.46 ***	-0.64 ***	-0.20 ***	-0.31 ***					
7 Organisational Slack[1]	0.799	0.449	-0.30 ***	0.37 ***	0.37 ***	0.12 ***	-0.05 ***	-0.54 ***				
8 Litigation Duration[1]	0.042	0.154	0.01 **	0.08 ***	0.10 ***	0.07 ***	0.14 ***	0.03 ***	-0.04 ***			
9 Heckman Exit	0.315	0.232	-0.08 ***	0.13 ***	0.18 ***	0.19 ***	0.33 ***	-0.04 ***	0.01	0.15 ***		
10 Patent Litigation	0.001	0.022	0.07 ***	0.02 **	-0.02 ***	0.00	-0.02 ***	0.04 ***	-0.02 **	0.16 ***	0.00	
11 Multi-Invention Industries	0.536	0.498	-0.16 ***	-0.05 ***	0.00	-0.02 **	-0.12 ***	0.07 ***	0.07 ***	-0.01	0.07 ***	-0.02 ***

Number of Observations=21.745 ; ***p<0.01; **p<0.05; *p<0.1. [1]Variable is IHS-transformed.

Table 24 illustrates the means, standard deviations and the correlations. The correlation matrix shows acceptable values among the independent variables. However, the value between Organisational Slack and R&D Intensity (-0,54) as well as Firm Age and Firm Size (0,45) unsurprisingly indicate a stronger correlation.

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[17] https://unstats.un.org/unsd/classifications/Econ/ISIC#ISIC3

To rule out multicollinearity issues, I calculated the variance inflation factors (VIFs) for each variable using the "collin" command in Stata. The mean VIF for the full model was 1.32, with ranging scores between 1.03 for Patent Litigation and 1.74 for R&D intensity. These VIFs are below 10, which is the cut off value defined by Myers (1990). Even though the test suggests that multicollinearity is not an issue for the analysis, I performed a robustness check to further rule out any multicollinearity issues. By excluding R&D intensity, it showed that the measure does not distort the results from the main model.

6.6 Results

Table 25 Multilevel Mixed Method Analysis: RQ3

	Model [1]	Model [2]	Model [3]	Model [4]	Model [5]	Model [6]	Model [7]	Model [8]	Model [9]
	Litigation Costs:			Firm Performance:					
Dependent Variable:	**Costs**[1]	**Costs**[1]	**Costs**[1]	**Sales**[1]	**Sales**[1]	**Sales**[1]	**ROS**[1]	**ROS**[1]	**ROS**[1]
	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
Control Variables	[SE]	[SE]	[SE]	[SE]	[SE]	[SE]	[SE]	[SE]	[SE]
Firm Age[1]	0.0002	0.0002	0.0002	0.008	0.007	0.007	0.168***	0.165***	0.164***
	[0.004]	[0.004]	[0.004]	[0.019]	[0.019]	[0.019]	[0.054]	[0.054]	[0.054]
Firm Size[1]	-0.021***	-0.021***	-0.021***	0.210***	0.210***	0.210***	0.884***	0.886***	0.887***
	[0.001]	[0.001]	[0.001]	[0.005]	[0.005]	[0.005]	[0.014]	[0.014]	[0.014]
R&D Intensity[1]	0.032***	0.032***	0.032***	-0.323***	-0.324***	-0.324***	-0.858***	-0.861***	-0.861***
	[0.001]	[0.001]	[0.001]	[0.004]	[0.004]	[0.004]	[0.014]	[0.014]	[0.014]
Organisational Slack[1]	-0.0002	-0.0002	-0.0002	0.670***	0.670***	0.670***	1.796***	1.792***	1.794***
	[0.004]	[0.004]	[0.004]	[0.014]	[0.014]	[0.014]	[0.048]	[0.048]	[0.048]
Litigation Duration[1]	0.025***	0.022***	0.022***	0.038	0.032	0.033	0.077	0.043	0.048
	[0.007]	[0.007]	[0.007]	[0.028]	[0.028]	[0.028]	[0.098]	[0.099]	[0.099]
Heckman Exit	0.006	0.007	0.007	-0.055***	-0.055***	-0.056***	-0.154**	-0.157**	-0.159**
	[0.005]	[0.005]	[0.005]	[0.019]	[0.019]	[0.019]	[0.067]	[0.067]	[0.067]
Independent Variable									
Patent Litigation		0.003***	0.003**		0.005	-0.002		0.027**	-0.016
		[0.001]	[0.001]		[0.004]	[0.005]		[0.013]	[0.016]
Multi-Invention Industries		-0.044***	-0.044***		0.233***	0.234***		0.756***	0.760***
		[0.010]	[0.010]		[0.079]	[0.079]		[0.158]	[0.158]
Interaction effects									
Patent Litigation x Multi-Invention Industries			-0.001			0.020**			0.133***
			[0.002]			[0.008]			[0.028]
Constant	0.238***	0.259***	0.259***	11.609***	11.515***	11.515***	-6.059***	-6.369***	-6.368***
	[0.017]	[0.017]	[0.017]	[0.082]	[0.088]	[0.088]	[0.219]	[0.227]	[0.227]
Year Controls	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.

Number of Observations=21.745 [3.269 Firms] ; ***p<0.01; **p<0.05; *p<0.1. [1]Variable is IHS-transformed.

Hypothesis 1 suggested that, in multi invention industries, strategic patent litigation has a more positive effect on firm cost than in single invention industries. The analysis shows that the influence of patent litigation intensity on costs is negative and insignificant in multi invention industries (coefficient = -0.001, p> .1). Therefore, Hypothesis 1 is not supported.

Table 25 shows the main results. In model 6, we can see that the influence of strategic patent litigation in the multi invention industries is positive on firm sales. Hence, the influence is increasing to a significant influence. Hypothesis 2 suggested that, in multi invention industries, strategic patent litigation has a less positive influence on firm sales than in single invention industries (coefficient = 0.02, p< .05). Therefore, Hypothesis 2 is not supported as the results suggest that in multi invention industries, patent litigation has a more positive influence than in single invention industries. The results show, that with a one-standard-deviation increase in litigation intensity, the dependent variable sales increases by 2% more than in the single invention industries.

Hypothesis 3 suggested that, in multi invention industries, strategic patent litigation has a less positive effect on firm profitability than in single invention industries. The analysis shows that the effect is positive and significant for patent litigation in multi invention industries (coefficient = 0.133, p< .01). With a one-standard-deviation increase in litigation intensity, the dependent variable ROS increases 13,88% more in the multi invention industries than in the single invention industries. Hence, Hypothesis 3 is not supported

To further examine the effect of intensive litigation on firm perfromance in the multi and single invention industries, I refined the analysis by drawing predictive margins at different levels of patent litigation. To do so, I transformed the IHS values back to their original scale.

Figure 13 illustrates the predicted margins for the influence of litigation intensity on sales in the different industries. Whereas an increased litigation intensity has a slight inverse effect on sales per employee, it is positive and growing in multi invention industries.

Figure 13 Predictive Margins Sales per Employee: RQ3
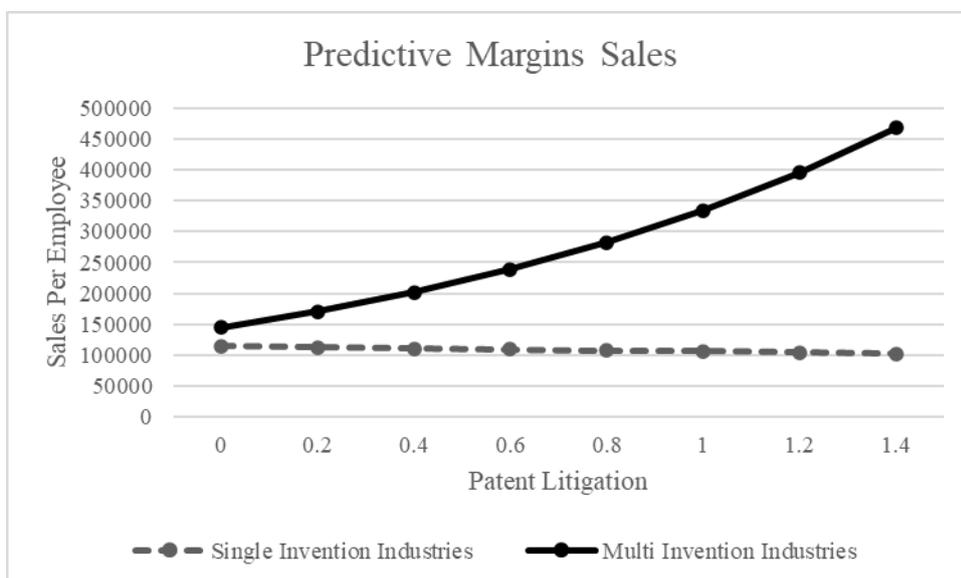
Figure 14 depict*s* the influence of patent litigation on ROS. Whereby the influence is becoming slightly negative with an increased number of cases in the single invention industries, the positive effect of infringement suits on ROS in multi invention industries is growing positive significantly fast.

Figure 14 Predictive Margins ROS: RQ3
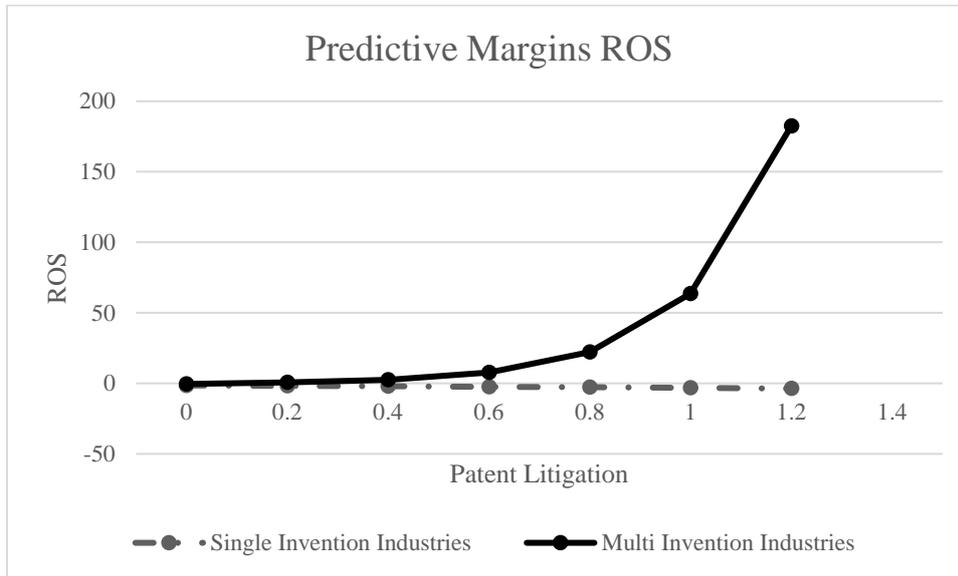
The most prominent finding to emerge from this study is that contrary to all predictions, strategic patent litigation seems more beneficial in multi invention industries than it is in single invention industries. This finding is similar to past research, which could not identify a positive relationship between patent litigation or inimitability and firm performance in the pharmaceutical industry (De Carolis, 2003; Rudy and Black, 2015).

