TECHNISCHE UNIVERSITÄT MÜNCHEN

Dr. Theo Schöller-Stiftungslehrstuhl für Technologie- und Innovationsmanagement

Univ.-Prof. Dr. Joachim Henkel

Design, Competition, and Intellectual Property Rights

Rainer Filitz

Vollständiger Abdruck der von der Fakultät für Wirtschaftswissenschaften der Technischen Universität München zur Erlangung des akademischen Grades eines Doktors der Wirtschaftswissenschaften (Dr. rer. pol.) genehmigten Dissertation.

Vorsitzender:	Univ.-Prof. Dr. Rainer Kolisch
Prüfer der Dissertation:	1. Univ.-Prof. Dr. Joachim Henkel
	2. Prof. Bruce S. Tether, Ph.D. University of Manchester

Die Dissertation wurde am 01.06.2015 bei der Technischen Universität München eingereicht und durch die Fakultät für Wirtschaftswissenschaften am 15.07.2015 angenommen.

Acknowledgements

Over the course of my Ph.D. I have been fortunate to receive support from many people. I wish to express my warmest gratitude for all those whose guidance, help and encouragement, personal and academic, have left a mark on this dissertation.

I am particularly indebted to my Ph.D. supervisor Joachim Henkel. He has provided invaluable advice at key moments in my work while also allowing me to develop my ideas independently. His joy and enthusiasm for innovation research were truly contagious and inspiring for me.

I would also like to thank my second Ph.D. supervisor Bruce Tether for the great collaboration on our joint projects and for securing funding from the European Community's Seventh Framework Programme (grant CRE8TV.EU–320203) that has enabled us to undertake this research.

Joachim and Bruce taught me a lot about the process of writing up (and publishing) research by co-authoring the papers underlying this dissertation. Their excellent feedback during this process probably helped me to become a better researcher, and certainly improved the quality of this thesis.

Moreover, I am grateful to Rainer Kolisch who kindly agreed to chair my dissertation committee.

For giving me the fantastic opportunity to spend four months as a Visiting Fellow at NYU School of Law, and for providing a very stimulating working environment during that time, I would like to thank Chris Sprigman and his colleagues at the Engelberg Center on Innovation Law & Policy.

Being part of the Schöller Chair in Technology and Innovation Management has been a great experience. This group has become a source of friendship as well as good advice and collaboration. I want to thank my colleagues for all those thoughtful, yet fun, discussions, and the student assistants for their endurance and meticulous work.

Above all, I am deeply grateful to my wife Karina, my friends and my family, who have provided me a lot of support and encouragement over the years which incredibly helped me on this journey.

— Rainer Filitz
May 2015

Table of contents

List of figures

List of tables

List of abbreviations

CAGR	Compound annual growth rate
CDR	Community Design Regulation
CEO	Chief executive officer
CIS	Community Innovation Survey
CTM	Community Trademark
DE	Germany
DKK	Danish krone
DPMA	Deutsches Patent- und Markenamt
EC	European Commission
EPO	European Patent Office
EU	European Union
EUR	Euro
GDP	Gross domestic product
HT	High-technology
IP	Intellectual property
IPR	Intellectual property right
KIS	Knowledge-intensive services
LKIS	Less knowledge-intensive services
LT	Low-technology
MHT	Medium high-technology
MLT	Medium low-technology
NACE	Statistical Classification of Economic Activities in the European Community
NBER	National Bureau of Economic Research
OECD	Organisation for Economic Co-operation and Development
OHIM	Office for Harmonization in the Internal Market
PACE	Pollution abatement costs and expenditures
PATSTAT	EPO Worldwide Patent Statistical Database
PCT	Patent Cooperation Treaty
R&D	Research and development
RCD	Registered Community Design

SIC	Standard Industrial Classification
SME	Small and medium-sized enterprise
TM	Trademark
U.S.	United States
UCD	Unregistered Community Design
UK	United Kingdom
UKIPO	Intellectual Property Office of the United Kingdom
VBA	Visual Basic for Applications
WIPO	World Intellectual Property Organization

Abstract

This dissertation focuses on an important, yet relatively underexplored, aspect of product innovation and differentiation – the design, or outer appearance, of a product. Specifically, I present three studies to enhance theoretical and practical knowledge at the intersection of the fields of design, inter-firm competition, and intellectual property protection. The first study is conceptual, offering a holistic theory of design-based competition; the second explores the use of registered design rights and firms' rationales behind it, while the third study examines the influence of the national context – of institutions, policies, cultures, and norms – on firms' propensity to protect their intellectual assets by means of registered designs and other types of legal exclusion rights.

I begin by proposing a unifying framework for the role of visible product design as a driver of inter-firm competition, covering aspects of both value creation and value capture. Drawing on various theoretical perspectives explaining the demand-side effects of design, I theorize how design choices (i) affect consumer preferences through different modes of differentiation, (ii) act as a moderator of psychological processes involved in comparative evaluations, and (iii) may collide with natural market-based barriers to imitation. I also introduce a formal model that allows me to analyze and illustrate the conditions under which similarity or dissimilarity to a competing product's design is likely to be most beneficial. In highlighting the competitive, hitherto largely neglected, role of design, I corroborate its much-vaunted strategic relevance and unveil additional levers for creating competitive advantage.

Second, I provide a foundation study on firms' use of Registered Community Designs (RCDs) – one of the legal options available to creators seeking to protect their designs in Europe. A decade after their introduction, approximately three-quarters of a million RCDs have been filed, and recent court cases suggest firms regard them as important for competition. This study reviews design protection in the European Union, discusses this legal instrument to protect designs and design innovations, and provides an overview of how RCDs are used by firms from different countries and industries. To develop a more detailed understanding of their usage, I also report an exploratory qualitative study on the use of RCDs by German firms in three industries: footwear, car manufacturing and tool-making. This reveals some important differences, notably

between judicious filing and "all-you-can-file" strategies, which implies that future research using this instrument requires attention be paid to firm and industry level behaviors. I develop a set of propositions, and set out a detailed research agenda.

As Europe has developed a single market, it has sought to align institutions and introduce new, "neutral" policy instruments – for example, the Registered Community Designs. But Europe is comprised of Member States with different institutions and traditions, including coordinated market economies, such as Germany, and liberal market economies, such as the UK. So to what extent is firm behavior in different European countries similar or different? In the third part of this dissertation, I examine this question with regard to the use of intellectual property rights (IPRs) by German and UK firms. Specifically, I match German firms to their closest UK counterpart on observed characteristics, and examine differences in the extent to which German and UK firms apply for registered designs, patents, and trademarks. For each type of IPR, I do this at three levels: national, European and international. I find that German firms are more likely to register IPRs than their UK "twins," which, I argue, is at least partly because German firms have greater incentives to do so. The magnitude of differences is however much reduced after matching, being greatest for national patenting, in high-tech sectors. Interestingly, the behavior of German and UK firms is most similar in the use of Community Trademarks and Registered Community Designs – the two most harmonized types of registered IPRs currently available in Europe. Convergence of formal institutions appears to substantially reduce behavioral diversity.

Zusammenfassung

Der Fokus dieser Dissertation liegt auf einem wichtigen, jedoch relativ wenig erforschten Aspekt von Produktinnovation und Differenzierung – dem Design, oder äußeren Erscheinungsbild, eines Produktes. Im Speziellen präsentiere ich drei Studien, die zum theoretischen und praktischen Verständnis an der Schnittstelle von Design, Unternehmenswettbewerb und Schutz geistigen Eigentums beitragen. Die erste Studie ist konzeptionell und bietet eine ganzheitliche Theorie designbasierten Wettbewerbs; die zweite analysiert, wie und aus welchen Gründen Unternehmen eingetragene Designrechte verwenden, während die dritte Studie den Einfluss des nationalen Umfelds – von Institutionen, Politik, Kultur und Normen – auf die Nutzung von Design- und anderen Schutzrechten untersucht.

Zunächst entwickle ich ein integratives Modell für die Rolle von sichtbarem Produktdesign als Wettbewerbstreiber, welches sowohl Facetten der Wertschöpfung als auch Wertaneignung abdeckt. Dazu greife ich auf verschiedene theoretische Perspektiven zurück, die die nachfrageseitigen Effekte von Design erklären. Dies erlaubt es mir aufzuzeigen, wie Designentscheidungen (i) Konsumentenpräferenzen durch unterschiedliche Arten der Differenzierung beeinflussen, (ii) die psychologischen Prozesse moderieren, die komparativen Evaluationen zugrunde liegen, und (iii) unter Umständen mit marktbasierten Imitationsbarrieren in Konflikt geraten. Zudem führe ich ein formales Modell ein, das analysiert und illustriert, unter welchen Bedingungen Ähnlichkeit oder Unähnlichkeit zum Design eines konkurrierenden Produktes vorteilhaft ist. Indem ich die bisher stark vernachlässigte, wettbewerbliche Dimension von Design betone, unterstreiche ich dessen vielgepriesene strategische Relevanz und zeige neue Wege zur Generierung von Wettbewerbsvorteilen auf.

Im zweiten Schritt präsentiere ich eine Grundlagenstudie über die Nutzung von Registered Community Designs (RCDs) – eines der rechtlichen Instrumente zum Schutz von Produktdesigns in Europa. Zehn Jahre nach der Einführung wurden bereits eine dreiviertel Million RCDs angemeldet und aktuelle rechtliche Auseinandersetzungen legen nahe, dass Unternehmen diese als wichtig im Wettbewerb erachten. Meine Studie gibt eine Einführung in die rechtlichen Grundlagen des europäischen Designschutzes, diskutiert die Eigenschaften von RCDs und bietet einen Überblick darüber, wie Unternehmen aus verschiedenen Ländern und Industrien RCDs verwenden. Außerdem

stelle ich eine qualitativ-explorative Studie vor, die den Einsatz von RCDs von deutschen Unternehmen in der Schuh-, Automobil- und Werkzeugindustrie im Detail untersucht. Diese offenbart einige wichtige Unterschiede, insbesondere zwischen selektivem Anmeldeverhalten und „all-you-can-file“ Strategien. Zukünftige Forschung, die RCDs als empirisches Instrument einsetzt, sollte daher firmen- und industriespezifische Verhaltensweisen berücksichtigen. Ich fasse die Kernergebnisse in Form von Propositionen zusammen und skizziere eine Forschungsagenda.

Auf dem Weg zu einem europäischen Binnenmarkt wurden Institutionen harmonisiert und neue, „neutrale“ Politikinstrumente eingeführt – wie beispielsweise die Registered Community Designs. Aber Europa besteht aus Mitgliedsstaaten mit unterschiedlichen Institutionen und Traditionen, darunter „coordinated market economies“ (z.B. Deutschland) und „liberal market economies“ (z.B. Großbritannien). Dies wirft die Frage auf, wie ähnlich oder verschieden sich Unternehmen über Ländergrenzen hinweg verhalten. Im dritten Teil der Dissertation untersuche ich diese Fragestellung hinsichtlich der Verwendung von Schutzrechten in Deutschland und Großbritannien. Dazu setze ich ein Matchingverfahren ein, das jedem deutschen Unternehmen ein möglichst ähnliches britisches Unternehmen auf Basis beobachtbarer Kriterien zuordnet, und untersuche Unterschiede im Anmeldeverhalten von eingetragenen Designrechten, Patenten und Marken. Für jedes Schutzinstrument werden nationale, europäische und internationale Anmeldungen berücksichtigt. Meine Ergebnisse zeigen, dass deutsche Unternehmen häufiger Schutzrechte anmelden als ihre britischen „Zwillinge“, was – so meine Argumentation – zumindest teilweise auf stärkere Anreize im deutschen Schutzrechtsystem zurückzuführen ist. Das Ausmaß der Differenzen wird durch das Matchingverfahren jedoch erheblich reduziert, wobei die deutlichsten Unterschiede für nationale Patentanmeldungen im Hightech-Sektor verbleiben. Interessanterweise verhalten sich deutsche und britische Unternehmen am ähnlichsten in Bezug auf Community Trademarks und Registered Community Designs – aktuell die am weitesten harmonisierten, eingetragenen Schutzrechte in Europa. Konvergenz formaler Institutionen scheint Verhaltensunterschiede maßgeblich zu reduzieren.

1 Introduction

1.1 Motivation

The design of new products – that is, their outer appearance – is a central element of product innovation. It is the most visible aspect of newness, helps to differentiate a market offering, and is often tightly linked to technical innovation. As such, design serves as an important strategic tool, as a means to gain a competitive advantage. Indeed, in many industries, including traditionally technological domains, firms compete in product appearance. Some introduce radically new designs to create superior value for their customers and, if successful, face the challenge to preserve their design advantage. Other firms respond to those choices, seeking either visual similarity or dissimilarity to the innovator's design. That more and more firms are willing to spend considerable resources contesting their design-related intellectual property rights (IPRs) further testifies to the preeminent role of design in inter-firm competition. One of the most spectacular disputes hit the headlines worldwide in 2011, when Apple accused Samsung of "slavishly copying"[1] aesthetic features of its iPhone and iPad products. Apple filed several lawsuits against Samsung worldwide, and succeeded in having an injunction placed on the sale of some Samsung products in Germany.