One of the more significant findings is that firms in multi invention industries which are strategically litigating in court can increase sales and profitability, hence, appropriate value from their innovations while protecting their patents from imitation. Furthermore, even though expected otherwise, strategic litigation is found to be less costly when it comes to administrative costs in multi invention industries compared to single invention industries.

6.6.1 Magnitude of the Effects

Accounting for random effects and mean centring, from the 90th to the 99.9[th] percentile of cases, the predicted sales per employee decreases from 173,191.8 to 170,488.8 in single invention industries, thus varying by 2,703.0. This predicted effect is less pronounced than in the multi invention industries with an increase of 39,997.6 from 218,655.9 to 258,653.5. The effect on ROS is similar, where it decreases from -0.6890 to -0.8668 which translates to 0.2 percentage

points for firms in single invention industries. For firms in multi invention industries, the effect reverses increasing from 0.1101 to 1.4467. Thus, here the litigation intensity accounts for a variation in ROS of 1.3 percentage points for companies in multi invention industries. *Table 26 and 27*, depict the results.

Table 26 Magnitude of the Effects for Sales per Employee: RQ3

Percentile	Patent Litigation	Predicted Sales per Employee	
	Value	Single Invention Industries	Multi Invention Industries
90.0	0	173,191.8	218,655.9
99.0	0.0008	173,181.4	218,793.7
99.2	0.0021	173,162.3	219,038.9
99.4	0.0083	173,077.5	220,191.9
99.6	0.1	171,834.1	237,814.1
99.9	0.2	170,488.8	258,653.5

Table 27 Magnitude of the Effects for ROS: RQ3

Percentile	Patent Litigation	Predicted ROS	
	Value	Single Invention Industries	Multi Invention Industries
90.0	0	-0.6890	0.1101
99.0	0.0008	-0.6896	0.1141
99.2	0.0021	-0.6907	0.1212
99.4	0.0083	-0.6961	0.1544
99.6	0.1	-0.7760	0.6814
99.9	0.2	-0.8668	1.4467

6.6.2 Additional Tests

I calculated the Akaike (AIC) (Akaikei, 1973) and Bayes (BIC) (Schwarz, 1978) information criteria to assess if the model benefits from including the multi and single industry distinction. The AIC and BIC of the model for sales not including the predictors and the moderator variable were (36825.23 and 37024.91). These values are higher than the full model with (36814.07 and 37024.91). This is supported by an information loss of $\triangle_i = 11.16 > 2$ if the predictors and the moderator are not included, calculated from the formula of Burnham and Anderson (2004) $\triangle_i = AIC_i - AIC_{min}$, which allows the interpretation of AIC scales. The same could be examined for the cost model, where the full model (-23651.75 and -23436.1) is better than the control model (-23638.07 and -23438.39), showing a $\triangle_i = 13,68 > 2$. The ROS model behaves similar showing a better fit for the inclusion of the predictor variables with (89506.65 and 89722.3), than without (89546.8 and 89746.47) and a delta difference of $\triangle_i = 40,15 > 2$.

6.7 Discussion and Conclusion

The present chapter contributed by stressing the importance of industrial contingencies in strategic litigation for the performance of firms by looking at multiple industries and 26 consecutive years. Thereby, this chapter followed a call by Somaya (2012) and Rudy and Black (2015) for more generalisable findings. The suggestions of these findings are twofold, one, industry-specific contingencies are vital in profit generation from innovation and efforts to secure inimitability of assets, and two, firms in multi invention industries show a higher ability to appropriate value from their innovations, despite exogenous restraints. Thus, firms in the multi invention industries can more effectively protect their innovation from imitation than firms in the single invention industries.

For the expanding field of strategic patent litigation, these contributions imply that the integration of industrial contingencies is necessary to reach clear explanations for competitive advantage due to abilities to ensure inimitability of assets with strategic patent litigation. Furthermore, this chapter contributes to the innovation literature by suggesting that even when firms operate in the same appropriability regime their effectiveness in shielding patents from imitation can significantly differ. Rent generation from IP rights in multi invention industries might not solely dependent on the exogenous appropriability regime, it might be endogenously pursued by firms to protect themselves from imitation.

Contrary to the expectations, firms in multi invention industries which are strategically litigating in court can increase sales and profitability, and hence, appropriate value from their innovations by protecting their patents from imitation. The beneficial effect on sales compared to the single invention industries might be explained by the characteristics of multi invention industries and the firms that are operating within it. The multi invention industries are shaped by cross-dependencies because of fragmented technologies and patent ownerships. Firms might utilise this environment to litigate against multiple infringers when promising patents are not designated for cross-licensing. Hence, the patent owners' sales might increase significantly as multiple firms can be blocked from selling important technology that might be in use in many different products. Firms might initiate one lawsuit first and if promising outcomes derived, proceed with taking multiple other infringers to court. These proceedings are then expected to be settled in a similar way, therefore, the risk and uncertainty of litigation are less pronounced than in single invention industries. Furthermore, trials might provide less organisational hurdles as the plaintiff can build efficiencies in the process, reducing overall administrative costs. As the non-significant effect on administrative costs in the results is showing, in multi invention

industries firms can neutralise the negative significant effect on strategic patent litigation on firm costs.

Moreover, strategic patent litigation can entail a significant signalling effect on competitors by showing a tough stance against imitation and a willingness to defend intellectual property (Somaya, 2003). While previous literature expected this effect to be one of the main reasons of improved performance in the pharmaceutical industry (Rudy and Black, 2015), the current findings suggest that it could also be important in the multi invention industries. In multi invention industries, where technology and patent rights are fragmented, signalling could be a very important strategy to scare off multiple competitors or to negotiate better outcomes for the plaintiff. Here, because of the mere dependence of the firms on each other, it might be that tough firms excel in profiting from their innovations by showing rigour. In single invention industries, however, showing rigour might deter infringers but because of the industry structure and R&D importance might not come with additional benefits due to a lack of dependence.

Another explanation could be the comparably low intensity of R&D, patent intensity and product introductions of firms in the pharmaceutical industry (i.e. single invention industries) as found by Rudy and Black (2015). The authors conclude that while firms in the industry rely more heavily on patent litigation, they are not putting enough products on the market, arguably because of stronger industry regulation, to generate sufficient sales and impact their profitability with strategic litigation. This could also be the case for other single invention industries.

In sum, the unique contribution of this chapter lies in showing that the trade-off between sales and costs in different institutional settings can determine the outcomes of strategic patent litigation on firm profitability. A strengthened effect of patent litigation on firm sales and a neutralised effect of it on sales are shown to positively influence firm profitability in multi invention industries. On the contrary, the reversed effect on sales and costs in single invention industries conditions negative profitability.

The research question on how the influences of strategic patent litigation on firm performance vary according to the industrial environment was examined in this chapter. Contrary to previous knowledge the chapter clarified the role of the institutional environment of firms and looked at multiple industries to assess the effectiveness of patent litigation as a surrogate for patent protection and imitation. It was shown that even though the environmental constraints in multi invention industries are severe, firms, however, skilfully apply patent litigation in those industries. The chapter provided a comprehensive set of industry characteristics that can influence the strategic patent litigation – performance relationships and thus refines our

knowledge on why some firms profit from their IP protection more than others. However, on limitation of this chapter is that the direct link between those characteristics, strategic patent litigation and performance could not be tested. Future research could refine that knowledge by testing the mechanisms and their individual influence on the results.

One main weakness of this study was the paucity of patent-related data on technological fields that did not allow industry classification based on another measure than Sic codes. Previous studies have criticised the usage of Sic codes as an industry measure due to the possibility of affiliation to multiple industries and diversification (Somaya et al., 2007). An additional uncontrolled factor is the distribution of litigation cases which are mainly clustered within the chemical and allied and instruments and related products industries. Notwithstanding these limitations, the study suggests that firms in the multi invention industries profit from their innovations more effectively than firms in the single invention industries, utilising strategic patent litigation in a way that allows them to appropriate value from their assets.

This research has thrown up some questions whereby there is room for further investigations into the reasons why firms in the multi invention industries can increase their sales and profitability from strategic patent litigation more than firms in the single invention industries while keeping their administrative costs lower. The findings will be of interest for future research on the specific capabilities of firms, which allows them to profit from strategic patent litigation in a given appropriability regime.

7 RQ 4: The Role of Institutional Targeting in Strategic Patent Litigation

The last chapter investigates institutional contingencies in strategic patent litigation. Moving from industry contingencies to a wider angle that incorporates the institutional specific knowledge of firms that will further refine scholarship on the link between strategic patent enforcement and competitive advantage. Chapter 4 is providing the completion of the set of contributions that are developed by answering the research questions from the integrative framework *Table 1*.

7.1 Introduction

The U.S. patent enforcement system offers a strong appropriability regime, where plaintiffs can defend their patented innovations in court effectively (Lerner, 1995; Lanjouw and Schankerman, 2004; Somaya and McDaniel, 2012; James et al., 2013; Beukel and Zhao, 2018). However, even though the system holds up well in the international comparison in facilitating patent enforcement, there are significant regional inter-district differences that paint a picture of an ununified patent enforcement system transforming the process to an opportunistic "hunt for venue" (Moore, 2001). These significant institutional inter-district differences might foster firm-specific strategies that companies employ to profit from their institutional environment in litigation.

Strategic patent litigation, as any strategic behaviour, is conditioned by the context of the firm. Peng et al. (2009), argue that to bring context to firm and industry-based strategic research, one has to integrate the perspective of the institutional environment of a firm. And in 2004, Hillmann et al. write, that strategic corporate activity directed at institutions and firm performance offers vast research opportunities. Thereby, by definition, institutions establish a formal and informal set of rules and constraints that condition behaviour and interaction (North, 1990; Peng et al., 2009). Hence, the focus on the firm and its abilities to appropriate value from innovation as well as the industry conditions that impact strategic appropriation is not sufficient. To fully understand strategic behaviour in patent litigation that enables a firm to isolate against imitation and create superior performance, one has to look at the firm-specific response to the United States patent system institutions. If firms operate in the same exogenously given institutional environment, they still might appropriate value from their innovations by strategically utilising those regimes to efficiently isolate against imitation. Hence, the purpose

of this chapter is to contribute to by incorporating institutional targeting as a mechanism to decrease costs, increase benefits and improve the profitability of strategic patent enforcement. Ultimately, this will give an insight into how some plaintiffs can capture value from their innovation while utilising their institutional context, and others are not.