The rising centrality of design and designers has also attracted increasing scholarly attention across management disciplines. While early contributions were mainly directed at a specialized audience (e.g., Black and Baker, 1987; Dumas and Mintzberg, 1989), design research has gradually diffused into journals of more general orientation, including the *Academy of Management Review* (Eisenman, 2013), the *Academy of Management Journal* (Gruber et al., 2015), and *Organization Science* (Rindova and Petkova, 2007). Product design (Ravasi and Stigliani, 2012), design innovation (Gemser and Wijnberg, 2001), design newness (Talke et al., 2009) and stylistic innovation (Cappetta et al., 2006) have also been receiving recent attention in various other journals.

---

[1] Mail Online, at http://www.dailymail.co.uk/sciencetech/article-1378490/Apple-sues-Samsung-slavishly copying-iPhone-iPad-designs.html (last accessed: 30 June 2014).

At the firm level – the focus of this dissertation – scholars have made considerable progress in understanding how design can be employed strategically to enhance company performance (e.g., Verganti, 2006; Walsh et al., 1992). Recent work has even proposed that design can be vital in stimulating and supporting firms' renewal processes (Ravasi and Lojacono, 2005; Rindova et al., 2011) and socio-cultural interactions (Abrahamson, 2011; Verganti, 2009). However, while existing firm-level studies have shed light on the use of design as a strategic tool, they have rarely recognized the competitive context in which design choices take effect, meaning that the core mechanisms governing firms' design-based rivalry are still poorly understood (Eisenman, 2013; Luchs and Swan, 2011; Noble, 2011). In acknowledging the competitive role of design, I draw attention to new dimensions along which to consider design strategy – both in terms of *creating value* through favorable design choices relative to competitors, and the management of design-related *value capture*. The results of this endeavor are presented in Chapter 2 of this dissertation, which is based on a joint working paper with Joachim Henkel.

Because strategic choices often trigger mimetic behavior among competitors, successful designs are also subject to imitation (note the countless iPhone and iPad look-alikes in the marketplace). This threat has led to the institution of legal design protection schemes in virtually all major jurisdictions (e.g., Monseau, 2012). Europe, in particular, has seen the introduction of Registered Community Designs (RCDs) in 2003, over three-quarters of a million of which have been filed since then. This indicates the significance of RCDs in design-related markets, innovation and competition, and at the same time appears to offer an enormously rich opportunity for the study of design, and design innovation, to which scholars of innovation have given surprisingly little attention hitherto. Hence, when exploring the use of RCDs and firms' rationales behind it, I enter largely uncharted territory. In so doing, I seek to provide some groundwork upon which future studies can be undertaken and to offer first insight into whether the way in which RCDs are being used is (or is not) in line with the intended policy objective of encouraging innovation and creativity in design as applied to industrial products. This foundation study on firms' legal design protection behaviors, and the use of RCDs in particular, is reported in Chapter 3. The paper underlying this part of the dissertation is co-authored by Joachim Henkel and Bruce Tether and is forthcoming in *Research Policy* (Filitz et al., 2015).

The introduction of a new legal instrument – such as the Registered Community

Designs – and the reformation of existing ones also poses challenges for European policy makers who aim to develop a single market, with harmonized institutions. One major challenge is that in harmonizing the IPR system, or systems, in Europe they risk favoring firms operating in one national context over those operating in another because of the institutional peculiarities that still exist across Member States. Hall and Soskice (2001), for example, contrast the liberal market economies (such as the UK) with coordinated market economies (of which Germany is a prime example), emphasizing differences across a range of phenomena likely to affect firms' IPR practices, including the extent of inter-firm competition versus cooperation, orientation toward incremental or radical innovation, and the functioning of the legal system. Whether comparable firms in different Member States are making similar or different IPR choices is therefore another important question – one of particular relevance for policy makers – that will be addressed in Chapter 4. This study is the result of a joint research project with Bruce Tether.

1.2 Contextualization and research objectives

This dissertation comprises three studies related to, and bringing together, the topics of visible product design, inter-firm competition, and legal IP protection. Below, I position each of these studies within the body of existing literature, outline their research objectives, and briefly describe the methods I apply to address the open issues. In the first study ("Competing in design"), I theorize the competitive implications of design choices by integrating the fragmented firm-level and demand-side literature on the topic. The second study ("Protecting aesthetic innovations?") exploits interview and statistical data to shed light on the use of Registered Community Designs and firms' rationales behind it. Finally, the third study ("Single market; same practices?") examines, based on an econometric matching method, the extent to which firms in two different, but converging national contexts – Germany and the UK – behave similarly or differently with regard to their use of registrable[2] IPRs.

Competing in design: differentiation, imitation, and value capture

Since the mid-1980s, numerous scholars have emphasized the strategic relevance

[2] IPRs fall into two categories: registrable and non-registrable. The former require the filing of an application to provide protection, while the latter do not need to be registered.

of product design and illuminated how certain firms manage design to gain and sustain a competitive advantage. Research in this field has traditionally been based on case studies of acknowledged "design leaders" such as Apple, Alessi, or Olivetti (e.g., Kotler and Rath, 1984; Ravasi and Lojacono, 2005; Verganti, 2006), but is increasingly complemented by quantitative studies that investigate the link between design orientation and company performance on a larger scale (e.g., Gemser and Leenders, 2001; Hertenstein et al., 2005; Rubera and Droge, 2013). A common theme in extant work is that design is a product dimension along which firms can differentiate particularly well. It is deemed especially useful in mature markets where the marginal value attributed to expected product performance improvements diminishes (e.g., Abernathy and Clark, 1985; Candi and Saemundsson, 2011; Norman, 2004).

What has been largely overlooked, though, is that design – along with its increasing strategic importance – can play a significant role in inter-firm competition (cf. Cappetta et al., 2006; Dell'Era and Verganti, 2007). This knowledge gap may partly explain why visible design attributes have not yet been fully elevated to the status of other, particularly technological (e.g., Henderson and Clark, 1990; Utterback, 1994), aspects of product differentiation and innovation. Indeed, only very recently have scholars begun to recognize that design choices for competing market offers are interdependent, not only because the degree of differentiation through design impacts the intensity of competition, but also because design creates visual references to existing products, thus stimulating comparative evaluations (Crilly et al., 2009; Rindova and Petkova, 2007).

As a result of the absence of theory, there is hardly any guidance in the literature on how to style a product relative to competing products' designs so as to maximize its potential for value creation (for an exception, see Person et al., 2008). Similarly, very little is known about the way in which the competitive design context influences firms' ability to use their innovative product designs exclusively, and capture value from them. Extending the nascent firm-level research on formal and informal appropriability mechanisms for design innovations (e.g., Gemser and Wijnberg, 2001; Moultrie and Livesey, 2011) by adding a competition perspective may help better understand under which conditions design can be a strategic asset that is not made readily obsolete through imitation (e.g., Barney, 1991). Hence, I pursue the following research objective:

> **Research objective 1:** *Develop a theoretically grounded framework for understanding the implications of design choices in competitive contexts, covering aspects of both design-related value creation and value capture.*

To address the gap in firm-level research on the role of design in competition, I adopt an approach recently pioneered by Rindova and Petkova (2007) and Eisenman (2013). These authors have demonstrated that organization and management research may benefit greatly from a theoretical integration with the rich pool of consumer-level research explaining the demand-side effects of design – arguably the best-developed area of product design research to date (for reviews, see e.g., Bloch, 1995; Luchs and Swan, 2011; Veryzer, 1995). Contributions in marketing, psychology and sociology have developed a solid understanding of how visible design elements affect consumers' choice as well as cognitive and emotional responses to product innovations, yet, as is common with many topics in the social sciences, this progress has rarely been integrated into the body of work in other disciplines.

In a first step, I draw on research examining the determinants of consumers' design preference formation (e.g., Bloch et al., 2003; Page and Herr, 2002) to disentangle the various facets of the differentiating nature of product design. As the organizing principle of the resultant framework, I distinguish between three modes of differentiation through design – horizontal, vertical, and what I call relative differentiation, the latter capturing the influence of visual references to competing products on consumers' evaluative judgments. Linking research on assimilation and contrast effects (e.g., Janakiraman et al., 2009; Mussweiler, 2003) as well as fairness norms (e.g., Hilton et al., 2004; Warlop and Alba, 2004) allows me to explicitly articulate the core psychological processes underlying relative differentiation, and to highlight the possibilities and challenges involved in attempting to influence them proactively. A simple formal model is introduced to illustrate and generalize the conditions under which similarity or dissimilarity to a competing product's design is likely to be most beneficial. Finally, I aim to shed light on the challenge of design-related value capture by elaborating how the psychological processes triggered by visual similarity perceptions may act as natural barriers to design imitation.

Protecting aesthetic innovations? An exploration of the use of Registered Community Designs

Legal design protection has been a topic of interest in legal scholarly communities (e.g., McKenna and Strandburg, 2013; Monseau, 2012; Suthersanen, 2010), but only recently has attracted attention from management and innovation scholars. To my knowledge, the first systematic empirical studies examining firms' use of design rights

were published in 2011 and 2012 by the UK Intellectual Property Office (Ahmetoglu and Chamorro-Premuzic, 2012; Bascavusoglu-Moreau and Tether, 2011; Moultrie and Livesey, 2011; Thompson et al., 2012). Though preliminary and focused on the UK, these studies point to the as yet unexploited potential of design rights as an empirical tool, and emphasize the need for more research in this area.

Design rights have also been included in studies on the use and effectiveness of various appropriability mechanisms, most of which are based on Community Innovation Survey data (e.g., Laursen and Salter, 2005; Mairesse and Mohnen, 2004; Thomä and Bizer, 2013). An interesting finding is that design protection, in terms of its effectiveness, is ranked at a level similar to that of other formal IP rights, such as patents and trademarks, and that these different legal protection mechanisms are frequently used in combination (Gallié and Legros, 2012; Sattler, 2003). Other authors have suggested (Alcaide-Marzal and Tortajada-Esparza, 2007; Livesey and Moultrie, 2008) and already incorporated (PRO INNO Europe, 2012; Rubera and Droge, 2013) registered design rights as innovation indicators that emphasize aesthetics and creativity rather than technological innovation.

Despite the initial progress that has been made, my impression is that the current academic understanding of firms' legal design protection behaviors remains surprisingly underdeveloped – especially with respect to Registered Community Designs (RCDs), a harmonized IPR instrument introduced in the European Union in April 2003. What is required – and what I attempt to provide in this dissertation – is a foundation study that highlights and discusses the interesting facets of RCD utilization and serves as a guideline for future inquiry in management and innovation research. I therefore pursue four aims:

> **Research objective 2:** *(i) Provide an introduction to design protection and specifically RCDs; (ii) explore the use of RCDs and firms' rationales behind it; (iii) assess the suitability of RCDs as a source of potential information about design innovation and how firms compete through design; and (iv) develop a research agenda for further studies of RCDs and design protection more generally.*

To tackle these issues, I first review the legal background to design protection in Europe, discussing its emergence and how it has recently been harmonized across the European Union. Then, to identify first trends and peculiarities, I perform a descriptive analysis of the use of RCDs in terms of which countries, industries and firms are most

active in registering them. This statistical data is complemented by a qualitative study of how and why RCDs are actually used by firms. I employ a case study approach because it is particularly appropriate for understanding as yet underexplored phenomena in complex social settings where the causal dynamics are not immediately apparent (e.g., Eisenhardt, 1989; Yin, 2009). In focusing on German firms active in three industries (footwear, car manufacturing and tool-making), I follow a strategy of diverse sampling to increase the generalizability of findings and to facilitate clear pattern recognition. Based on insights from the literature review, the descriptive analysis and the fieldwork, I propose a detailed research agenda including issues concerning (i) the adoption and use of RCDs, (ii) the suitability of RCDs as innovation indicators, (iii) their effects on appropriation and creativity, (iv) their interaction with other intellectual property rights, (v) their actual and potential misuse and inefficiencies, and (vi) their role in competition.

Single market; same practices? The use of intellectual property rights by German and UK firms

There is a long-standing tradition in empirical innovation research of relating firms' propensity to use IPRs, as well as choices about the extent of their use (i.e., number of applications) to industry and firm parameters (for a recent review, see Hall et al., 2014). This line of research has, for example, established that IPRs are more or less widely used across industries depending on the characteristics of their technologies (e.g., Cohen et al., 2000; Levin et al., 1987) and services (e.g., Blind et al., 2003; Mendonça et al., 2004). Similarly, IPR choices have been found to be significantly correlated with company characteristics such as size and age (e.g., Amara et al., 2008; Arundel and Kabla, 1998; Gallié and Legros, 2012). Partly due to a lack of cross-country studies, we know, however, very little about the effect of the national context – of institutions, policies, cultures and norms – on firms' preferences for legal exclusion rights. The scarce evidence available suggests that the influence of factors such as IPR legislation, enforcement systems, and prevalent management attitudes toward legal IP protection can be substantial (Arundel et al., 1995; Cohen et al., 2002; Pitkethly, 2001).