Strong appropriability regimes must be exogenously given by institutions to create an environment where patents can be challenged in a court based on rules and laws (Teece et al., 1997; Cohen et al., 2000). Thereby, the purpose of institutions is to reduce uncertainty by providing a framework which sets boundaries to actions. However, although they pose a limit to the behaviour of firms, institutions also give room for firms to make choices within these boundaries (Lee et al., 2007; Peng et al., 2009). Consequently, the strategies of a firm, although made within the constraints of the institutional environment, are still rational choices to pursue internal goals and gain competitive advantage (Peng et al., 2009). More so, literature postulates firms can create institutional capabilities influencing competitive advantage (Rumelt, 1984; Oliver, 1997). Related literature has looked at how firms manage their ties with institutions, for example, regulatory agencies or courts, to increase performance in different environments (Holburn and Vanden Bergh, 2008), targeting of pivotal institutions (Vanden Bergh and Holburn, 2007), and how creed and responsiveness of courts influence firm lobbying (De Figueiredo and De Figueiredo Jr, 2002). However, despite the growing popularity of studies concentrating on patent enforcement strategies (Somaya, 2003; Lanjouw and Schankerman, 2004; Agarwal et al., 2009; Somaya and McDaniel, 2012; Rudy and Black, 2015), only a few papers concentrated on litigation strategies responding to the institutional environment of a firm (Somaya and McDaniel, 2012; Rudy and Black, 2015).

Scholars in the litigation field, have studied "non-market" strategies related to institutions in litigation by looking at the firm-level experience as determinants of institutional targeting (Somaya and McDaniel, 2012), firm, country and industry characteristics that influence institutional targeting (Beukel and Zhao, 2018), as well as the global effect they might have for international firms (Chen et al., 2015; Beukel and Zhao, 2018) or resulting institutional or policy changes (Somaya and McDaniel, 2012; Beukel and Zhao, 2018). Furthermore, Paik and Zhu (2016), looked at how potential patent litigation can determine court targeting of firms with different patent portfolios in strong and weak institutional settings. Hence, whereby the determinants of court targeting in weak and strong appropriability regimes have been discussed (Somaya and McDaniel, 2012; Paik and Zhu, 2016; Beukel and Zhao, 2018), scholars in the field of patent litigation paid little attention to firm-specific abilities with regards to institutional

targeting and the effect it can have on the costs and benefits of strategic patent litigation in the same appropriability regime, the United States court system.

Taking the importance of strategies in risky litigation endeavours into account, this chapter will clarify if the firm-specific efficiencies that companies built to profit from their institutional environment influence costs, sales and profitability of patent litigation. Hence, this chapter seeks to present institutional targeting as a strategic ability of companies to take advantage of their experience with their institutional environment to maximise profits from their innovations.

In the following, a theoretical framework for strategic location choices in patent litigation is developed and the proposed hypotheses are presented. Then, the influence of repeated institutional targeting on firm costs as well as performance measures on firm sales and overall profitability is tested. Afterwards, the results are discussed, and it is concluded with a link to the integrative framework *Table 1*.

7.2   Theoretical Background and Literature Review

Institutional targeting or forum shopping are terms describing the act of a plaintiff strategically choosing a venue to bring forward a claim (Somaya and McDaniel, 2012). Forum shopping is a common practice that is often recognised and thoroughly discussed within the legal community (Moore, 2001; Hricik, 2004; Leychkis, 2006; Love and Yoon, 2017). Especially in patent litigation, the chosen venue can be one of the most crucial factors determining the course of a lawsuit. In patent litigation suits, the plaintiff(s) are responsible for choosing an appropriate court to file their suits. Venue statutes are in place that traditionally regulated the venue of a suit, however, their loose interpretation gives plaintiffs freedom to choose jurisdiction in any district (Moore, 2001). Hence, plaintiffs developed a habit of forum shopping, choosing venues that might be favourable towards them (Black et al., 1999; Leychkis, 2006) or that they are familiar with.

Institutional targeting results in a landscape of litigation where some courts being chosen more frequently by plaintiffs, creating hotspots for patent litigation. Forum shopping is driven by substantial differences among district courts that are often caused by discretionary choices of jurisdictions and procedural differences. The benefits of institutional targeting strategies, however, might inter alia derive from institution-specific efficiencies that companies built from repeated litigation experiences within the same court(s).

In 2007, the top ten targeted districts accounted for half of the filed patent cases (Leychkis, 2006). The Eastern District of Texas rose to be one of the most popular venues for plaintiffs (Moore, 2001; Leychkis, 2006; Love and Yoon, 2017; Beukel and Zhao, 2018). Many practitioners ironically pick on the fact, that Marshall, Texas, where the court is located, is a small town that does not host many innovative businesses and is most famous for its annual Fire Ant Festival (Leychkis, 2006), questioning the motives of venue choice. Other districts, for example, the Northern District of California are also well-targeted. However, less surprising as it is located in Silicon Valley and serves twice as much population (Moore, 2001; Leychkis, 2006; Love and Yoon, 2017). According to a study by Leychkis (2006), the northern district of California decided in more than half of its cases in favour of the plaintiff. Nevertheless, under the most frequented courts, there are also such that only win less than a third of their cases in favour of the plaintiff. From an economic perspective, looking at the outcome rate, why would firms target these courts so frequently? Practice-oriented scholarship seems to be inconclusive in answering that question. For example, Leychkis (2006) argued, that Texas popularity stems from three factors: the knowledge and experience of the judges with patent litigation, discovery practices and verdicts in favour of the plaintiffs. Others claim, it is targeted because of it being a "rocket docket", where cases are brought to trial quickly (Zhu, 2010). However, Love and Yoon (2017) argued, that in direct comparison, Texas is not the fastest district and less plaintiff-friendly than others. While Texas does offer some favourable procedural benefits for plaintiffs, for example, early timing of discovery (hence, expensive for defendants), and might be targeted because of other factors, such as speed, and judge's experience. In sum, from a practical strategic perspective, we know that firms target specific courts for benefits such as judges' experience, time advantages and favourable verdicts (Leychkis, 2006).

One of the main arguments in this chapter of why some firms might be able to increase their outcomes from patent litigation is that they are better in building their ability to learn from their previous experience with institutions. While venues offer the same framework for all plaintiffs, some might be able to create institution-specific capabilities (Somaya and McDaniel, 2012) which enable them to profit from strategic litigation. Research postulates that institution-specific capabilities can foster firm performance (Hillman et al., 2004; Somaya and McDaniel, 2012), in saying that nonmarket strategies of firms are aimed at utilising their legal and political environment in the form of institutions (Baron, 1995; Somaya and McDaniel, 2012; Rudy and Black, 2015) to generate value. This is an important observation because strategic location choice can be the make or break point, deciding about costs, advantages and possible outcomes

of strategic patent litigation for the plaintiff (Zhu, 2010; Somaya and McDaniel, 2012; Beukel and Zhao, 2018).

Firms can develop institution-specific resources and capabilities from repeated experience at the same jurisdictional venue (Somaya and McDaniel, 2012). Such experience might include knowledge about networks within the institution, judges and court-employees, procedures, the verdict history of an institution (Beukel and Zhao, 2018) or with an institution. These might be factors, why firms become more tied to a single or a few courts. Regardless of the case and judge, it might be that firms accumulate court specific organisational knowledge, making them more reluctant to litigate elsewhere. Hence, firms that actively engage in repeated targeting of the institutions that they are familiar with, might create advantages towards their competitors. If that is the case, repeated litigation at the same institutions can link strategic patent litigation to decreased costs, increased benefits and improved profitability.

7.3 Hypotheses

The following shows, that firm's targeting practices might influence the effect of strategic patent litigation on performance if the firm is repeatedly litigating at the same venues.

Costs

From past scholarship on forum shopping, it can be derived, that specification varies across courts in the United States. Judges can collect experiences by being targeted repeatedly by firms of a particular industry. For example, judges in the Delaware district court are especially experienced in pharmaceutical litigation because many pharmaceutical firms have headquarters there. In turn, litigating in courts with experienced judges reduces uncertainty and increases predictability for the plaintiffs (Somaya and McDaniel, 2012; Beukel and Zhao, 2018). Therefore, firms litigating in the same courts repeatedly might increase the judge's knowledge of their patented technology. This can have the effect, that future cases reach a verdict sooner which can decrease costs of trial for the plaintiff as shorter litigation periods disburden employees and management teams from disruptive court proceedings.

With increasing transactions with the same court, judges not only gain knowledge about firm-specific technology, but firms also get to know unique practices and procedures, requirements, organisation, structure and expected time frames of litigation activities in the same court. Once

the court and its prior decision on cases have been evaluated, the costs of data collection will eventually reduce for future cases. Costs involved transactions with courts as formal institutions not only comprise direct costs, such as court fees, they also most likely incorporate fees of managerial time involvement, compensation for attorneys who have to familiarise themselves with the specific court and processes as well as other relational costs, such as networking. All of which, and maybe more might be inherently tied to transaction cost savings resulting from repeated transactions (Riordan and Williamson, 1985; Williamson, 2002). Thereby, each additional lawsuit filed at the same venue potentially influences the costs of future transactions. That is because gathered knowledge might reduce the perceived risks associated with a given court and facilitate speed and execution ease of administrative work (Beukel and Zhao, 2018). Procedural costs can be saved as it reduces litigation expenses, and allows managers to reallocate resources while meeting demands of shareholders and collaborators, it also deters defendants from inflating procedural costs, for example, with unnecessary delays (Somaya and McDaniel, 2012). Hence, litigating in the same court repeatedly might lower the administrative costs associated with patent enforcement.

Hypothesis 1: Repeated use of the same courts weakens the positive effects of strategic patent litigation on firm costs.

Sales

If firms target the same courts repeatedly, they do not have to familiarise themselves over and over again with procedural differences, new judges, and other venue-specific particularities. Customising infringement lawsuits to different courts takes time and entails risks, which might lead to delays that postpone decisions. More crucially, judges need to be familiarised with and capable of reaching a verdict on the patented technology (Beukel and Zhao, 2018). Furthermore, timing is crucial in patent litigation endeavours because technology often has short product life cycles with small windows to benefit from innovation (Cohen et al., 2000). Concentrating on courts known to the plaintiff and preferably already familiarised with its technology can increase the speed and quality of a verdict urging infringers to stop commercialising products sooner and thus, sales benefits can be increased by a unique market position.

Firms can develop knowledge on the past verdicts at one jurisdiction and increase their knowledge on the peculiarities at specific courts if they have litigated there frequently. Moreover, besides experience, firms can create social capital at a specific court derived from networking. Firms get familiar with decision-makers, local service firms, business partners, and of course, judges and legal personnel at the venue (Yoffie 1987 cited in Somaya and McDaniel,

2012). These ties might facilitate their learning and increase the potential of successful strategic patent litigation due to risk minimisation or other benefits from the personal network. These benefits might lead to successful outcomes of legal endeavours and increase the possibilities of favourable or speedy proceedings. This, in turn, leads to a better market position when competition can be diminished and fewer substitutes are produced, increasing sales for the plaintiff.

Also, independently of whether the actual infringement occurred, some courts are known for posing high discovery costs at the beginning of trials. Defendants will often settle for less if deterred by high costs of discovery early in the proceedings. Targeting a few courts that are expected to proceed the cases to trial quickly or present high discovery costs (expensive for the defendant) early on, can lead to faster decisions and possible actions to prevent the manufacturing of substitutes.

Furthermore, if plaintiffs strategically repeatedly litigate in courts that are located in non-business areas (for example, Marshall Texas) defendants are forced to dispute the case in unknown courts with no geographic or cognitive proximity to their familiar environment. This can increase their willingness to settle the dispute (Love and Yoon, 2017) but also diminishes their chances of winning the case. Hence, the plaintiff has better chances of ensuring that competitors have to stop commercialising the patented innovation.

Hypothesis 2: Repeated use of the same courts strengthens the positive effects of strategic patent litigation on firm sales.

Profitability

In sum, firms can increase sales benefits by repeatedly targeting the same institutions while reducing administrative costs due to repeated transactions. Therefore, firms that repeatedly target the same institutions might increase profitability more than firms which do not target the same institutions repeatedly.

Hypothesis 3: Repeated use of the same courts strengthens the positive effects of strategic patent litigation on firm profitability.

7.4 Data and Methods

7.4.1 Sample

I used litigation data from the PLD provided by USPTO and merged it with financial data from the TOB dataset. Court data was originally consolidated within the USPTO dataset as information included for each case, hence, data cleaning and matching were redundant. To create a court specific measurement, I excluded duplicates within the court data (i.e. when the same case was assigned to the same court twice). Then, I consolidated differences in spelling to a clear and coherent name categorisation and created a firm-year-specific variable.

The sample to test the Hypotheses contains active and inactive publicly traded and private U.S. companies. The data is unbalanced panel data ranging over 16 years, from 2000-2015. The sample concentrates on manufacturing firms (SIC codes 20-39), excluding firms with the Sic code 39, other manufacturing industries (see: Cohen 2000). I further excluded industries based on the 4-digit Sic codes with less than 5 firm-year observations. The final sample for the analysis comprises 3,269 litigating and non-litigating firms from 278 Industries with 21,745 observations.

7.4.2 Additional Independent Variable

Litigating Repeatedly in the Same Court(s)

Previous litigation research measured institution-specific capabilities by accumulating the prior patent enforcement experience of a firm, hence prior suits filed in each court (Somaya and McDaniel, 2012). While the theoretical rationale for targeting courts repeatedly does not translate to measuring direct experience towards a specific institution (operationalized by Somaya and McDaniel (2012) when looking at general purpose or specialized tribunals), I followed the logic of the construct and altered it to measure the proposed theoretical concept of repeated litigation in the same courts. Similarly, to repeated use of the same legal personnel and Somaya and McDaniel (2012), I counted prior and current suit-years for each individual court a plaintiff was litigating in, incorporating multiple infringement suits if necessary. Thereby, I can account for the differences in the significance of litigation cases and estimate a proxy for the firm's institution-specific knowledge accumulation over time (Somaya and McDaniel, 2012).

I proceeded with estimating a ratio, dividing the cumulative sum of the number of cases filed across all courts in a given year by the total number of targeted courts per year. Other than Somaya and McDaniel (2012), the panel data structure of the data required to measure each year based on the courts that a company was litigating in that given year. Moreover, because I did not distinguish between two type of courts (as Somaya and McDaniel did) but included multiple court locations, forming a ratio was necessary to account for the number of courts a firm chose to litigate at. Furthermore, I created a moderator variable with patent litigation using standardised measures.

To test the alternative measure of a count of the number of lawsuits filed at different courts, I excluded case duration to focus on the repeated filing only. This alternative measure did not distort the results from the main model. Hence, I proceeded with incorporating litigation duration as this is in line with the measurement practice of previous scholars which used court-specific lawsuit measures by counting the years and cases in a specific court accumulated for up to 10 years (Somaya and McDaniel, 2012) and measurement operationalisations in similar streams of research (Delios and Henisz, 2000).

Previous literature on court targeting in litigation used the Herfindahl Index (Herfindahl, 1950; Kelly, 1981) to measure global litigation concentration based on the number of infringement cases across countries (Beukel and Zhao, 2018). Following the theoretical logic, that concentrating on a few courts increases predictability and reduces risks and costs associated with uncertainty. One benefit of targeting fewer courts is that firms do not have to familiarize themselves with different procedural processes, judges, and other venue-specific particularities. Customizing infringement lawsuits to different courts takes time and executive attention, which might lead to delays that postpone decisions. More crucially, judges need to be familiarised with and capable of reaching a verdict on the proprietor patented technology (Beukel and Zhao, 2018). Hence, concentrating on fewer courts that might be familiarised with the technology can increase the speed and quality of a verdict, and hence, sales benefits can be increased. Furthermore, concentrating on fewer courts decreases the costs involved with repeatedly educating on the technology, uncertainty with the verdict, and, travel costs. Somaya and McDaniel (2012) and Beukel and Zhao (2018) noted that targeting courts educated in a specific context can be cost-saving with respects to the education of judges on special legal, political or technological circumstances.

To measure the effect of court concentration (i.e. the rate of concentration on courts), I created the Herfindahl Index for plaintiffs in infringement suits per firm-year by calculating how many

infringement cases each plaintiff had in each court in each year (n) and dividing this measure by the total number of infringement suits each plaintiff had per year (N). Then, the result is squared and summed per firm-year. The sum of squared shares results in a plaintiff-year-cases-court-concentration ratio.

$$\text{Herfindahl Index (Firm-Year)} = \sum_{k=0}^{n} \left(\frac{n}{N}\right)^2$$

However, a huge drawback of the court concentration measure is, that does not take previous cases into account. It is calculated on a year by year basis. Hence, the measure is a mismatch to the theoretical argument of the dissertation but would be beneficial to evaluate if companies that litigate in fewer courts increase their performance due to streamlining of the litigation process. Nevertheless, the alternative operationalization did not fit the proposed theoretical concept properly.

7.5 Descriptives

Table 28 Descriptive Statistics and Correlations: RQ4

Variable	Mean	S.d.	1	2	3	4	5	6	7	8	9	10
1 Costs[1]	0.159	0.221										
2 Sales[1]	12.881	1.108	-0.05 ***									
3 ROS[1]	-0.238	4.095	-0.49 ***	0.59 ***								
4 Firm Age[1]	3.177	0.600	-0.17 ***	0.27 ***	0.37 ***							
5 Firm Size[1]	5.921	2.605	-0.30 ***	0.42 ***	0.60 ***	0.45 ***						
6 R&D Intensity[1]	2.533	2.070	0.52 ***	-0.46 ***	-0.64 ***	-0.20 ***	-0.31 ***					
7 Organisational Slack[1]	0.799	0.449	-0.30 ***	0.37 ***	0.37 ***	0.12 ***	-0.05 ***	-0.54 ***				
8 Litigation Duration[1]	0.042	0.154	0.01 **	0.08 ***	0.10 ***	0.07 ***	0.14 ***	0.03 ***	-0.04 ***			
9 Heckman Exit	0.315	0.232	-0.08 ***	0.13 ***	0.18 ***	0.19 ***	0.33 ***	-0.04 ***	0.01	0.15 ***		
10 Patent Litigation	0.001	0.022	0.07 ***	0.02 **	-0.02 ***	0.00	-0.02 ***	0.04 ***	-0.02 **	0.16 ***	0.00	
11 Court Repetition	0.179	0.800	0.01	0.08 ***	0.10 ***	0.08 ***	0.13 ***	0.02 **	-0.03 ***	0.81 ***	0.14 ***	0.12 ***

Number of Observations=21.745 ; ***p<0.01; **p<0.05; *p<0.1. [1]Variable is IHS-transformed.

Table 28 depicts the means, standard deviations and the correlations. The correlation matrix shows acceptable values among the independent variables. However, it is striking that Organisational Slack and R&D Intensity, as well as court repetition and the duration of the litigation cases measured on days, show a correlation of (-.54) and (.81) respectively. A correlation between litigation duration and repeated court targeting is not surprising, as targeting is measured for the entire duration of the litigation case.

However, to rule out multicollinearity issues, I calculated the variance inflation factors (VIFs) for each variable using the "collin" command in Stata. The mean VIF for the full model was 1.79, with ranging scores between 1.03 for Patent Litigation and 2.99 for Litigation Duration.

These VIFs are below 10, which is the cut off value defined by Myers (1990). Even though the test suggests that multicollinearity is not an issue for the analysis, I performed a robustness check to further rule out any multicollinearity issues. By excluding Duration of Litigation, it showed that the measure does not distort the results from the main model. Furthermore, to curb multicollinearity issues, I mean centred the court experience variable of the moderator interaction term (Aiken et al., 1991).

7.6 Results

Table 29 includes the results from the multilevel mixed method analysis of strategic patent litigation and institutional targeting on costs, sales and ROS.