Whether comparable firms in different national contexts are making similar or different IPR choices is a question particularly relevant in Europe, where the legal IPR framework has undergone a series of major reforms in recent decades, with the principle aim of harmonizing patent, trademark and design protection across Member States. Yet,

while political and regulatory efforts have been enormous, it is unclear to what extent *the use* of these rights has become aligned across countries. Literature, particularly in the "varieties of capitalism" tradition (e.g., Hall and Soskice, 2001; Whitley, 1999), emphasizes the existence of deep seated differences in the nexus of IPR-related institutions within Member States, suggesting that behavioral differences in the utilization of legal protection mechanisms can be anticipated.

If cross-country differences in firms' IPR behaviors do indeed exist, it would be interesting to know if these have diminished over time, whether they are smaller for the new, harmonized rights (i.e., Registered Community Designs and Community Trademarks) than for established instruments (e.g., national design rights and trademarks), and if they are more pronounced across certain sectors and categories of firms than across others. Thus, the purpose of this study is:

> **Research objective 3:** *Examine the extent to which firms in different Member States behave similarly or differently with regard to their use of registrable IPRs. Assess potential variation (i) over time, (ii) between new, harmonized IPRs and established instruments, and (iii) across sectors and different types of firms.*

I approach this topic by undertaking a detailed comparison of IPR registration patterns of firms in Germany as compared with apparently similar firms in the UK. The choice of comparison countries is not arbitrary, as prior work highlights the difference between coordinated market economies, such as Germany, and liberal market economies, such as the UK (e.g., Hall and Soskice, 2001). For the purpose of this study, I compiled a unique database that integrates information on a variety of registrable IPRs at the firm level: patents, trademarks, and registered designs – each of which may be filed at the national, European or international[3] office.

The two-country comparison is based on an econometric matching method (e.g., Heckman et al., 1998; Imbens, 2004; Rosenbaum and Rubin, 1984) which seeks to estimate differences in IPR registration behaviors between German and UK firms controlling for all observable factors (e.g., sector of activity, size, productivity) except location. While matching techniques were originally developed to estimate treatment effects in observational studies subject to selection bias, recent work has demonstrated their usefulness in examining inter-group disparities (e.g., Aggarwal et al., 2010;

[3] "International office" refers here to the International Bureau of the World Intellectual Property Organization (WIPO).

Schneider et al., 2004). The adjusted differences are quantified for nine IPR instruments over a period of up to eight years. Several additional analyses are performed to investigate the robustness of the results and to explore potential sources of heterogeneity in the distribution of gaps in more detail.

1.3 Structure of this dissertation

The remainder of this dissertation is organized as follows. **Chapter 2** presents the holistic framework of design-based competition (*Research objective 1*). I first outline the scope and direction of the study (2.1), before discussing the relation between consumers' absolute design preferences and horizontal or, respectively, vertical product differentiation (2.2). Extending this established view, I introduce and demonstrate the significance of the novel concept of relative differentiation (2.3). To this end, I highlight several mechanisms by which proximity to the design of a competitor's product can have either positive or negative effects on consumers' evaluative judgments. Combining these mechanisms into a simple formal model yields important insights for the process of value creation through design. Thereafter, I discuss the significance of relative differentiation in terms of providing natural barriers to design imitation (2.4), and conclude with theoretical and managerial implications of the framework (2.5).

Chapter 3 reports the foundation study on firms' use of Registered Community Designs – one of the legal options available to owners seeking to protect their designs in Europe (*Research objective 2*). Following an introductory section (3.1), I provide a review of past research on design protection (3.2) as well as of the pertinent legal background (3.3). My empirical exploration into the use of RCDs is based on a descriptive analysis of filing activities at the level of countries, product categories and firms (3.4), and a cross-industry case study, where I discuss the findings of interviews with managers of German firms and their legal advisors (3.5). As is evident from the research agenda (3.6), RCDs, and design protection more generally, offer a number of interesting avenues for future investigations. Brief conclusions close this chapter (3.7).

In **Chapter 4**, I examine the degree to which firms in Germany and the UK behave similarly or differently with regard to their use (and extent of use) of registrable IPRs (*Research objective 3*). I first motivate the study from an academic and policy perspective (4.1), before highlighting how the incentives to register intellectual properties differ between the two countries (4.2). Following this, I describe the unique dataset (4.3), and explain why I apply a matched pairs approach to quantify the cross-

country differences and how it is implemented in this study (4.4). The results are presented in three parts: differences in IPR behaviors between German and matched UK firms as observed in the baseline model, robustness tests, and a differential analysis relating the magnitude of gaps to important industry and firm parameters (4.5). Finally, I discuss the findings (4.6) and summarize (4.7).

Concluding this dissertation, **Chapter 5** reviews the main results and contributions, and points to promising research opportunities that extend beyond the scope of the present investigation.

2 Competing in design: differentiation, imitation, and value capture[4]

2.1 Introduction

Scholars of competition, both in the tradition of the resource-based (e.g., Barney, 1991; Hart, 1995; Wernerfelt, 1984) and industrial organization (e.g., Bain, 1968; Porter, 1985) schools, agree on the potency of differentiation for creating competitive advantage. While resource-based arguments focus on exploiting idiosyncratic organizational traits and competences, proponents of the industrial organization perspective rationalize the value-adding potential of differentiation from an industry structure and positioning point of view.

Visible product design – that is, the combination of a product's physical form and aesthetic attributes such as color and texture – has been much-heralded to serve as a facilitator of such differentiation-based advantages (e.g., Bloch, 1995; Kotler and Rath, 1984; Schmitt and Simonson, 1997). Indeed, the trend toward a strategic use of product design, and associated aesthetic and symbolic choices, pervades many industries, including traditionally technological preserves (Abrahamson, 2011; Karjalainen and Snelders, 2010; Rindova and Petkova, 2007).

Extant research on visible product design in the broader context of competition can be categorized into firm-level and demand-side investigations. At the firm level – the focus of my study –, management and innovation scholars have provided rich and compelling evidence on companies that successfully employ design as a strategic tool (Verganti, 2006; Walsh et al., 1992). The link between design orientation and company performance has also been quantified (Gemser and Leenders, 2001; Hertenstein et al., 2005; Rubera and Droge, 2013). Recent endeavors are increasingly directed toward understanding design in the context of dynamic capabilities, vital in stimulating and supporting firms' renewal processes (Ravasi and Lojacono, 2005; Rindova et al., 2011)

[4] This chapter is based on a joint paper with Joachim Henkel, which was presented at the 2014 CRE8TV.EU Plenary Project Meeting (Budapest) and is accepted for presentation at the 2015 Academy of Management Meeting (Vancouver). I gratefully acknowledge the funding from the European Community's Seventh Framework Programme under grant agreement CRE8TV.EU–320203.

and socio-cultural interactions (Abrahamson, 2011; Verganti, 2009). At the same time, much scholarly attention has been devoted to the effective management of design processes (e.g., Cillo and Verona, 2008) and resources (e.g., Dell'Era and Verganti, 2010).

However, while existing firm-level studies have shed light on the use of design as a strategic tool, they provide surprisingly little insight into the role of design in driving inter-firm competition (for industry-specific exceptions, see Cappetta et al., 2006 and Dell'Era and Verganti, 2007). Yet, understanding the mechanisms underlying firms' design innovation and imitation behaviors is crucial for offering guidance on styling decisions (Eisenman, 2013; Luchs and Swan, 2011; Noble, 2011). Similarly, the question of how innovators may preserve their design-based advantage over imitators remains largely unanswered to date. First attempts have been made to study firms' use of intellectual property rights (see Chapter 3) and informal appropriability mechanisms (Gemser and Wijnberg, 2001) for design innovations, but this nascent field of inquiry is mostly dominated by legal scholarly work (e.g., Monseau, 2012; Raustiala and Sprigman, 2006). What is lacking – and what I provide a step toward in this study – is a holistic and theoretically grounded framework for better understanding the role of design in competition.

To address the above gap in firm-level research on the role of design in competition, studies on the demand-side effects of design may be helpful (Eisenman, 2013; Rindova and Petkova, 2007). Such studies are plentiful with contributions stemming from numerous disciplines, notably marketing, psychology, and sociology. These studies have not only shown that product design captures consumer attention (Berkowitz, 1987; Bloch, 1995) and significantly influences preference and choice (Homburg et al., 2015; Talke et al., 2009), but they have also developed a thorough understanding of consumers' cognitive and emotional responses to visible design elements. Importantly, design (i) provides visual cues that activate schemes through which products are interpreted (Goode et al., 2013; Kreuzbauer and Malter, 2005), (ii) communicates functional information that influences consumers' inferences about the product's quality and/or functional performance (Creusen and Schoormans, 2005; Page and Herr, 2002), (iii) triggers sensory experiences through aesthetics, which themselves result in affective responses such as liking or distaste (Holbrook, 1986; Veryzer, 1993), and (iv) conveys symbolic information through which consumers attach higher-order meaning and value to a product (Csikszentmihalyi and Rochberg-Halton, 1981;

Solomon, 1983).

Two recent studies by Rindova and Petkova (2007) and Eisenman (2013) have demonstrated that organization and management research may benefit greatly from a theoretical integration with this rich pool of consumer-level research explaining the effects of design. While Rindova and Petkova (2007) illuminate how firms can create value through design by modulating the perceived technological novelty of a product innovation, Eisenman (2013) theorizes the changing role of design in the context of technological evolution and concludes that design is particularly beneficial for firms as new technologies emerge (owing to its explanatory function) and when technologies are very mature (owing to its potential for creating excitement and symbolic value).

In this study, I follow the approach pioneered by Rindova and Petkova (2007) and Eisenman (2013) of inducing insights on the strategic role of design through integration of advances in consumer-level research, but adopt a different, competitive focus. First, I draw on research examining determinants of consumers' design preference formation (e.g., Bloch et al., 2003; Page and Herr, 2002) to shed light on the differentiating nature of visible design elements. I distinguish between three modes of differentiation through design – horizontal, vertical, and what I call relative differentiation –, thereby laying the foundation for a new and enlightening perspective on firms' design-based rivalry. Second, elaborating on the novel notion of relative differentiation I propose a demand-side model for the perceived quality of a market offering as a function of the firm's design choices relative to competitors. Again, guidance comes from consumer-level research, this time on effects triggered by consumers' responses to design similarity (e.g., Janakiraman et al., 2009; Mussweiler, 2003; Warlop and Alba, 2004). Third, I outline the implications of my findings for mechanisms that facilitate the appropriation of value in the field of design.

With these three components I propose a holistic framework that, on the one hand, enhances our theoretical understanding of value creation and value capture, especially with regard to visible product attributes and the demand-side environment in which these processes take place, and, on the other hand, provides practical guidance on how to strategically manage design and anticipate competitor responses to new product introductions.

2.2 Absolute design preferences

Differentiation is ubiquitous in modern marketplaces. Almost all products are differentiated to some extent, be it along physical (e.g., performance specifications, design) or non-physical (e.g., price, brand, location) attributes (Levitt, 1980; Porter, 1976). Yet, visible product design stands out as a differentiator. Appearance-based differences are often the most salient to potential buyers (e.g., Ulrich, 2011; Veryzer, 1995), and there are rarely any two products, even within a single firm's portfolio, that look exactly the same. Accordingly, it is widely acknowledged that design attributes differentiate (e.g., Berkowitz, 1987; Homburg et al., 2015; Sharp and Dawes, 2001).

The virtues of differentiation have been well appreciated since Chamberlin's (1933) and Robinson's (1933) work on deviations from the perfect competition model, which are based on consumers' preference for product heterogeneity, and Hotelling's (1929) modeling of heterogeneous consumer preferences. Differentiated products are imperfect substitutes, thus facing less direct competition. Accordingly, firms may benefit from reduced cross-price elasticity with respect to competitors' products and a more loyal customer base (Caves and Williamson, 1985; Dickson and Ginter, 1987). Building on this argument, both the competitive strategy (e.g., Hart, 1995; Porter, 1985) and marketing (e.g., Aaker, 1991; Dickson and Ginter, 1987; Levitt, 1980) disciplines have developed normative theories that incorporate differentiation as an important source of performance differentials.