Table 29 Multilevel Mixed Method Analysis: RQ4

	Model [1]	Model [2]	Model [3]	Model [4]	Model [5]	Model [6]	Model [7]	Model [8]	Model [9]
	Litigation Costs:			Firm Performance:					
Dependent Variable:	**Costs[1]**	**Costs[1]**	**Costs[1]**	**Sales[1]**	**Sales[1]**	**Sales[1]**	**ROS[1]**	**ROS[1]**	**ROS[1]**
Control Variables	Coef. [SE]	Coef. [SE]	Coef. [SE]	Coef. [SE]	Coef. [SE]	Coef. [SE]	Coef. [SE]	Coef. [SE]	Coef. [SE]
Firm Age[1]	0.0002	0.0001	0.0001	0.008	0.008	0.008	0.168***	0.167***	0.168***
	[0.004]	[0.004]	[0.004]	[0.019]	[0.019]	[0.019]	[0.054]	[0.054]	[0.054]
Firm Size[1]	-0.021***	-0.021***	-0.021***	0.210***	0.210***	0.210***	0.884***	0.884***	0.884***
	[0.001]	[0.001]	[0.001]	[0.005]	[0.005]	[0.005]	[0.014]	[0.014]	[0.014]
R&D Intensity[1]	0.032***	0.032***	0.032***	-0.323***	-0.323***	-0.323***	-0.858***	-0.858***	-0.858***
	[0.001]	[0.001]	[0.001]	[0.004]	[0.004]	[0.004]	[0.014]	[0.014]	[0.014]
Organisational Slack[1]	-0.0002	-0.0002	-0.0001	0.670***	0.670***	0.670***	1.796***	1.796***	1.796***
	[0.004]	[0.004]	[0.004]	[0.014]	[0.014]	[0.014]	[0.048]	[0.048]	[0.048]
Litigation Duration[1]	0.025***	0.024**	0.023**	0.038	0.056	0.045	0.077	0.021	-0.025
	[0.007]	[0.010]	[0.011]	[0.028]	[0.040]	[0.041]	[0.098]	[0.143]	[0.144]
Heckman Exit	0.006	0.007	0.006	-0.055***	-0.054***	-0.055***	-0.154**	-0.153**	-0.154**
	[0.005]	[0.005]	[0.005]	[0.019]	[0.019]	[0.019]	[0.067]	[0.067]	[0.067]
Independent Variable									
Patent Litigation		0.003***	0.005***		0.005	0.020***		0.027**	0.089***
		[0.001]	[0.002]		[0.004]	[0.007]		[0.013]	[0.025]
Court Repetition		-0.001	-0.0003		-0.005	-0.003		0.005	0.013
		[0.002]	[0.002]		[0.006]	[0.006]		[0.022]	[0.022]
Interaction effects									
Patent Litigation x Court Repetition			-0.001			-0.005**			-0.022***
			[0.001]			[0.002]			[0.008]
Constant	0.238***	0.238***	0.238***	11.609***	11.607***	11.608***	-6.059***	-6.060***	-6.057***
	[0.017]	[0.017]	[0.017]	[0.082]	[0.082]	[0.082]	[0.219]	[0.219]	[0.219]
Year Controls	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.

Number of Observations=21.745 [3.269 Firms] ; ***p<0.01; **p<0.05; *p<0.1. [1]Variable is IHS-transformed.

Hypothesis 1 stated, that if a plaintiff in infringement lawsuits is litigating in the same courts repeatedly, it will have a negative influence on firm costs. Although the results show a negative effect on firm sales, the result is not significant on the p<0.05 level (coefficient = -0.001, p>.05).

Even though this implies that the positive effect is normalised by experience with the courts, Hypothesis 1 is not supported.

In Hypothesis 2, it was suggested, that if a plaintiff in infringement lawsuits is litigating in the same courts repeatedly, it will have a positive influence on firm sales. From the results, it can be deducted, that litigating in the same court repeatedly negatively influences the effect of strategic patent litigation on firm sales (coefficient = -0.005, p< .05). Thus, Hypothesis 2 is not supported.

Lastly, Hypothesis 3 specified, that if a plaintiff in infringement lawsuits is litigating in the same courts repeatedly, it will have a positive influence on firm profitability. From the results, it can be seen, that the positive influence of strategic patent litigation is turned negative and significant when firms repeatedly litigate in the same courts and have a high litigation intensity (coefficient = -0.022, p< .01). This can be interpreted as for every one standard deviation increase in the moderator, return on sales decreases by 2,2%. Therefore, Hypothesis 3 is not supported.

To further break down the influence of strategic patent litigation on firm sales and profitability, if a firm is litigating repeatedly in the same courts, I refined the analysis by drawing predicted margins at different levels of patent litigation. To do so, I transformed the IHS values back to the original scale.

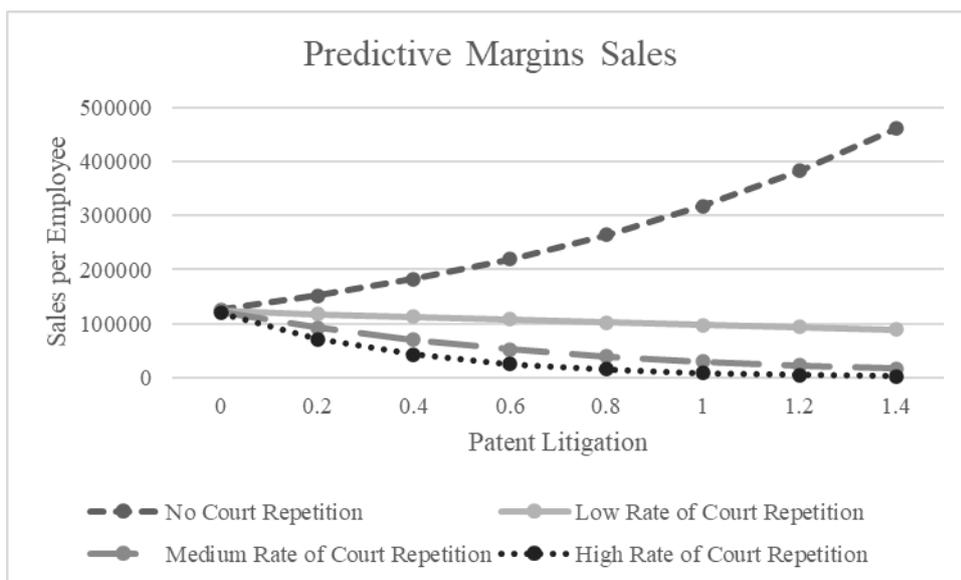*Figure 15 Predictive Margins Sales per Employee: RQ4*

Figure 15 depicts the effect of strategic patent litigation on sales per employee for four different rates of case repetition in a given court. It is striking that patent litigation at lower levels has a positive effect on firm sales, however, with increasing litigation intensity, the influence of it on

sales lessens if a firm is not solely litigating in a low repetition rate, hence, different courts. If they do so, however, the positive influence is strengthened.

Figure 16 Predictive Margins ROS: RQ4
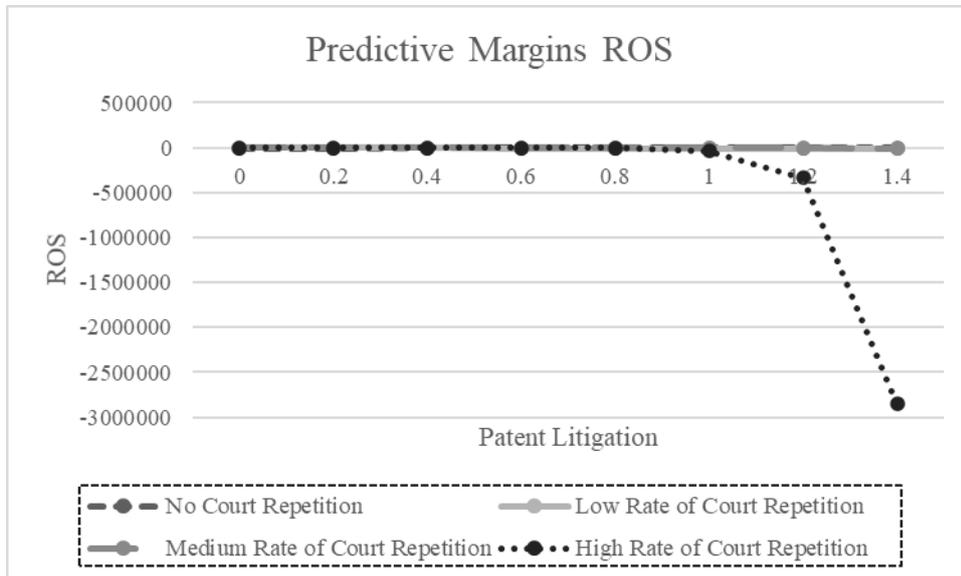
Figure 16 shows the effect of strategic patent litigation intensity on ROS. Whereas the effect is close to zero for firms that litigate up to a medium rate of suit years and a medium rate of court repetition, the effect drastically becomes negative if firms litigate intensively in the same courts repeatedly. This suggests, that either, firms might become rigid in using the court system to their advantage in a way that inhibits their performance significantly, or it can be argued that the freedom of choice to litigate in the same venue repeatedly might not be as pronounced as expected.

7.6.1   Magnitude of the Effects

Keeping everything else equal and adjusted for random effects and mean centring, with a higher litigation intensity from the 90th to the 99.9^{th} percentile the predicted sales per employee increase from 196,385.1 to 236,419.4 thus varying by 40,061.3 if the plaintiff is not litigating in the same courts repeatedly. For the medium rate of repetition of courts, the effect does not increase as steep, it varies by 8,844.1 decreasing from 193,432.3 to 184,588.2. Whereas sales per employee decreases by 46,402.3 from 190,523.9 to 144,121.6 if the company has a high rate of court repetition. Between the 90th and 99.9^{th} percentile, the predicted ROS increases from -0.2450 to 0.6319 which translates to an increase of 0.88 percentage points for firms that do not litigate in the same courts repeatedly. For firms with a medium court repetition, the effect is less significant ranging from -0.1755 to -0.3304, hence, 0.15 percentage points. For a high

rate of repetition, the effect is decreasing from -0.1069 to -1.5930, thus, between the 90th to the 99.9[th] percentile litigation intensity accounts for a variation in with a variance in ROS of 1.49 percentage points for companies that have a high rate of court repetition. *Table 30 and 31* show the results.

Table 30 Magnitude of the Effects for Sales per Employees: RQ4

Percentile	Patent Litigation Value	Predicted Sales per Employee		
		No Court Repetition (90th Percentile)	Medium Rate of Court Repetition (99th Percentile)	High Rate of Court Repetition (99.9[th] Percentile)
90.0	0	196,385.1	193,432.3	190,523.9
99.0	0.0008	196,522.6	193,397.5	190,323.9
99.2	0.0021	196,764.5	193,337.5	189,970.3
99.4	0.0083	197,909.0	193,055.5	188,320.9
99.6	0.1	215,473.4	188,958.5	165,706.4
99.9	0.2	236,419.4	184,588.2	144,121.6

Table 31 Magnitude of the Effects for ROS: RQ4

Percentile	Patent Litigation Value	Predicted Sales ROS		
		No Court Repetition (90th Percentile)	Medium Rate of Court Repetition (99th Percentile)	High Rate of Court Repetition (99.9[th] Percentile)
90.0	0	-0.2450	-0.1755	-0.1069
99.0	0.0008	-0.2417	-0.1761	-0.1112
99.2	0.0021	-0.2360	-0.1771	-0.1188
99.4	0.0083	-0.2091	-0.1819	-0.1548
99.6	0.1	0.1776	-0.2522	-0.7287
99.9	0.2	0.6319	-0.3304	-1.5930

7.6.2 Additional Tests

I calculated the Akaike (AIC) (Akaikei, 1973) and Bayes (BIC) (Schwarz, 1978) information criteria to assess if the model benefits from including the court experience moderator. The AIC and BIC of the model for sales not including the predictors and the moderator variable were (36825.23 and 37024.91). These values are higher than the full model with (36822.81 and 37038.46). This is supported by an information loss of $\triangle_i = 2.24 > 2$ if the predictors and the moderator are not included, calculated from the formula of Burnham and Anderson (2004) $\triangle_i = AIC_i - AIC_{min}$, which allows the interpretation of AIC scales. The same could be examined for the cost model, the full model with (-23636.37 and -23420.72) is better than the control model (-23638.07 and -23438.39), showing a $\triangle_i = 1,7 < 2$. This delta is particularly low, suggesting that the findings of the G&A expenses value are not based on a model that significantly benefitted from parsimony. The ROS model behaves better showing a better fit for the inclusion of the predictor variables with (89542.49 and 89758.14), than without (89546.8 and 89746.47) and a delta difference of $\triangle_i = 4,31 > 2$.

7.6.2.1 Court Popularity

As discussed in this chapter, plaintiffs might choose specific venues more frequently based on multiple factors, inter alia, such factors are proximity to the location of business, previous litigation experience at a venue and the anticipation for favourable decisions or procedural differences (Black et al., 1999; Leychkis, 2006; Love and Yoon, 2017; Beukel and Zhao, 2018). Moreover, forum shopping causes some courts being chosen more frequently by plaintiffs, creating hotspots for patent litigation. Litigation activity shows a certain level of concentration on a number of most targeted courts (Leychkis, 2006). However, some of these venues for example, the Eastern District of Texas are targeted by a specific type of firms, predominantly patent sharks (Leychkis, 2006). As this is a particular demographic that is not represented by the sample of this dissertation, I decided to control for court popularity by estimating a firm-year measure of the average frequency of court popularity among the targeted courts. The sample of this dissertation contains lawsuit filed in 91 district courts. From a total of 9,454 cases, 6,812 cases were filed in the top ten of the most frequently targeted district courts. This distribution shows similarities to the findings of previous studies (Leychkis, 2006). Whereas the first three most targeted district courts account for approximately two-fifth of the targeted venues. It is important to note, that the location decision is often made by proximity, hence, some courts experience a higher frequency of litigation because of their location, such as Delaware's District Court as many U.S. corporations are incorporated in Delaware (1st most frequented court in the sample), New Jersey's district court as it is close to the pharmaceutical and life science sector hub in the area (2nd most frequented court in the sample) or California's Silicon Valley as the California Northern District Court is close to the Silicon Valley cluster (3rd most frequented court in the sample). However, as many scholars stated before, (Leychkis, 2006; Zhu, 2010; Love and Yoon, 2017; Beukel and Zhao, 2018) and as discussed in this chapter, these courts are also targeted because of their unique characteristics and the tendency of firm to repeatedly litigate in the same courts.

To make sure that the results of this chapter are not driven by the most frequented courts in the sample, I estimated the number of cases that were filed in each court in each year from 2000-2015 and used this measure to estimate a firm-year average depicting the average frequentation of popular venues. Hence court popularity shows how intensely a company was frequenting the most popular venues in each year across its cases. I used this measure in an additional robustness test as a control variable to account for court popularity effects. *Table 32* shows that the findings are robust to the changes.

Table 32 Controlling for the Effect of Court Popularity

	Model [1]	Model [2]	Model [3]	Model [4]	Model [5]	Model [6]	Model [7]	Model [8]	Model [9]
	Litigation Costs:			Firm Performance:					
Dependent Variable:	**Costs[1]**	**Costs[1]**	**Costs[1]**	**Sales[1]**	**Sales[1]**	**Sales[1]**	**ROS[1]**	**ROS[1]**	**ROS[1]**
Control Variables	Coef. [SE]	Coef. [SE]	Coef. [SE]	Coef. [SE]	Coef. [SE]	Coef. [SE]	Coef. [SE]	Coef. [SE]	Coef. [SE]
Firm Age[1]	0.0001	0.0001	0.0001	0.008	0.008	0.008	0.169***	0.169***	0.169***
	[0.004]	[0.004]	[0.004]	[0.019]	[0.019]	[0.019]	[0.054]	[0.054]	[0.054]
Firm Size[1]	-0.021***	-0.021***	-0.021***	0.210***	0.210***	0.210***	0.883***	0.884***	0.884***
	[0.001]	[0.001]	[0.001]	[0.005]	[0.005]	[0.005]	[0.014]	[0.014]	[0.014]
R&D Intensity[1]	0.032***	0.032***	0.032***	-0.323***	-0.323***	-0.323***	-0.859***	-0.858***	-0.858***
	[0.001]	[0.001]	[0.001]	[0.004]	[0.004]	[0.004]	[0.014]	[0.014]	[0.014]
Organisational Slack[1]	-0.0001	-0.0001	-0.0001	0.670***	0.670***	0.670***	1.794***	1.794***	1.795***
	[0.004]	[0.004]	[0.004]	[0.014]	[0.014]	[0.014]	[0.048]	[0.048]	[0.048]
Litigation Duration[1]	-0.034	-0.028	-0.028	-0.086	-0.056	-0.060	-0.782**	-0.762**	-0.778**
	[0.024]	[0.025]	[0.025]	[0.091]	[0.095]	[0.095]	[0.323]	[0.337]	[0.337]
Heckman Exit	0.006	0.006	0.006	-0.056***	-0.055***	-0.055***	-0.158**	-0.157**	-0.158**
	[0.005]	[0.005]	[0.005]	[0.019]	[0.019]	[0.019]	[0.067]	[0.067]	[0.067]
Court Popularity[1]	0.007***	0.006**	0.006**	0.015	0.013	0.013	0.101***	0.093**	0.090**
	[0.003]	[0.003]	[0.003]	[0.010]	[0.010]	[0.010]	[0.036]	[0.036]	[0.036]
Independent Variable									
Patent Litigation		0.002**	0.004**		0.004	0.019***		0.023*	0.083***
		[0.001]	[0.002]		[0.004]	[0.007]		[0.013]	[0.025]
Court Repetition		-0.001	-0.000		-0.005	-0.003		0.004	0.011
		[0.002]	[0.002]		[0.006]	[0.006]		[0.022]	[0.022]
Interaction effects									
Patent Litigation x Court Repetition			-0.001			-0.005**			-0.021**
			[0.001]			[0.002]			[0.008]
Constant	11.609***	11.607***	11.608***	11.609***	11.607***	11.608***	-6.061***	-6.062***	-6.059***
	[0.082]	[0.082]	[0.082]	[0.082]	[0.082]	[0.082]	[0.219]	[0.219]	[0.219]
Year Controls	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.

Number of Observations=21.745 [3.269 Firms] ; ***p<0.01; **p<0.05; *p<0.1. [1]Variable is IHS-transformed.

7.6.2.2 *The Link Between the Repeated Use of the Same Attorneys and the Same Courts*

In order to investigate the link between using the same legal personnel and using the same courts, I conducted a correlation analysis. The correlation matrix in *Table 33* shows acceptable and expected values among the independent variables. However, the correlation coefficient of 0.73 between the repeated use of the same courts and the same attorneys indicates a stronger correlation. The square of the correlation coefficient $r^2 = .53$ which translates to 53% of variation in the repeated use of attorneys can be explained by the variation in the repeated use of the same courts.

This can be explained by the possibility, that the decision to choose a team of attorneys might not always be individually made but sometimes the decision to litigate within a specific venue

might result in choosing a legal team that has been previously worked with to litigate in the same venue (Beukel and Zhao, 2018).

Table 33 Descriptive Statistics and Correlation: Link Between RQ2 and RQ4

Variable	Mean	S.d.	1	2	3	4	5	6	7	8	9	10	11
1 Costs[1]	0.159	0.221											
2 Sales[1]	12.881	1.108	-0.05 ***										
3 ROS[1]	-0.238	4.095	-0.49 ***	0.59 ***									
4 Firm Age[1]	3.177	0.600	-0.17 ***	0.27 ***	0.37 ***								
5 Firm Size[1]	5.921	2.605	-0.30 ***	0.42 ***	0.60 ***	0.45 ***							
6 R&D Intensity[1]	2.533	2.070	0.52 ***	-0.46 ***	-0.64 ***	-0.20 ***	-0.31 ***						
7 Organisational Slack[1]	0.799	0.449	-0.30 ***	0.37 ***	0.37 ***	0.12 ***	-0.05 ***	-0.54 ***					
8 Litigation Duration[1]	0.042	0.154	0.01 **	0.08 ***	0.10 ***	0.07 ***	0.14 ***	0.03 ***	-0.04 ***				
9 Heckman Exit	0.315	0.232	-0.08 ***	0.13 ***	0.18 ***	0.19 ***	0.33 ***	-0.04 ***	0.01	0.15 ***			
10 Patent Litigation	0.001	0.022	0.07 ***	0.02 **	-0.02 ***	0.00	-0.02 ***	0.04 ***	-0.02 **	0.16 ***	0.00		
11 Repeated Use Legal Personnel	0.249	1.330	0.08 ***	0.01 ***	0.10 ***	0.08 ***	0.13 ***	0.02 ***	-0.03 ***	0.81 ***	0.14 ***	0.12 ***	
12 Court Repetition	0.179	0.800	0.07	0.02 ***	0.08 ***	0.07 ***	0.12 ***	0.02 **	-0.03 ***	0.68 ***	0.13 ***	0.22 ***	0.73 ***

Number of Observations=21.745 ; ***p<0.01; **p<0.05; *p<0.1. [1]Variable is IHS-transformed.