In order to impact on competition, differentiation requires product differences that are perceived by consumers and affect preferences (Carpenter et al., 1994; Ries and Trout, 2001). Dependent on the nature of consumer preferences it is common to distinguish between horizontal and vertical differentiation (e.g., Beath and Katsoulacos, 1991; Tirole, 1988). Both relate to absolute preferences – "absolute" in the sense that they solely depend on the focal product. I will address the contrasting case of *relative* differentiation, where preferences for a given product are formed with reference to other products, in the following section, and now turn to the two modes of differentiation that relate to absolute design preferences.

2.2.1 Horizontal differentiation through design

Horizontal differentiation occurs if distinct product variants with the same price tag

appeal to different groups of consumers – consider, for example, ice cream flavors. Consumer choice is therefore driven by individual, heterogeneous preferences (e.g., Eaton and Lipsey, 1989; Hotelling, 1929). The notion that the appreciation of design is a subjective thing, a matter of taste, has led to the entrenched view of visible product design as a means for horizontal differentiation (e.g., Caulkins et al., 2007; Shaked and Sutton, 1987; Sharp and Dawes, 2001). It is deemed particularly useful in mature markets where the marginal value attributed to "vertical" performance improvements of expected technological features diminishes (e.g., Abernathy and Clark, 1985; Candi and Saemundsson, 2011; Norman, 2004). Design preferences indeed vary in the population, as illustrated by the example of colors. Some consumers prefer a blue car over a red car, but others might decide to the contrary. In such cases of horizontal differentiation there are no "goods" or "bads", that is, blue is not inherently better or worse than red. The same argument holds for various other aspects of product aesthetics.

The reasons for heterogeneity in individual design preferences are manifold (for an overview, see Bloch, 1995 and Bloch et al., 2003). Among the potential causes are differences in consumers' demographic and psychographic variables (e.g., Goldsmith et al., 1993; Holbrook, 1986), divergent abilities with respect to recognizing, categorizing and evaluating product designs (e.g., Childers et al., 1985; Csikszentmihalyi and Robinson, 1990), as well as social and cultural influences (e.g., Adams and Osgood, 1973; McCracken, 1986).

The implications of horizontal differentiation for design-based competition are relatively obvious. If all locations in design space are equally attractive, as in the circular model of product differentiation by Lerner and Singer (1937), then firms will design their products such as to maximize the distance in design space to competing offers. If, in contrast, some designs are preferred by more consumers than others, as those at the center of Hotelling's (1929) linear product differentiation model, then sellers have to trade off the benefits of a more attractive design against the downside of intensified competition with other sellers that are equally drawn to the more attractive design.

2.2.2 Design as a vertical differentiator

While the association of design with heterogeneous preferences is intuitive and empirically sound, I argue that the resulting, traditional understanding of design as a means for horizontal differentiation is incomplete. Rather, I now demonstrate the

existence of design features that are unanimously preferred over others, thus corresponding to some level of higher "quality" and giving rise to vertical differentiation.

If products are vertically differentiated, all consumers at equal prices prefer the same variant. Their preference orderings are identical, as for example regarding the operating speed of a computer processor. Yet, the most preferred variant is likely to be the most expensive one so that vertical differentiation typically entails a trade-off between price and quality (e.g., Gabszewicz and Thisse, 1979; Shaked and Sutton, 1983). With heterogeneous budget constraints, consumers will solve this trade-off in different ways, thus opting for different product variants.

The lack of objective performance criteria for design makes it more difficult to define and identify superiority among visible design attributes than along technological product dimensions. Nevertheless, the literature indicates that design and vertical differentiation might not be mutually exclusive by characterizing visible designs as "good" (Finn, 1990; Kotler and Rath, 1984), "high-quality" (Sharp and Dawes, 2001), "optimal" (Veryzer, 1995), or even "quintessential" (Sexton, 1987). In the following, I present four key shapers of individual tastes that can imply convergent design preferences, thus giving rise to situations that correspond very closely to the definition of vertical differentiation. Specifically, I discuss innate design preferences; quality signals through design; trends and fashions; and technology-design interactions.

Innate, hardwired design preferences common to all mankind constitute a natural starting point in the quest for general notions of aesthetic value. The golden ratio, going back to at least Euclid, provides a classical example. Since Fechner's (1876) famous "Vorschule der Aesthetik," Gestalt theorists and evolutionary psychologists have proposed various further rules for generating aesthetic appreciation. These rules relate, for example, to objects' colors, curvature, or balance and proportion ratios (e.g., Bellizzi et al., 1983; Silvia and Barona, 2009; Veryzer, 1993). However, such generalizations are difficult to verify (e.g., Carbon, 2010; McManus and Weatherby, 1997) because contextual factors such as culture, tradition, and the spirit of the time critically reshape notions of aesthetic value (e.g., Jacobsen, 2010; Tomasello, 1999). This indicates that convergence in individual design preferences – at least in a certain context – may be other than biologically induced.

Second, when design attributes signal superior product quality and excellent manufacturing processes, design works as a vertical differentiator in its own right. For

example, if the design was created by a renowned designer (e.g., Jacob Jensen for the premium hi-fi equipment maker Bang & Olufsen), requires demanding manufacturing techniques (e.g., complex bending processes in the automotive industry), or is made of premium materials (e.g., real wood furniture), then consumers will opt for the visibly "better" or more exclusive alternative at equal prices (cf. Creusen and Schoormans, 2005; Page and Herr, 2002). Similar to product performance improvements, this type of vertical differentiation through design is likely to involve higher cost. Relatedly, design attributes may also signal higher cost per se. Such a cost increment may translate into vertical differentiation either because an expensive design allows its owner to signal higher social status, or because consumers conclude that wasteful expenditures on design – in a similar way as "burning money" on advertising (Milgrom and Roberts, 1986; Nelson, 1974) – make sense only for products that are superior also in other, less observable quality dimensions.

Third, perceived design superiority may be triggered by social and cultural forces through the mechanism of prevailing trends and fashions. Longer-term trends and cyclical fashions form a "collective taste" which operates as a sensitive selector for appreciation or dislike of certain styles and the design elements they encompass (e.g., Abrahamson, 2011; Blumer, 1969; Cappetta et al., 2006). Importantly in the present context, at any given point in time the prevailing trend or fashion in a product category may thus induce vertical differentiation in the design space. Most product categories exhibit trends and fashions on visible design elements in some way. The automotive industry, for example, has seen alternating periods of preference for curved and, respectively, angular forms (Carbon, 2010). Color pallets, too, undergo regular updates to fit consumer preferences (Grossman and Wisenblit, 1999). Robinson (1975) reports how the height/length ratio of American cars in the 1950-60s steadily decreased to an extreme low, just to upturn thereafter. As these examples demonstrate, "collective tastes" – and thus perceptions of design superiority – underlie a natural transformation, such that continuously new styles emerge or old styles revive.

Several theories exist to explain the rise and fall of trends and fashions. The most prominent are based on "status" or "prestige" goods which allow consumers to be implicitly associated with other high-status consumers of that good (e.g., Bagwell and Bernheim, 1996; Pesendorfer, 1995; Robinson, 1961). Thus, if an elitist group adopts a new style, this might initially trigger a bandwagon effect. Yet, as the mass of consumers flocks to the same style, it will become less valuable to all consumers, since it no longer

satisfies individuals' need for expressing uniqueness and/or belongingness to an elite group. An alternative theory bears on the perceived novelty of a style (Hemphill and Suk, 2009). Consumers have always been attracted to the new and exciting, thus seeking also novel designs as a source of pleasure and stimulation (e.g., Rindova and Petkova, 2007; Talke et al., 2009). However, each style's perceived degree of novelty and, accordingly, the collective fascination erode over time. That is, when a style becomes too common and overexposed it is finally abandoned and a new trend takes shape.

A fourth source of perceived design superiority arises from technology-design interactions. Most technological product innovations inherently require some physical embodiment and as such serve as a platform for visible design innovations. Interestingly, the dominant architecture of a new product category, which crystallizes at the transition point between periods of variation and selection (e.g., Abernathy and Utterback, 1978; Anderson and Tushman, 1990), typically not only manifests itself in terms of technological specifications, but also as a selection of the product's principal external appearance among many variants (Bijker, 1995; Dell'Era and Verganti, 2007; Eisenman, 2013). The selection process of the visible product design that wins the allegiance of the marketplace may be partly driven by supply-side forces. The designers' degrees of freedom may be severely restricted by technical, ergonomic, regulatory or legal constraints (Bloch, 1995; Lawson, 2006). In particular in product categories governed by functionality-related rather than aesthetic tenets (such as F-clamps), the archetypical product form may inevitably result as the most efficient variant from the firms' optimization of technological parameters (Abrahamson, 2011; Townsend et al., 2011).

Technology-design interactions that affect preferences may also exist on the demand side. Eisenman (2013) proposes that those designs are ultimately selected that best help consumers to understand and approach complex new technologies. In a similar vein, Rindova and Petkova (2007) argue that designs that facilitate consumers' coping with product novelty tend to be perceived as superior. By emphasizing or hiding aspects of the underlying technological change, superior design can elicit optimal consumer responses to product innovations somewhere between boredom and confusion (Bianchi, 2002; Mugge and Dahl, 2013).

In the context of design-based competition, vertical differentiation matters in three respects. First, just like horizontal differentiation it limits substitutability and thus

allows to mitigate competition. Second, since superior designs are preferred by consumers, they will ceteris paribus also be more attractive to sellers. Higher costs of production may partly or fully offset this demand-side advantage. Third, as I will show in the following section, consumer norms against imitation tend to be less stringent in case superior designs are imitated. Strategists making design decisions in vertically differentiated design spaces need to trade these effects off against each other. In addition, they need to take relative differentiation into account, which I address next.

2.3 Design distance: relative differentiation

Both horizontal and vertical differentiation exploit absolute preferences for visible design features, in the sense that each consumer derives a certain utility from design A irrespective of the existence of other designs. However, I argue that rather than the design itself, it is often the perceived distance of a product's design to that of existing reference products that critically influences consumer responses and preference formation. I therefore posit and demonstrate the significance of a third, hitherto largely neglected mode of differentiation through design – *relative* differentiation – that captures the effects of visual proximity on consumer preferences. Relative differentiation may impact competition even when consumers lack absolute design preferences.

In most industries, decisions on design distances[5] run the gamut from truly unique to blatantly imitative. Some firms offer radically new designs, while others engage in creative adaptions or "referencing." Still others seek closer similarity to competitors' designs – famous examples being Lexus in the late 1980's (accused of mimicking design features of Mercedes cars), and Samsung in recent years (accused of copying the design of Apple's iPhone and iPad products). Finally, there are literal design copies that explicitly target the original for replication.

I develop a framework to analyze the competitive implications of design distance choices. In so doing, I focus on demand-side arguments because of the close link between visual product design and consumer preference formation (e.g., Bloch, 1995;

[5] "Design distance" as a measure of visual proximity may refer to both, products perceived as cohesive wholes (e.g., the overall appearance of two cars) or individual design elements of these products (e.g., the design of both cars' rims). There is some debate as to what extent aesthetic impressions are formed holistically and/or from linear processing of products' individual design elements (e.g., Bloch, 1995), yet the relevance of both aspects is undisputed.

Bloch et al., 2003). Moreover, prior research has indicated that market responses rather than firms' supply-side interactions may be critical in determining the success of innovative and, respectively, imitative design strategies (Cappetta et al., 2006; Gemser and Wijnberg, 2001). Finally, I see an opportunity to further illuminate the strategic role of design by integrating well-established, yet fragmented, bodies of work from the fields of marketing, psychology, and sociology.

In developing the framework, I first discuss mechanisms by which proximity to the design of a competitor's product can have either positive or negative effects on consumers' quality perceptions. I then combine these mechanisms into a simple formal model. By accounting for the moderating effects of key contingency factors, the model allows me to illustrate and generalize the conditions under which similarity or dissimilarity to a competing product's design is likely to be most beneficial.

2.3.1 Design distance and quality perceptions

The concept of perceived quality

Perceived quality – broadly defined as perceived overall excellence or superiority of a product (Zeithaml, 1988) – can be regarded as a holistic evaluative product judgment.[6] Three characteristics of quality perceptions are fundamental for the model. First, quality perceptions are higher-order inferential assessments based on lower-level quality cues. Specifically, consumers draw on both physical and non-physical product attributes to infer quality. Recent studies have shown that product appearance functions as an important physical cue for quality perceptions (Creusen and Schoormans, 2005; Mugge and Schoormans, 2012; Page and Herr, 2002), which links to the concept of vertically differentiating designs. Important non-physical indicators of quality are, amongst others, price, brand name, and product warranties.

Second, quality perceptions are subject to uncertainty, the degree of which depends on the predictive power of the lower-level cues. Respective confidence levels, which capture consumers' subjective certainties about the correctness of their quality judgments, increase with information availability and processing, and hence are

[6] I focus here on quality instead of value perceptions. Both involve preferences, but value is a more idiosyncratic and personal concept, typically entailing a trade-off between "get" and "give" components such as quality versus price (Steenkamp, 1990; Sweeney and Soutar, 2001). For the purpose of this study – an aggregate analysis at the market level that abstracts from heterogeneity in individuals' tastes – the concept of perceived quality appears better suited because it reflects more probably a collective consensus.

typically higher for an incumbent's than a new entrant's product (e.g., Muthukrishnan, 1995; Schmalensee, 1982).