I estimated the variance inflation factors (VIFs) to investigate if the two variables are linearly related. The mean VIF for the full model was 1.94, with 2.32 for the repeated use of the same attorneys and 3.59 for the repeated use of the same courts. These VIFs are below 10, which is the cut off value defined by Myers (1990).

However, to further explore the possibility, that the results are influenced by the common variation between the two variables, I followed previous research (Kafouros and Aliyev, 2016b) and conducted a principal component analysis and re-estimated the model including the first principal component as a control variable. The results can be examined in *Table 34*.

Table 34 The Link between RQ2 and RQ4

	Model [1]	Model [2]	Model [3]	Model [4]	Model [5]	Model [6]	Model [7]	Model [8]	Model [9]
	Litigation Costs:			Firm Performance:					
Dependent Variable:	**Costs[1]**	**Costs[1]**	**Costs[1]**	**Sales[1]**	**Sales[1]**	**Sales[1]**	**ROS[1]**	**ROS[1]**	**ROS[1]**
Control Variables	Coef. [SE]	Coef. [SE]	Coef. [SE]	Coef. [SE]	Coef. [SE]	Coef. [SE]	Coef. [SE]	Coef. [SE]	Coef. [SE]
Firm Age[1]	0.000	0.000	0.000	0.008	0.008	0.008	0.168***	0.167***	0.168***
	[0.004]	[0.004]	[0.004]	[0.019]	[0.019]	[0.019]	[0.054]	[0.054]	[0.054]
Firm Size[1]	-0.021***	-0.021***	-0.021***	0.210***	0.210***	0.210***	0.884***	0.884***	0.884***
	[0.001]	[0.001]	[0.001]	[0.005]	[0.005]	[0.005]	[0.014]	[0.014]	[0.014]
R&D Intensity[1]	0.032***	0.032***	0.032***	-0.323***	-0.323***	-0.323***	-0.858***	-0.858***	-0.858***
	[0.001]	[0.001]	[0.001]	[0.004]	[0.004]	[0.004]	[0.014]	[0.014]	[0.014]
Organisational Slack[1]	-0.000	-0.000	-0.000	0.670***	0.670***	0.670***	1.795***	1.796***	1.796***
	[0.004]	[0.004]	[0.004]	[0.014]	[0.014]	[0.014]	[0.048]	[0.048]	[0.048]
Litigation Duration[1]	0.019*	0.022**	0.020*	0.056	0.058	0.045	0.042	0.025	-0.028
	[0.010]	[0.011]	[0.011]	[0.040]	[0.041]	[0.041]	[0.140]	[0.145]	[0.146]
Heckman Exit	0.006	0.007	0.006	-0.055***	-0.054***	-0.055***	-0.154**	-0.153**	-0.154**
	[0.005]	[0.005]	[0.005]	[0.019]	[0.019]	[0.019]	[0.067]	[0.067]	[0.067]
First Principal Component	0.001	0.003	0.004	-0.003	-0.002	0.000	0.006	-0.007	0.004
	[0.001]	[0.002]	[0.002]	[0.005]	[0.009]	[0.009]	[0.017]	[0.031]	[0.031]
Independent Variable									
Patent Litigation		0.002**	0.005***		0.005	0.020***		0.028**	0.089***
		[0.001]	[0.002]		[0.004]	[0.007]		[0.014]	[0.025]
Repeated Litigation Same Courts		-0.004	-0.004		-0.003	-0.004		0.012	0.008
		[0.003]	[0.003]		[0.011]	[0.011]		[0.040]	[0.040]
Interaction effects									
Patent Litigation x Repeated Litigation Same Courts			-0.001* [0.001]			-0.005** [0.002]			-0.022** [0.008]
Constant	0.238***	0.237***	0.238***	11.609***	11.607***	11.608***	-6.061***	-6.062***	-6.059***
	[0.082]	[0.082]	[0.082]	[0.017]	[0.016]	[0.016]	[0.219]	[0.219]	[0.219]
Year Controls	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.

Number of Observations=21.745 [3.269 Firms] ; ***p<0.01; **p<0.05; *p<0.1. [1]Variable is IHS-transformed.

Even though the first principal component is not significant in all of the nine models, including it as a control resulted in a shift from a non-significant cost coefficient to a significant cost coefficient. However, as the pattern of results in the main model for profitability stay robust to the changes, meaning that the link between repeated use of legal personnel and repeated use of courts does not influence the main finding. However, this link poses a valuable research direction for further research on the role of attorneys and courts in patent litigation. The determinants of the choice of the legal teams as well as the venue for litigation lawsuits might enrich our understanding of why some firms experience a higher profitability from patent litigation.

7.7 Discussion and Conclusion

The last empirical chapter of this dissertation investigated if forum shopping influences the relationship of strategic patent litigation and firm performance, measured on sales and profitability while also considering costs. Thereby, the purpose was to determine the role of institutional targeting for firm performance and enhance the RBV by looking at how firms can utilise institutional contingencies and protect their IP from imitation. Prior to this study, it was difficult to make predictions about the performance implications of using institutional targeting practices in strategic patent litigation. This research is one of the few first attempts to thoroughly examine forum shopping in strategic patent litigation and its role for firm performance.

The unexpected findings could be explained by the rigidities a firm is confronted with when concentrating on one court repeatedly. Thereby, the negative influence of high repetition of patent litigation in the same institutions on firm sales could mean that firms are not sufficiently utilising the given institutional contingencies to create value from their innovations and IP rights. Firms that actively litigate in the same courts repeatedly at a high level might not be diverse enough in their choice of court, rather relying on the institutions they know. However, different courts possess different benefits and detriments for plaintiffs depending on the unique circumstances of the case, hence, firms that do not actively employ their strategies in patent litigation might not be able to sufficiently adapt to their institutional environment to provide them with the ability to generate profit from patent litigation. It might be that such capabilities are more valuable in generating sales than the experiences built from repeated litigation in the same courts. As the results show, peated litigation in the same venue does normalise the positive influence of strategic patent litigation on firm costs, however, it might not be pronounced enough to compensate for the losses of sales. Therefore, the trade-off between sales and costs results in negative profitability for the firm.

The chapter contributes to strategic literature on patent litigation by enhancing our knowledge forum shopping. Thereby, the focus was set on institutional contingencies to research why some firms are more able to build efficient patent litigation strategies within the given environment. Firms use court-targeting practices to increase their possibilities to appropriate value from their IP rights, however, firms fail to generate profits from it, when they litigate and target in a limited number of courts. Future research on forum shopping might be able to take a closer look at institution-specific firm capabilities and targeting strategies to enhance our understanding of why some firms are managing strategic litigation better in their given institutional environment. Nevertheless, the present research already adds to our understanding of how firms benefit from

this practice. Theory is developed by presenting the different levels of institutional targeting experience and its influence on the strategic patent litigation - performance relationship to determine the experience firms have to build to utilise strategic litigation as a surrogate for imitation. This chapter clarified, that with increasing litigation activity, repeated litigation in the same courts can have a detrimental effect on firm performance. Hence, to benefit from their innovations, firms have to find a balance between building experience and economies of scale with specific institutions and targeting more diverse institutions that might better fit the suit of dispute.

The findings presented in this chapter pose interesting implications for practitioners. Firms that rely more heavily on experience with specific courts should carefully assess if they gain value from transaction costs savings or if their cases might be better litigated in a different, more suitable court to leverage the possibilities provided by the United States court system. Sometimes, managers might find that they have to adjust their strategies to generate value from their innovation. They should review these implications carefully and may consider a more diverse targeting practice aimed at sales generation to better appropriate rent from strategic patent litigation.

This study leaves some limitations. First, it does not differentiate between different types of tribunals identified from previous research (Somaya and McDaniel, 2012). Such a tribunal distinction might have added additional knowledge of why firms target specific venues.

Second, whereas the study does provide theory on the question why some firms benefit more from strategic patent litigation, the chapter does not address the differences in experiences that can be built by targeting and how firms build and utilise such experience to benefit from strategic patent litigation. This poses a promising route for future research to further refine our knowledge of the mechanisms that connect strategic patent litigation with firm performance.

Third, institutional targeting might influence other non-financial outcomes, as firms use institutional targeting as non-market strategies (Somaya and McDaniel, 2012), that could be, for example, directed at policy changes. An interesting example from the recent years is that of the case "TC Heartland v. Kraft Foods Group Brands" which directly affected forum shopping practices and had an immediate effect on corporate, institutional targeting strategies in patent litigation ("TC Heartland v. Kraft Foods Group Brands", 2017). The case set a precedent by ruling, that plaintiffs must sue in courts where the defendant firm is incorporated or regularly conducts business. Since the verdict in 2017, multiple sources reported, that companies, for example, Apple Inc., will close their branches in the eastern district of Texas. When looking at

this case, it is exceptionally striking that the focus on targeting is very important to explain the utilisation of institutional contingencies as it already influences policymaking. Hence, it does not seem farfetched to say, that firms will further refine their institutional targeting strategies to abstract value from their innovations, therefore, it will remain a lively research setting in strategic patent litigation research. Especially, the focus on policy implications in strategic patent litigation research constitutes a promising field for further research.

8 Integrated Discussion and Conclusion

There are several important areas where this study makes an original contribution to previous research, including the holistic consideration of costs and benefits of litigation, the mechanisms of patent litigation affecting these performance implications and the contingencies that provide strategic opportunities while enforcing IP. This dissertation presented, that firm-specific, industry-specific as well as institutional contingencies, can enhance or diminish the effectiveness of a strategic patent litigation on firm performance.

8.1 Filling the Gaps from the Integrative Framework

The integrative framework *Table 1* outlined four research gaps for potential contribution. The framework proposed that knowledge on organisational as well as industrial and institutional contingencies has to be refined. This dissertation looked at the performance of strategic patent litigation in three promising research questions directed at strategic litigation abilities of firms and their contingencies.

Chapter 1 concentrated on three outcomes of strategic patent litigation costs, sales and profitability while stressing the role of firm strategy in securing inimitability of assets. Thereby, the positive influence of strategic patent litigation on costs and performance could be confirmed. However, the influence on sales did not show significant results. Nevertheless, these findings contribute to the litigation literature by establishing strategic patent litigation as an important isolating mechanism.

Chapter 2 highlighted that the repeated use of the same legal personnel can act as a link between TCE and the RBV. Whereby is was striking that although placing legal teams repeatedly on multiple cases, diminished strategic litigation costs with increasing litigation intensity, it also had negative influences on overall financial performance. Hence, repeated employment of attorneys can affect firm sales and profitability negatively, especially with increasing litigation

intensity. Chapter 2 contributed to the literature by showing that appropriability from innovation, essential to gain and maintain a competitive advantage, can derive (in this case be diminished) by the unique competencies of the firm to manage the litigation process.

Chapter 3 showed that companies in multi invention industries that increasingly litigated had better outcomes on sales and profitability than firms with the same strategy in single invention industries. Thereby, Chapter 3 contributed by showing that appropriability regimes are not solely exogenously given as firms can strategically respond to their industrial environment to appropriate rents from their innovations. This sheds light on the link between inimitability of assets and competitive advantage by not only suggesting firms need to pursue patent enforcement actively, but they also have to leverage (and are constrained by) their industrial environment. Hence, that is why the internal capability of integrating strategic litigation in multi invention environments lead to a higher increase in sales and performance than in single invention industries.

Chapter 4 expanded the radius even further by integrating a firm's practices to strategically target formal institutions as a link between patent enforcement and firm performance. Contrary to all predictions, firms seem to not benefit from repeatedly targeting the same courts for strategic litigation. Therefore, institutional targeting is not a sufficient appropriability mechanism to profit from innovations. The findings show that such experience influences sales and profitability more negatively, the more a company is litigating. Targeting the same institutions repeatedly does also not save costs. These findings contribute to our knowledge by showing that targeting the same courts for litigation repeatedly does not benefit the appropriability from innovation.

This study showed that strategic patent litigation does influence sales and profitability in a similar way. However, even though the costs saving strategies of firms to diminish financial investments seem to work in some contexts, the trade-off between sales and cost implications of strategic targeting was only partly visible. Hence, it might be more complicated for firms to assess the risks involved in litigation to draft a strategy that increases sales and diminishes costs. Nevertheless, it can be deduced from the chapters in this dissertation, that the influence of strategic litigation on sales and costs is a driving force of profitability.

The significant findings from this dissertation can be examined in *Table 35*:

Table 35 The Integrative Framework Revisited

Research Gap	Research Question	Findings
The Outcomes of Strategic Patent Litigation	**1:** What is the influence of strategic patent litigation on costs and firm performance, measured on sales and profitability.	Strategic patent litigation significantly increases costs and profitability. A significant increase in sales could not be found.
Firm-Specific Legal Contingencies in Strategic Patent Litigation	**2:** How does the influence of strategic patent litigation on firm performance vary according to the repeated use of the same legal personnel?	Repeated use of the same legal personnel more negatively influences firm sales, costs and profitability with increased litigation intensity.
Industrial Contingencies in Strategic Patent Litigation	**3:** How does the influence of strategic patent litigation on firm performance vary according to the industrial environment?	In multi invention Industries, increased litigation intensity influences sales and profitability more positively than in single invention industries. The effect on costs is insignificant.
Institutional Contingencies in Strategic Patent Litigation	*4:* How does the influence of strategic patent litigation on firm performance vary according to the repeated litigation in the same courts?	Repeated litigation in the same courts more negatively influences sales and profitability with increased litigation intensity. The effect on costs is insignificant.

8.2 Academical and Practical Contributions and Implications

Whereby strategic patent enforcement is increasingly practised by firms, the mechanisms that link it with profitability were not yet fully understood. Hence, this dissertation contributed to the strategic patent litigation field and the resource-based theory of the firm by identifying organisational, industrial and institutional contingencies that affect a firm's ability to capture value from strategic litigation and its influence on costs, sales and profitability. Comprehensively, the four different research directions of this dissertation developed knowledge on the importance of firm-specific appropriability efforts that respond to

organisational, industrial and institutional contingencies of strategic patent litigation. The dissertation also provides theoretical contributions that tie together the four different chapters by integrating not only research on the outcomes of strategic patent litigations moderated by internal and external contingencies and the abilities of firms to respond to such, it also shows, that some abilities are relevant in different contextual settings, as for example, experience and knowledge on markets and institutions. The completion of the doctoral study shows a threefold contribution to existent knowledge on strategic litigation and the resource-based view of the firm.

First, this research contributes to the development of the literature to view strategic patent litigation as a surrogate for inimitability of resources in order to appropriate value from patents. Firms can protect their innovations from imitation with strategic patent litigation. Thus, firms can restore inimitability by employing a suitable and effective patent litigation strategy that constitutes a barrier against imitation. Hence, knowledge protection postulated in the RBV includes the strategic enforcement of property rights. From a theoretical standpoint, the dissertation adds to the resource-based view of the firm towards a broader focus of its assumption of inimitability of assets, highlighting the importance of strategic patent litigation as rent appropriation strategy. In particular, scholarship on firm, industry and institutions could be refined to unravel the contingencies that affect firms' abilities to create barriers of imitation with strategic patent litigation to sufficiently protect patented assets and maintain or create a competitive advantage of the firm by appropriating rents from innovations.

Second, the study contributes to litigation research by clarifying and testing how strategic litigation can lead to or sustain positive performance outcomes. Thereby, it shed light on the profitability of strategic enforcement by emphasising the important marginal effect between sales and costs of firms during patent litigation endeavours. The profitability lens is of particular importance because literature often indicates the critical trade-off between costs and revenues of patent ligation (Lanjouw and Schankerman, 2001; Somaya, 2003). However, previous literature remarked, that even in the patent domain, investigation on inimitability and multiple performance measures is scarce (Markman et al., 2004). Consequently, many litigation studies also rely on single performance measures like sales (Rudy and Black, 2015), costs (Bessen and Meurer, 2008b) or stock market reactions (Bhagat et al., 1994). Thereby, this study differs from previous literature by incorporating two different measures of performance as well as firm costs. It contributes by showing a direct influence of strategic patent litigation on costs, sales and profitability in different contexts. Hence, firms use patent litigation to appropriate value from their innovation.

Third, this dissertation identifies firm, industrial and institutional contingencies that influence the ability of the firm to effectively create value from their innovation by employing strategic patent litigation to create firm performance. Both legal and industrial circumstances were not thoroughly considered in the consulted literature on strategic litigation outcomes (Agarwal et al., 2009; Rudy and Black, 2015). Addressing this gap contributes by identifying the repeated use of the same attorneys, multi invention industry characteristics and institutional targeting practices that explain the differences in strategic patent litigation outcomes on firm performance. For this purpose, the study differentiates from previous scholarship by concentrating empirically on legal representation, multi invention market characteristic differences among different industries and repeated court targeting as factors that influence the firm's ability to build effectiveness of strategic patent litigation. Thereby, the practice of Somaya et al. (2007) is followed, who investigated resource combinations and integrated firm-level and industry-level factors to embed the RBV within patenting research. Furthermore, the contribution of this study responds to Rudy and Black (2015) advocating for a closer focus on firm-specific legal and institutional moderators. By incorporating firm, industry and institutional perspectives to strategic patent enforcement, litigation literature and the resource-based view are advanced by showing that some firms in the different contexts are more skilled in appropriating value through strategic patent enforcement than others.

Theory building efforts should continue to focus on strategic patent litigation and the unique contingencies that influence its outcomes. Thereby future scholarly work could further define the unique characteristics of the firm, industry and institutional environment that link strategic patent litigation with firm performance. However, beyond the academic contributions listed above, the study has practical implications as well. The specific focus on experience with lawyers and courts helps to determine strategies for legal representation for patent litigation. The findings have implications for managers to keep their focus on sales and licensing generation to increase profits rather than solely on cost reduction of litigation. Similar to previous research by Rudy and Black (2015), this dissertation could not find a more positive direct link between strategic patent litigation and firm performance in the industries with single invention characteristics than in multi invention industries. Hence, especially in the single invention industries, strategic patent litigation should be reassessed carefully to respond to industrial constraints with better-fitted strategies that foster profitability.

8.3 Limitations and Future Research

It is always a challenge to find a balance between the breadth and depth of a research project. In this dissertation, it was a particular challenge because the field of strategic patent enforcement offers multiple promising research avenues that are oftentimes not limited by extensive scholarship. Therefore, the goal was to focus on three major contexts, the firm, the industry and the institutions. This allowed the study to occupy research gaps and provide a first research typology for further refinement. However, this also comes with unique challenges.

One limitation of this dissertation is that to create generalisable results throughout the chapters, the study concentrated on a smaller sub-sample of the collected data. This resulted in a smaller but reproducible sample. However, the sample size is still bigger than comparable studies in this area (see: Rudy and Black, 2015). For additional analysis, the data could be further cleaned to counteract some inherent data issues, as for example, subsidiary linkages.

Another limitation of this research project is that it could not additionally include the country of litigation as the last missing piece for a complete context study. However, this offers a promising area for future research, as many firms in the sample are global enterprises and litigation laws and practices are country specific. Hence, it is a promising area of future research to investigate the influence of strategic patent litigation on firm performance in different countries. Nevertheless, concentrating solely on the firm, industry and institutional contingencies, allowed to add a layer of depth to each investigated context by identifying specific contingencies and practices of the firm in each context.

The present study highlighted the contingencies of the firm (repeated use of the same attorneys), industry (multi and single invention industry distinction) and institutions (repeated institutional targeting). However, all of the three contingencies contain multiple mechanisms that can link them to firm performance, including but not limited to the mentioned sales and revenue generation, exclusion of competitors, indirect costs, disruption, licences and royalties time and speed. Further research should aim at identifying additional mechanisms and characteristics that influence the relationship between patent litigation and firm performance in the given environments. Hence, the firm, industry and institutional contexts should be filled with additional strategies to build efficiencies in patent litigation and additional mechanisms (for example, non-market or non-financial) to provide a more fine-grained picture of a firm's ability to guard its patents from imitation.

8.4 Conclusion

In conclusion, this doctoral research has exciting contributions to theory and praxis as well as opportunities for publications in highly ranked journals. In this dissertation, the influence of patent litigation strategies on performance was discussed, and multiple hypotheses for the analysis of the research questions were presented. The doctoral project aimed at investigating strategic patent litigation and its influence on firm performance, in particular, sales and profitability while considering costs. Moreover, the influence of strategic litigation was shown to differ in multi and single invention industries. Furthermore, it was intended to create an understanding of the influence of the strategies directed at legal bodies involved, with a specific focus and legal representation and institutional targeting.

In the introduction, this dissertation was hinting at the flaws of patent protection and the difficulty for firms to appropriate value from their innovations. After a thorough investigation of the strategies and politics of strategic patent litigation, these issues were again visible. However, what hopefully prevailed are the plentiful chances of firms to protect themselves against imitation to profit from innovative ideas and the fruitful research opportunities that lie ahead.

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