Third, judgments of quality are made within and in relation to a specific context. Importantly, products judged concurrently or retrieved from memory (Biernat et al., 1991; Farley et al., 1978; Janakiraman et al., 2009), as well as prevalent norms (Mussweiler, 2003; van Horen and Pieters, 2012a) provide a frame of reference that guides consumers' quality evaluations of a target product. I contend that several of the corresponding psychological mechanisms at work – assimilation and contrast effects, and norm-based penalties – are significantly affected by perceptions of visual proximity. As fleshed out below, design distance choices may thus co-determine the transfer of quality perceptions across competing products and the extent of devaluation due to violation of demand-side norms.

Assimilation and contrast effects

Research in cognitive psychology and social cognition has demonstrated that the impact of activated context information on ambiguous target judgments, including quality perceptions, can be assimilative or contrastive (e.g., Mussweiler, 2003; Schwarz and Bless, 1992; Sherif and Hovland, 1961). When assimilation dominates, then the evaluation of the target is biased toward that of the respective applied comparison standard, whereas contrast causes a shift away. I argue that design features can be crucial to these processes due to their potential for activating context information on potential comparison standards. It is well known that visual proximity promotes perceptual linkages and associations between products, thus inviting comparative evaluations (Crilly et al., 2009; Rindova and Petkova, 2007; van Horen and Pieters, 2012a). The smaller a standard's design distance to the target, the higher the mental accessibility of the standard, and the more likely it will actually be consulted by consumers to infer quality perceptions (e.g., Feldman and Lynch, 1988; Janakiraman et al., 2009).

Upon selection of a comparison standard, consumers engage in either similarity or dissimilarity testing (Mussweiler, 2003). If they test the hypothesis that target and standard are similar, they tend to do so by selectively seeking for evidence indicating similarity – the default consequence being assimilation. A selective focus on target-standard dissimilarities, on the contrary, yields contrastive comparison effects. In essence, and transferred to the present context, there are situations where similarity in

appearance between two products is generalized to similarity in quality (Loken et al., 1986). In other situations, visual resemblance stipulates a certain quality level against which the target product is contrasted, an effect that magnifies perceived quality differences (van Horen and Pieters, 2012b; Warlop and Alba, 2004).

Whether similarity or dissimilarity testing occurs, and thus assimilation or contrast, depends on multiple factors (for a review, see Biernat, 2005) and is therefore difficult to predict. As important factors standard extremity, judgment order, and the confidence level of the target judgment have been identified.

When the contextual standard, relative to the target, is moderately extreme with regard to the judgmental dimension (here: perceived quality), then according to one line of research judges naturally gear toward similarity testing and assimilation is likely to occur. Contrarily, when primed with relatively extreme exemplars, there is a tendency toward dissimilarity testing with contrastive consequences (Herr, 1986, 1989; Stapel et al., 1997).

The relationship between judgment order and type of context effect is the focus of various other studies (e.g., Stapel and Winkielman, 1998; Wilcox et al., 2011). A common finding is that sequential evaluations of a standard followed by a target are more conducive to contrast effects than simultaneous evaluations where perceptions tend to be unitized. For example, consumers often have distinct a priori impressions of prototypical pioneer products which thus lend themselves well as reference points against which later entrants are contrasted (e.g., Carpenter and Nakamoto, 1989; Grewal et al., 2003).

Finally, the confidence level of the target judgment produces robust results as a moderator of assimilation versus contrast effects (Herr et al., 1983; Lee and Suk, 2010; Mussweiler, 2003; Pelham and Wachsmuth, 1995; Stapel et al., 1997). When the target is unambiguous, judges will be immune to assimilative and contrastive influences, because they already have concrete conceptions of the target's properties (consider quality judgments where the predictive power of the lower-level cues is extremely high). Evaluations of highly ambiguous targets, in contrast, typically assimilate to the context, as they provide the interpretational leeway required to construe target-standard similarity (consider quality judgments where lower-level cues are not meaningful at all). At intermediate confidence levels, the direction of the comparative influence is likely to incline toward contrastive as conceptions become more concrete (Herr et al., 1983; Mussweiler, 2003).

Norm-based penalties

The demand-side environment in which a target product is evaluated also holds norms that reflect consumers' commonly shared beliefs of what is considered morally acceptable, just, or fair. Visual proximity to a competitor's product may violate demand-side norms if consumers see imitators free riding on other firms' design efforts. In such cases, similarity arouses reactance which has detrimental effects on product evaluations, including quality perceptions (van Horen and Pieters, 2012a; Warlop and Alba, 2004). Several studies have demonstrated that reactance is particularly high if an ulterior motive becomes apparent, such as when consumers realize that design similarity is used as an intentional ploy to pretend similarity in quality to a competitor's product (e.g., Bolton et al., 2003; Campbell and Kirmani, 2000). Larger design distances, in contrast, less likely invoke norm-based penalties.

Whether a certain design distance is considered acceptable or not is strongly context-dependent. An important determinant are social and cultural values, which exert a great influence on demand-side norms and respective fairness perceptions (e.g., Reidenbach et al., 1991; Swinyard et al., 1990). Societies that are generally prone to imitation will also develop a more relaxed attitude toward close design copies.

A second determinant is the nature of the imitated design. I propose that similarity to vertically differentiating designs is considered less reprehensible, precisely because of the designs' accepted superiority. This argument builds on consequentialism – the class of ethical theories that justify behaviors on grounds of beneficial outcomes. According to this view, fairness perceptions may be biased toward an individual's or a certain group's self-interest. Proximity to vertically differentiating fashion designs, for example, is more generously accepted because of individuals' desire to be in fashion (e.g., Hemphill and Suk, 2009). Indeed, consumers themselves engage in mimesis to participate in trends and fashions, so they will also be more appreciative to imitating firms. This tendency is particularly pronounced for clothing fashion where imitation is endemic and arguably a core activity of the industry. Most fashion designers practice and condone imitation to some extent. Hence, there is no reason for consumers to disdain such conduct (Hilton et al., 2004). Technology-design interactions, too, provide reasons to justify close design distances on grounds of beneficial outcomes, such as proximity to the most "efficient" design or to the one that best explains a new technology. A case in point are the ironic comments by various news services on the

design patent litigation between Apple and Samsung, stating that "Apple is granted a patent on the rectangle."[7]

Finally, also characteristics of the innovating and imitating firms may set off cognitive justification processes in which visual resemblance is rendered morally acceptable. The burgeoning literature on determinants of counterfeit purchases reports that fairness perceptions depend on how strong consumers feel the need to support an innovating or imitating firm. When innovators do not seem to come to harm (e.g., due to little overlap between markets for the original and the copy) or have a bad reputation, imitations may be perceived as more legitimate (e.g., Ang et al., 2001; Poddar et al., 2012). A similar effect occurs when consumers sympathize with the imitator, as is often the case with small, unknown firms (e.g., Penz and Stottinger, 2005; Tom et al., 1998).

2.3.2 Modelling the optimal design distance

Model set-up

I consider two products, 1 and 2. Product 1 serves as the comparison standard when consumers evaluate Product 2. Consumers are homogeneous. They have no absolute preference for certain locations in design space. The design of each product is described by its position in the design space, which is modeled by the positive real axis. Without restriction of generality I assume that Product 1 is located at 0, while Product 2 is located at $d > 0$. Thus, d also denotes the design distance of the two products.

When consumers judge each product in isolation, they arrive at the perceived stand-alone qualities, q_{10} and q_{20}, which they consider to be unbiased estimates of the (unobservable) true qualities. I denote the difference in stand-alone qualities by $\Delta \equiv q_{10} - q_{20}$, and interpret the absolute value of Δ as a measure of standard extremity (relative to Product 2).

I assume that consumers have full confidence when assessing the quality of Product 1, for example because it has been on the market for longer or because it comes from an established firm with a known reputation. Thus, they would not modify their judgment of Product 1 when assessing it jointly with Product 2 as opposed to judging it in isolation, and so its effective quality q_1 equals its stand-alone quality, $q_1 = q_{10}$. In contrast, consumers have limited confidence when assessing the quality of Product 2, which may be a recently introduced product from a new market entrant. The parameter

[7] See, e.g., The Register at http://www.theregister.co.uk/2012/11/08/apple_rectangle_rounded_corners (last accessed: 8 January 2015).

ε indicates how large an error consumers feel they make in determining q_{20}. Full confidence is described by $\varepsilon = 0$; a complete lack of confidence, by $\varepsilon = 1$. When assessing the quality of Product 2 jointly with that of Product 1, consumers take the latter's quality and the products' similarity into account as additional cues. The adjusted quality estimate, q_2, differs in general from q_{20}.

The strength of the various effects at work depends on the products' distance in design space (d), the difference in perceived stand-alone qualities (Δ), and the error made in determining the quality of Product 2 (ε). I discuss each effect and its dependence on the parameters in turn.

The assimilation effect is described by the term $a(d,\Delta,\varepsilon)$. From my qualitative discussion it follows that $a(d,\Delta,\varepsilon)$ decreases in absolute size with increasing design distance (d); has the same sign as Δ; is limited in absolute size to $|\Delta|$, which implies $a(d,0,\varepsilon) = 0$; and increases in absolute size when the error (ε) increases. Furthermore, I make the plausible assumption that $|a(d,\Delta,\varepsilon)|$ increases with increasing $|\Delta|$. Finally, I assume a separable functional form, $a(d,\Delta,\varepsilon) = a_1(\Delta,\varepsilon)a_2(d)$, where $a_2(d)$ is positive, decreasing with d, and approaching zero for large d. For Propositions 1 and 4, I specify $a_2(d)$ as $e^{-\alpha d}$ with $\alpha > 0$. The following assumptions, and those made below regarding $c_1(\Delta,\varepsilon)$, make sure that for small (large) $|\Delta|$ the assimilation (contrast) effect dominates: For $\Delta > 0$ ($\Delta < 0$), $a_1(\Delta,\varepsilon)$ is assumed to be positive and concave (negative and convex) in Δ and its slope to go to zero for large $|\Delta|$. To make sure that for small ε the contrast effect dominates, while for large ε the assimilation effect becomes relatively more important, I assume that $|a_1(\Delta,\varepsilon)|$ is convex in ε and its slope vanishes at zero.[8]

The contrast effect is described by the term $c(d,\Delta,\varepsilon)$. Again, from my qualitative discussion it follows that $c(d,\Delta,\varepsilon)$ has the opposite sign to Δ, and that $|c(d,\Delta,\varepsilon)|$ decreases with d and increases with ε. I further assume that $|c(d,\Delta,\varepsilon)|$ is zero for $\Delta = 0$ and increases with $|\Delta|$. Again, I assume a separable function, $c(d,\Delta,\varepsilon) = c_1(\Delta,\varepsilon)c_2(d)$, where $c_2(d)$ is positive, decreasing with d, and approaching zero for large d. The term $c_1(\Delta,\varepsilon)$ is negative and concave (positive and convex) in Δ for $\Delta > 0$ ($\Delta < 0$) and its slope with respect to Δ equal to zero at $\Delta = 0$. With regard to ε, $|c_1(\Delta,\varepsilon)|$ is assumed to be concave. For Propositions 1 and 4, I specify $c_2(d) = e^{-\gamma d}$, $\gamma > 0$.

The effect of norms, finally, is described by the term $n(d,\Delta)$. It is negative;

[8] Examples of specific functional forms that fulfill my assumptions are $a_1(\Delta,\varepsilon) = a_0\Delta(1+\Delta^2)^{-1/4}\varepsilon^2$ and $c_1(\Delta,\varepsilon) = -c_0\Delta|\Delta|(1+|\Delta|)^{-1}\varepsilon^{1/2}$.

decreases in absolute size with d; and should be independent of ε. I assume that $|n(d,\Delta)|$ decreases with $|\Delta|$ since, with large $|\Delta|$, consumers should perceive the products as addressing different market segments, in which case design imitation is less harmful to the original product. Again, I assume separability ($n(d,\Delta) = n_1(\Delta)n_2(d)$) with $n_2(d) > 0$, $\partial n_2/\partial d < 0$, and $\lim_{d\to\infty} n_2(d) = 0$, and for Propositions 1 and 4 specify $n_2(d) = e^{-\nu d}$, $\nu > 0$. Table 1 summarizes my assumptions.

I can thus express the quality spillovers $S(d,\Delta,\varepsilon)$ from Product 1 to Product 2 as follows:

$$S(d,\Delta,\varepsilon) \equiv q_2(d,\Delta,\varepsilon) - q_{20} = a_1(\Delta,\varepsilon)a_2(d) + c_1(\Delta,\varepsilon)c_2(d) + n_1(\Delta)n_2(d) \quad (1)$$

I refer to the absolute values of the summands at $d = 0$ as the *effect sizes*, which in the case of an exponential dependence on d equal $|a_1|$, $|c_1|$, and $|n_1|$, respectively.

Table 1: Model assumptions

	symbol	sign	$\frac{\partial}{\partial d}\lvert\cdots\rvert$	$\frac{\partial}{\partial \lvert\Delta\rvert}\lvert\cdots\rvert$	$\frac{\partial^2}{\partial \lvert\Delta\rvert^2}\lvert\cdots\rvert$	$\frac{\partial}{\partial \varepsilon}\lvert\cdots\rvert$	$\frac{\partial^2}{\partial \varepsilon^2}\lvert\cdots\rvert$
assimilation effect	$a(d,\Delta,\varepsilon)$	sign(Δ)	–	+	–	+	+
contrast effect	$c(d,\Delta,\varepsilon)$	– sign(Δ)	–	+	+	+	–
norms effect	$n(d,\Delta)$	–	–	–	no ass.	0	0

Solving the model

Regarding the shape of the function $S(d,\Delta,\varepsilon)$, I need to make four case distinctions. The first concerns the sign of Δ, that is, if the comparison standard is perceived as better ($\Delta > 0$) or worse ($\Delta < 0$) than Product 2. I first analyze the case of $\Delta > 0$, and subsequently show that the case of $\Delta < 0$ follows, mutatis mutandis, the same logic. To avoid lengthy and not particularly insightful discussions, I omit limiting cases and focus on strict inequalities in my case distinctions. For $\Delta > 0$, the other three case distinctions are as follows:

(a) Are quality spillovers positive (rows a and b in Figure 1) or negative (rows c and d) in the case of perfect imitation ($d = 0$)?

(b) Is the rate of decrease α of the assimilation effect (i) less than those of both other effects ($\alpha < \gamma$ and $\alpha < \nu$, column 1 in Figure 1), (ii) between them ($\gamma < \alpha$

< ν or ν < α < γ, column 2), or (iii) greater than those of both other effects (α > γ and α > ν, column 3)?

(c) Do quality spillovers decrease (rows a and c in Figure 1) or increase (rows b and d) with *d* when the design distance is close to zero?

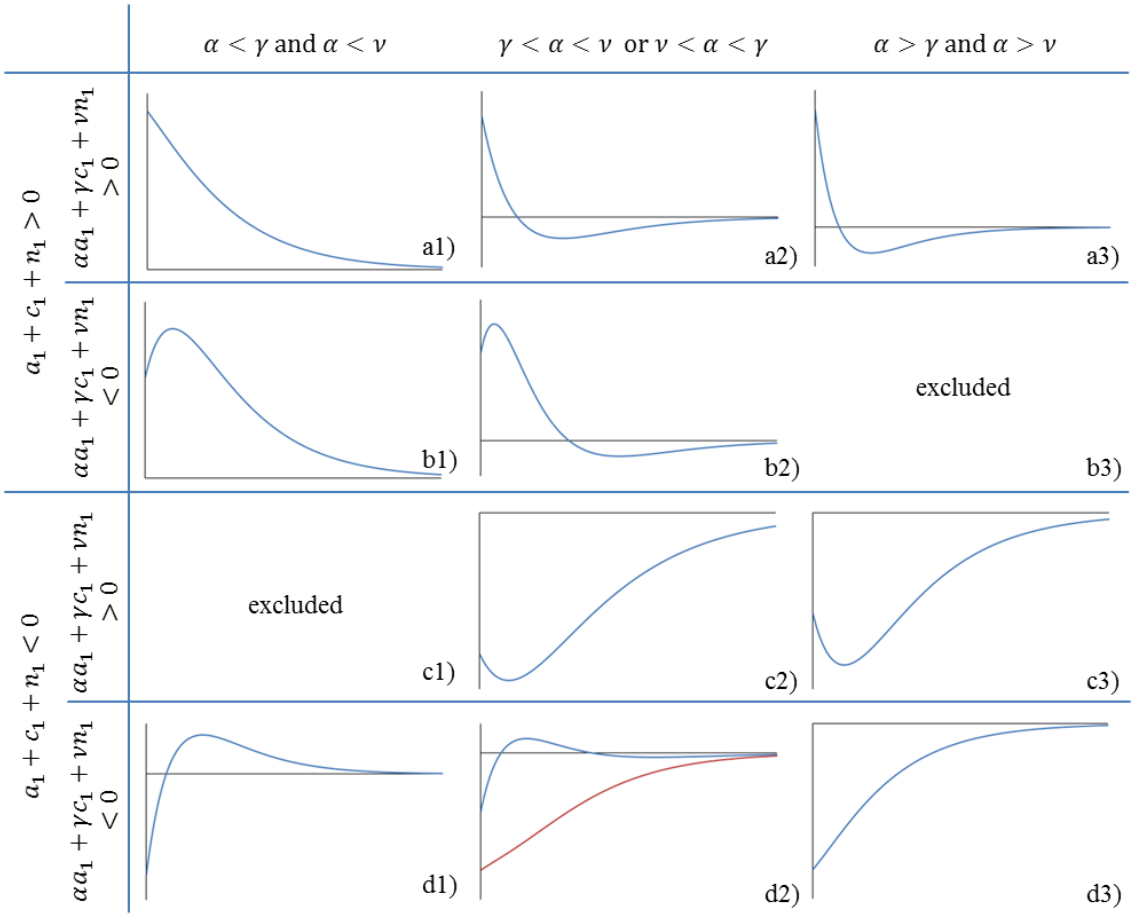

Figure 1: Shapes of spillover function $S(d)$ with exponential dependence on d ($\Delta > 0$)

Combining the case distinctions yields 2 × 3 × 2 = 12 cases, two of which can be excluded.[9] The other cases can be classified according to the existence and, in that case, position of the maximum of $S(d,\Delta,\varepsilon)$ with respect to d. I prove[10] the following:

[9] Distinction (c) is not independent of (a) and (b). For example, if α is larger than γ and ν and a_1 is larger than $c_1 + n_1$, then αa_1 cannot be less than $\gamma c_1 + \nu n_1$. This excludes the case b3.

[10] The proof of Proposition 1, and all that follow, are relegated to the Appendix, A.1.

Proposition 1:

If $\Delta > 0$, $a_2(d) = e^{-\alpha d}$, $c_2(d) = e^{-\gamma d}$, *and* $n_2(d) = e^{-\nu d}$, *then*

(a) S(d,Δ,ε) has at most one local maximum with respect to d in [0;∞).

(b) S(d,Δ,ε) has its global maximum with respect to d at d=0 if $S(0,\Delta,\varepsilon) > 0$ *and* $\partial/\partial d\ S(d,\Delta,\varepsilon)_{d=0} < 0$.

(c) S(d,Δ,ε) has its global maximum at some positive and finite value d^* *if* $\partial/\partial d\ S(d,\Delta,\varepsilon)_{d=0} > 0$ *and [[S(0,Δ,ε) > 0] or [[S(0,Δ,ε) < 0] and [[* α *is less than both* γ *and* ν *] or [[* α *lies between* γ *and* ν *] and [* a_1 *is large enough such that S(d,Δ,ε) attains positive values]*[11] *]]]].*[12]

(d) S(d,Δ,ε) has no global maximum at finite values of d if S(0,Δ,ε) < 0 and one of the following three conditions is met: [$\partial/\partial d\ S(d,\Delta,\varepsilon)_{d=0} > 0$ *and* $\alpha > \gamma \wedge \alpha > \nu$ *] or [[* $\partial/\partial d\ S(d,\Delta,\varepsilon)_{d=0} > 0$ *and [* $\gamma < \alpha < \nu$ *or* $\nu < \alpha < \gamma$ *] and [* a_1 *is not large enough for S(d,Δ,ε) to attain positive values]] or [* $\partial/\partial d\ S(d,\Delta,\varepsilon)_{d=0} < 0$ *]. In these cases, S(d,Δ,ε) approaches the supremum of 0 for* $d \to \infty$. *A local (but not global) maximum at d=0 exists for* $\partial/\partial d\ S(d,\Delta,\varepsilon)_{d=0} < 0$.

The proposition shows that the optimal design distance d^* for Product 2 with respect to quality spillovers depends on the effect sizes of the three effects and on how strongly they decrease with increasing design distance. According to part (a) of the proposition, the analysis is simplified by the fact that the quality spillover function has at most one local maximum. Thus, if a local maximum with positive spillovers exists it is also the global maximum (since for large design distances the quality spillovers approach zero).

The proposition further specifies under what conditions the maximum is achieved with perfect imitation (part (b)), a finite and positive design distance d^* (part (c)), or in the limit of very large design distances (part (d)).

Perfect imitation maximizes spillovers if the effect size $|a_1|$ of the assimilation effect is large compared to those of the contrast ($|c_1|$) and the norms effect ($|n_1|$) and the (negative) slope of the assimilation effect near $d = 0$ is sufficiently large that it more than outweighs the positive slopes of the counteracting effects (row a in Figure 1).[13]

---

[11] This condition can be made explicit, but since it is not informative I abstain from doing so.

[12] The brackets are added to make the nested "and" and "or" conditions unambiguous.

[13] Note that I am still focusing on the case that Product 1 is perceived as superior to Product 2 ($\Delta > 0$), such that a_1 is positive while c_1 and n_1 are negative.

That is, the product of effect size and rate of decrease ($|\alpha a_1|$) is large for the assimilation effect compared to contrast and norms effect.

A positive and finite design distance d^* maximizes quality spillovers if the decrease αa_1 of the assimilation effect near $d = 0$ is not large enough to outweigh the positive slopes of the counteracting effects, the relative rate of decrease α of the assimilation effect with design distance is smaller than one or both of those of the other effects, and the effect size of the assimilation effect is large enough for positive spillover values (cases b1, b2, d1, and d2).

No maximum exists if quality spillovers are negative for all finite design distances. This is the case if spillovers with perfect imitation are negative and either (i) perfect imitation is not locally optimal and the assimilation effect decreases faster with d than both other effects (case d3); (ii) perfect imitation is not locally optimal, the assimilation effect decreases faster with d than exactly one of the other effects, and the effect size of the assimilation effect is too small for positive spillover values (case d2, lower curve); or (iii) perfect imitation is locally optimal (row c).

On a more abstract level one can summarize the conditions as illustrated in Figure 2. Perfect imitation maximizes spillovers if both the assimilation effect and its slope are large in absolute size at $d = 0$. As stated at the axes in Figure 2, all conditions are meant relative to the corresponding parameters of the counteracting effects. A maximum at some positive and finite distance d^* occurs if the assimilation effect decreases with distance more slowly than at least one of the other effects and if the product of its effect size and rate of decrease is not too large. Finally, the maximum possible design distance is optimal with respect to quality spillovers if the effect size of the assimilation effect is small and its rate of decrease is "medium" or large.

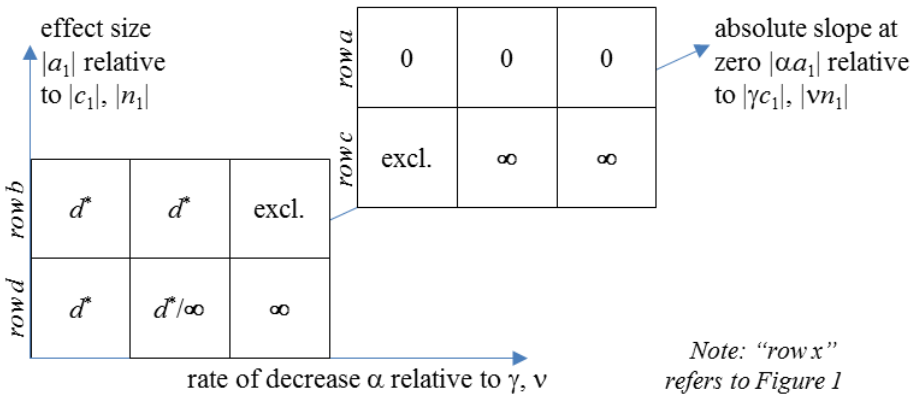

Figure 2: Location of spillover maximum with exponential dependence on d ($\Delta > 0$)

I now focus on how the spillover function and in particular the position of its maximum depend on the quality difference Δ and the assessment error ε.

Proposition 2: *If $\Delta > 0$ and $S(d,\Delta,\varepsilon)$ has its global maximum at $d^* > 0$, then with increasing quality difference Δ the optimal design distance d^* (i) increases if the norms effect is zero or sufficiently small and (ii) decreases if the contrast effect is zero or sufficiently small. In general, the outcome depends on the relative sizes of norms and contrast effect.*

The intuition behind part (i) of the proposition is that with increasing quality difference both assimilation and contrast effect become stronger, but the latter more so. This makes a larger design distance more attractive. If the contrast effect is negligible and thus only assimilation and norms effect matter (ii), then an increase in quality difference leads to an increase of the former and a decrease of the latter, making a higher degree of similarity attractive for Product 2. A similar result holds for the effect of the assessment error:

Proposition 3: *If $\Delta > 0$ and $S(d,\Delta,\varepsilon)$ has its global maximum at $d^* > 0$, then with increasing assessment error ε the optimal design distance d^* decreases.*

For this result, the intuition is that with increasing assessment error both assimilation and contrast effect increase, but the former becomes relatively more important. Thus, the harder it is for consumers to assess the quality of a newcomer product, the more it makes sense for its seller to seek design proximity to known products (of superior quality).

I now turn to the case of a negative quality difference. That is, consumers perceive Product 2 as superior, but are still uncertain about its precise quality. In this case, the roles of assimilation effect and contrast effect in shifting the perceived quality q_2 are reversed. Since the corresponding terms in Equation (1) are structurally identical, I obtain:

Proposition 4: *If $\Delta < 0$ then the results of Proposition 1 carry through with a_1 and c_1 and α and γ interchanged.*

As an example, the box with the outcome d^* in the upper left corner of the front panel in Figure 2 corresponds to the case, if $\Delta < 0$, that the effect size of the contrast

effect c_1 is large relative to a_1 and n_1, its rate of decrease γ is smaller than both α and ν, and the product γc_1 of both is less than the sum of the other two products. In a similar fashion, I obtain the following results regarding the effects of Δ and ε:

Proposition 5: *If $\Delta < 0$ and $S(d,\Delta,\varepsilon)$ has its global maximum at $d^* > 0$, then with increasing quality difference Δ (i.e., decreasing $|\Delta|$) the optimal design distance d^* increases.*

Proposition 6: *If $\Delta < 0$ and $S(d,\Delta,\varepsilon)$ has its global maximum at $d^* > 0$, then with increasing assessment error ε the optimal design distance d^* increases if the norms effect is zero or sufficiently small.*

To conclude the analysis I comment on generality of the model. Propositions 1 and 4 assume a specific functional form, that is, exponential dependence on d. In the general case, as assumed in all other propositions, multiple local maxima of the spillover function with respect to d may occur. In that case, Propositions 2, 3, 5, and 6, which rely on the general assumptions regarding how the three effects vary with quality difference and assessment error, can be rephrased as saying that any local maximum of the spillover function shifts to lower or higher values of d with an incremental change of Δ or ε. I also note that functional forms that lead to multiple local equilibria would have a somewhat implausible shape, with alternating sections of low and high curvature with respect to d. More importantly though, despite its specificity the model in Propositions 1 and 4 conveys the intuition that the relative sizes of the effects at play and their relative rates of decrease are central to the question of design-transmitted quality spillovers.

2.4 Implications for design-related value capture

Design choices for competing products are interdependent. In the context of horizontal and vertical differentiation, similarity implies better substitutability and thus intensified competition, which tends to make distant design choices preferable. On the other hand, a clustering of designs may be attractive because a certain design is preferred by consumers or because it is advantageous in terms of cost. An important additional determinant of design attractiveness are quality spillovers based on relative differentiation, which may work for or against similarity to existing designs.

These considerations raise the questions under what circumstances innovators need

to be concerned about design imitation, and which mechanisms may help them to prevent it. In this section, I therefore shift the focus from the follower's value creation through favorable design choices to the challenge of design-related value capture on the part of the innovator. Before analyzing the role of relative differentiation in this regard, I synthesize the literature on firms' use of design protection mechanisms and their perceived effectiveness.

2.4.1 Established design protection mechanisms

A first general insight is that design-related appropriability conditions (Teece, 1986), or isolating mechanisms (Rumelt, 1984), are relatively weak. As regards legal barriers, designs may qualify for protection under specific design laws (e.g., design patents in the U.S. and (un)registered design rights in the EU) as well as other schemes (in particular copyright, trademark, and unfair competition law) (for a detailed overview and discussion of legal design protection mechanisms, see Chapter 3 of this dissertation). However, cross-industry surveys (e.g., Arundel, 2001; Gallié and Legros, 2012; Thomä and Bizer, 2013) show that design-related intellectual property rights are considered relatively ineffective, especially when compared to informal mechanisms such as lead time and complementary assets. Qualitative studies in design-intensive industries such as furniture (Gemser and Wijnberg, 2001), footwear (Alcaide-Marzal and Tortajada-Esparza, 2007), and fashion (Myers, 2009), arrive at similar conclusions. And just like legal barriers, also natural impediments to imitation are largely ineffective in the design context: secrecy, because designs must be exposed by their very nature, and complexity, because most designs can be copied easily and rapidly (e.g., Dickson and Coles, 1998; Monseau, 2012).

With weak appropriability conditions, privileged access to complementary assets should become a critical determinant in capturing value (Teece, 1986). And indeed, scholars have pointed to a variety of complementary assets and capabilities that facilitate value capture in domains where competition is mainly based on aesthetics. These include brand image and reputation, the firm-specific context in which a design enfolds its symbolic meaning, pleasurable in-store experiences, production know-how and facilities, as well as trusting relationships with designers, suppliers and retailers (Candi and Saemundsson, 2011; Dell'Era and Verganti, 2007; Dickson and Coles, 1998; Gemser and Wijnberg, 2001; Hemphill and Suk, 2009).

A third research stream focuses on norms as barriers to imitation. Studies in various

domains of the creative industries have shown that groups of competing individuals and firms often have shared norms that distinguish acceptable inspiration from illegitimate copying (for a recent review, see Raustiala and Sprigman, 2012). In case of deviant behavior, the community applies sanctions against the infringer and thus helps to enforce exclusivity. Such norms-based intellectual property systems may function as complements to or even substitutes for law-based systems (e.g., Di Stefano et al., 2013; Fauchart and von Hippel, 2008). It seems plausible – and there is first evidence (Dickson and Coles, 1998) – that designers adhere to supply-side norms similar to those reported in other creative domains. Importantly in the present context, also demand-side norms may sanction imitation. These are likely to exert a particularly strong influence in the context of visible product attributes since design imitations are usually readily apparent to consumers. Gemser and Wijnberg (2001), based on interviews with design leaders in the Italian and Dutch furniture industries, found the threat of reputational losses to be the most effective deterrent to imitation. Similarly, Schultz (2006) and Bauer et al. (2014) identified norms against imitation in fan and, respectively, crowdsourcing communities.

2.4.2 Design protection based on relative differentiation

My analysis reveals that demand-side effects can play a key role for design-based competition. They may help to protect an innovative design, but may also make imitation more attractive. I now examine when one or the other is the case, pointing out interactions with horizontal differentiation, vertical differentiation, and intellectual property rights. I treat the case that the innovator's product is perceived as better than the follower's ($\Delta > 0$) in parallel to the reverse situation ($\Delta < 0$), highlighting the differences.

Positive spillovers at $d = 0$: If for $\Delta > 0$ the assimilation effect dominates at $d = 0$, and equally if for $\Delta < 0$ the contrast effect dominates at $d = 0$, then quality spillovers are maximized with exact imitation (row a in Figure 1). If the follower actually chooses $d = 0$, this has a detrimental effect on the innovator since competition in the design dimension – which in most cases will correspond to horizontal differentiation – is

intensified, the more so the more pronounced the consumers' design preferences are.[14] Interestingly, in conjunction with intellectual property rights the outcome may be turned on its head: if all designs with positive spillovers are legally prohibited for being too close to imitation, then the second best choice for the follower may be maximum differentiation in design (cases a2, a3, and b2 in Figure 1). An interesting difference between the cases of $\Delta > 0$ and $\Delta < 0$ arises regarding vertical differentiation. For $\Delta > 0$, positive quality spillovers to the follower's product decrease the products' distance also in the vertical (quality) dimension, intensifying competition further. For $\Delta < 0$, in contrast, positive quality spillovers amplify the perceived (absolute) quality difference, thus mitigating competition in the vertical (quality) dimension and shielding the innovator from the effects of imitation.

Negative spillovers at $d = 0$: The situation is generally more favorable to the design innovator if quality spillovers are negative for an exact copy (rows c and d in Figure 1). The anticipation of negative spillovers may push the follower to choose a larger design distance – either a positive, finite distance (cases d1, d2) or even the largest possible distance (cases c2, c3, d2, d3) – thus reducing competition in the (horizontal) design dimension. If the follower still opts for $d = 0$ (because this design is attractive to consumers or in terms of cost, or because the firm acts irrationally), the effects of relative differentiation depend on the products' relative quality. If the innovator's is superior ($\Delta > 0$), then the negative quality spillovers increase the perceived quality difference between the products. Thus, they afford the innovator some protection against the negative effects of design imitation by mitigating competition in the vertical (quality) dimension. For $\Delta < 0$, in contrast, negative quality spillovers reduce the perceived quality difference and thus intensify competition also in the vertical (quality) dimension. Anticipation of this additional negative effect may constitute a further reason for the follower to avoid a direct design copy.

Moderating effect of quality difference (Δ): If quality spillovers are maximal at some positive and finite value d^* (cases b1, b2, d1, d2), then (for $\Delta > 0$) if the norms effect is negligible larger quality difference Δ implies larger d^*. If the follower chooses its design accordingly, then less inferior products are located more closely to the

[14] By "more pronounced" I mean, for horizontal differentiation, that each consumer's utility decreases strongly with deviations from his or her most preferred design. In Hotelling's (1929) classic model of horizontal differentiation this is captured by the transportation cost parameter, *c*. For vertical differentiation, it means that a consumer's evaluation of a certain price-quality combination changes strongly with variations in quality, as captured by the parameter Y in the model by Shaked and Sutton (1983).

innovator's. This is detrimental to the innovator because it implies that better (but still inferior) follower products are closer both in the horizontal dimension (by choice of d^*) and in the vertical dimension (due to quality spillovers). For $\Delta < 0$, in contrast, these effects counteract each other. Decreasing absolute quality difference $|\Delta|$ implies larger d^*. If the follower aims at maximizing quality spillovers, then follower products that are close to the innovator's in the quality (vertical) dimension are located further away in the horizontal (design) dimension. Thus, a reduction of horizontal competition mitigates the intensified competition in quality.

Moderating effect of assessment error (ε): For $\Delta > 0$, a smaller assessment error (ε) implies larger d^*. This suggests the innovator can use the effects of relative differentiation to its advantage by reducing ε, for example by building a reputation for initiating tests and consumer reports about its own and competing products. In the case of $\Delta < 0$, and if the norms effect is negligible, then a *larger* assessment error benefits the innovator by implying a larger d^*. The innovator may use this effect to its advantage by spreading uncertainty about new competing products.

2.5 Concluding discussion

Drawing on a variety of theoretical perspectives explaining the demand-side effects of design, I have developed a unifying framework that moves management research toward a better understanding of design-based competition. As the first component and backbone of the proposed framework, I disentangle the various facets of the differentiating nature of design. I challenge the entrenched view of design as simply another horizontal differentiator in crowded marketplaces by introducing the concepts of *de facto* vertical and relative differentiation through design. The latter captures – irrespective of absolute design preferences – the effect of visual linkages to competing offers on consumers' evaluative judgments. The framework's second component explicitly articulates the psychological processes underlying relative differentiation, and illuminates how design distance choices may serve as a strategic tool to moderate these processes in order to enhance a product's perceived quality. The mathematical rigor introduced by the formal model allowed me to derive testable research propositions that link the optimal degree of design distance to key contingency factors. Finally, I advance the idea that the psychological processes triggered by visual similarity may also act as natural barriers to imitation, and as such shed light on the challenge of design-related

value capture. In the following, I conclude with theoretical and managerial implications of the framework, and suggest avenues for further study.

2.5.1 Toward a deeper understanding of design-based competition

The last three decades have seen an upsurge in interest on topics related to visible product design across management disciplines. While early contributions were mainly directed at a specialized audience (e.g., Black and Baker, 1987; Dumas and Mintzberg, 1989), design research has gradually diffused into journals of more general orientation (e.g., Cillo and Verona, 2008; Eisenman, 2013; Gruber et al., 2015; Ravasi and Stigliani, 2012; Rindova and Petkova, 2007). I believe, however, that the current academic picture remains partly incomplete and imbalanced because it does not adequately account for the competitive dimension of design and the dependence of design choices on the demand-side environment in which they take effect. Both shortcomings are addressed in this study.

The competitive dimension of design

Numerous studies have demonstrated the potency of design to enhance company performance, either based on case studies of acknowledged "design leaders" (e.g., Ravasi and Lojacono, 2005; Verganti, 2009) or by measuring ordinary firms' design orientation on a larger scale (e.g., Gemser and Leenders, 2001; Hertenstein et al., 2005). What has been largely overlooked, though, is that design – along with its increasing strategic importance – can be a significant factor in inter-firm competition. Indeed, in most consumer industries firms literally compete in product appearance. Some experiment with truly novel designs as levers for superior value creation and, if successful, will try to preserve their design advantage. Other firms respond to those choices – either near or distant.

Importantly, I argue that styling decisions for competing offers are interdependent, not only because the degree of differentiation impacts the intensity of competition, but also because design creates visual references to existing products, thus stimulating comparative evaluations. One key contribution of my framework is to provide insight into how the competitive design context actually co-determines a product's potential for creating competitive advantage. While first attempts have been made to study the conditions under which rival firms develop homogeneous or heterogeneous design strategies (Cappetta et al., 2006; Dell'Era and Verganti, 2007), to date, no conceptual

framework exists that systematically analyzes the implications of design choices relative to competitors' designs. My framework attempts to fill this lacuna. In acknowledging the competitive dimension of visible product design, I corroborate its much-heralded strategic relevance (e.g., Kotler and Rath, 1984; Noble, 2011; Rindova et al., 2011), and hope to further re-position the topic as a legitimate area of theoretical and empirical enquiry.

Demand-side embeddedness

Another shortcoming of extant studies is that they tend to be either firm-level or demand-side oriented, although the benefits of a careful fit between firms' design strategies and the market environment have been emphasized since the inception of the field (e.g., Berkowitz, 1987; Bloch, 1995). My framework may be seen as an additional step of drawing together common threads, using insights on preference formation processes from marketing, psychology and sociology as a foundation for design competition and strategy theorizing that covers aspects of both, value creation and value capture. The main novelty is that I introduce an explicit treatment of how design distance choices affect the psychological processes involved in comparative evaluations. Linking research on context effects (e.g., Janakiraman et al., 2009; Mussweiler, 2003) and fairness norms (e.g., Hilton et al., 2004; Warlop and Alba, 2004) to visual product design draws attention to new dimensions along which to consider design strategy and highlights further possibilities for cross-fertilization. What is clear from my analysis is that design-based competition cannot be fully understood disassociated from the demand-side environment in which it is embedded. I thus encourage, along with others (Eisenman, 2013; Ravasi and Stigliani, 2012; Rindova and Petkova, 2007), future organizational-level studies in this field to be more sensitive to the demand-side effects of design.

2.5.2 Rethinking design choices in practice

The framework I develop also serves as a guideline for practitioners on how to strategically manage visible product design and anticipate competitor responses to new product introductions. Such advice is crucial, given the complexity of these seemingly surface decisions (e.g., Crilly et al., 2009), and the great deal of unease design choices continue to create due to a lack of theory (e.g., Noble, 2011).

Traditionally, product styling has been treated primarily as a task of appropriately

reconciling competing and conflicting constraints (e.g., Alexander, 1964; Bloch, 1995; Lawson, 2006). Limiting factors are plentiful, such as those endogenously imposed by the technology and the intended functionality of the product as well as regulatory and legal requirements that must be met. With the gradual emancipation of design decision making from this constraining school of thought, attention has been directed toward understanding and proactively influencing consumers' cognitive and emotional responses to visible design attributes. The recent, market-oriented approach has yielded more strategic uses of design, for example as a means to help consumers cope with product novelty and complexity (Eisenman, 2013; Rindova and Petkova, 2007) or to capitalize on socio-cultural trends (Dell'Era and Verganti, 2010; Verganti, 2009).

By situating design decision making in a competitive context, I unveil additional levers to exploit the strategic potential of design. The little advice on competitive product styling that has been offered so far remains more general, rarely proposing causal mechanisms between degrees of differentiation and marketplace success (Person et al., 2008). On the one hand, my framework is intended to sensitize practitioners for the challenge of finding the right balance between adherence to widely preferred locations in the design space and a certain degree of differentiation to mitigate competition. By suggesting various types of horizontal and vertical designs, I extend prior thinking that has been largely limited to the trade-off between flocking to market trends while, at the same time, maintaining a firm's stylistic identity (Cappetta et al., 2006; Cillo and Verona, 2008; Karjalainen and Snelders, 2010). Moreover, I shed light on broader competition dynamics based on an ethically-grounded explanation for why imitation of generally preferred designs is likely to be a more viable strategy than proximity to a competitor's design that is only horizontally differentiated.

Furthermore, I emphasize the importance of design distance choices in moderating comparative evaluations. To grasp the competitive implications of this mechanism, practitioners need to enhance their awareness of the visual references to competing products that a design makes, the direction and strength of quality spillovers, and the potential penalties imposed due to violation of demand-side norms. Key relationships and contingencies have been proposed that can be used in tailoring design choices to conditions most likely to lead to a favorable outcome. A general advice is to actively take advantage of the psychological processes exposed in this study. For example, a higher-quality design follower could reduce levels of quality uncertainty through advertising in order to shift comparative influences from assimilative to contrastive,

while an innovator might spur consumer reactance toward close design copies (as an informal appropriability mechanism) by polishing its brand image. To help designers relate their work to broader issues of competition, both strategic guidance and consumer insights are crucial, which underlines recent calls for a closer coordination of firms' design, management, and marketing activities (Cillo and Verona, 2008; Ravasi and Lojacono, 2005).

2.5.3 Model extensions and future research directions

I do not argue that the integrative framework presented here entails an exact or complete representation of the processes and mechanisms governing firms' design-based rivalry but, rather, that it accounts for relationships, variables, and contingencies sufficiently realistic and informative to provide insight about design competition and strategy theorizing. As such, my framework provides a rich foundation for future work that may extend, empirically validate, and apply the ideas discussed in this study.

Specifically, with regard to the stylized model of relative differentiation, I opted for an aggregate analysis at the market level that abstracts from heterogeneity in individuals' tastes. Yet, as apparent from my discussion of horizontal and vertical differentiation through design, consumers typically vary in their absolute preferences for certain design features. While beyond the scope of the present investigation, explicitly modeling the interaction between consumer heterogeneity and design decision making would allow building a richer theory of design strategy-environment fit. To keep the formal model tractable, I incorporated another simplification, namely, that consumers do not modify their judgment of the pioneer's product when assessing it jointly with the follower's product. Future work might relax this assumption by accounting for the possibility of "reverse" quality spillovers. An interesting question in this context is under which conditions a low-quality, little-known innovator brand may *benefit* from an imitative design strategy by a high-quality, reputable follower brand.

Moreover, I encourage future empirical studies to systematically analyze, in light of the propositions derived, the influence of design choices relative to competitors on product evaluations. Research along this line of inquiry might produce a more fine-grained account of the psychological processes underlying relative differentiation, their relative importance, and the moderating effects of key contingencies. Such work will require methods and tools from consumer-level research that have traditionally been treated as part of the marketing, psychology and sociology disciplines, but which can

provide important insight into organizational processes of creating and capturing value through design.

At the firm level, comparative case-based research would initially be helpful to better understand the antecedents of firms' competitive design choices and the extent to which the mechanisms discussed in this study are used strategically to influence perceptions. While I have attempted to develop a generalizable framework applicable across industries, future research should try to map out and make sense of the drivers of firms' design innovation and imitation behaviors in diverse industrial settings (cf. Dell'Era and Verganti (2007) on the Italian furniture industry). Ultimately, quantitative studies could be undertaken to examine the performance implications of design strategies on a large scale. The degree of visual similarity between two products – that is, their design distance – may be operationalized, for example, based on experiments with human subjects (Talke et al., 2009), automated image analyzing algorithms (Landwehr et al., 2011), references made in design patent applications (Chan et al., 2014), or a combination of these approaches.

3 Protecting aesthetic innovations? An exploration of the use of Registered Community Designs[15]

3.1 Introduction

The significance of design, and competing through design, hit the headlines worldwide when, in 2011, Apple accused Samsung of "slavishly copying" both aesthetic and technical aspects of its iPhone and iPad products.[16] Apple filed a number of lawsuits against Samsung worldwide, and succeeded in having an injunction placed on the sale of some Samsung products in Germany. Among these lawsuits was one that alleged Samsung's infringement of Apple's Registered Community Design (RCD No 000181607-0001) related to its iPad products. The case was heard in the High Court in London in July 2012. While acknowledging the two products to be similar – with Samsung's considered to be "less cool" – the judge ultimately found them to be insufficiently similar to constitute an infringement, and therefore ruled in Samsung's favor. The verdict, which had EU-wide jurisdiction, was upheld on appeal in October 2012. A similar case reached the Supreme Court in The Hague, which also found in Samsung's favor.

That Apple, Samsung and others[17] are willing to spend considerable resources contesting their rights to compete at least in part through the "look and feel" of their

---

15 The paper, on which this chapter is based, is forthcoming in *Research Policy* (Filitz et al., 2015). It was presented at the 2014 Academy of Management Meeting (Philadelphia) and 2013 CRE8TV.EU Plenary Project Meeting (Mannheim). The author is grateful to the bck GmbH, Munich, and the Office of Harmonization for the Internal Market, Alicante, for providing access to the database of Registered Community Designs. Special thanks go to the interviewees for contributing their time and insights to this project. I am also grateful to the editor of *Research Policy* and three anonymous reviewers for helpful suggestions which have significantly improved this work. I also gratefully acknowledge the funding from the European Community's Seventh Framework Programme under grant agreement CRE8TV.EU–320203. The views expressed in this paper are those of the author, and do not necessarily represent the views of any other person or organization.

16 Mail Online, at http://www.dailymail.co.uk/sciencetech/article-1378490/Apple-sues-Samsung-slavishly-copying-iPhone-iPad-designs.html (last accessed: 30 June 2014).

17 Other celebrated cases of alleged infringement of registered designs include Procter & Gamble versus Reckitt Benckiser (air freshener spray container – 2007 & 2008) and Dyson versus Vax (vacuum cleaners – 2011). Hartwig (2007, 2008, 2009, 2012a), meanwhile, has collected more than 300 decisions on design protection cases before European courts from diverse industries such as apparel, footwear, furniture, automotive, and electronics.

products testifies to the significance of product form, aesthetics and styling, all attributes directly related to design, and more particularly industrial design and ergonomics. Yet, perhaps surprisingly, innovation studies have paid little attention to these matters. In *Research Policy*, for example, there is only a smattering of papers that are directly concerned with design and product form.[18] A notable exception is Cappetta et al. (2006), who examine "stylistic innovation" directly and relate this to the longitudinal development of the fine fashion industry. In other journals, product design (Ravasi and Stigliani, 2012), design innovation (Rubera and Droge, 2013), design newness (Talke et al., 2009), aesthetic innovation (Eisenman, 2013) and stylistic innovation (Tran, 2010) have been receiving recent attention.

I perceive that product form is an important yet relatively neglected aspect of how firms compete, and a relatively neglected aspect of innovation. If innovation involves changes to the characteristics of products (Saviotti and Metcalfe, 1984), then these characteristics should embrace both the inner workings of the product and its external expression – the latter constituting aesthetic or stylistic innovations.

Innovation scholars also have a tradition of seeking out new sources of data to provide new insights. In the early 1990s efforts were made to develop an output based measure of innovation drawn from the announcement of new products in the trade press (Coombs et al., 1996; Kleinknecht, 1993).[19] Perhaps the dataset of European Registered Community Designs (RCDs), over three-quarters of a million of which have now been filed since registration began in April 2003, offers a new opportunity to complement patent data and revive the object based approach, especially with respect to design, aesthetic or stylistic innovations, all of which may be particularly significant in the "lower-tech" sectors of the economy.

This study therefore has four aims: (i) to provide an introduction to design

[18] Design papers in *Research Policy* include Moultrie and Livesey (2014) on design investments, Walsh (1996) on "design, innovation and the boundaries of the firm," and Sanderson and Uzumeri's (1995) study of how Sony competed through managing design and product families. Ulrich (1995), a classic study on the role of product architecture in manufacturing firms, is also relevant, but deals primarily with the functional or engineering aspects of design, rather than stylistic or aesthetic considerations (cf. Salter and Gann (2003); Barlow and Köberle-Gaiser (2008); Gil and Tether (2011)).

[19] Note that this "object based approach," where the primary unit of analysis is the product, or design, has received little attention of late however, in part because data is difficult to gather. In contrast, the "intermediate object based approach" which uses patent data has enjoyed great popularity, especially since these data became easily available. But this turns a blind eye to innovation in design. The "subject based approach" (where the primary unit of analysis is the firm) has also blossomed due to vast quantities and numerous rounds of Community Innovation Survey (CIS) data produced by Eurostat and various national statistical agencies, but CIS data provides little insight into design innovation.

protection and specifically RCDs; (ii) to explore the use of RCDs and firms' rationales behind it; (iii) to assess their suitability as a source of potential information about design innovation and how firms compete through design; and (iv) to develop a research agenda for further studies of RCDs and design protection more generally.

To contextualize the study, I begin with an overview of past research on design protection, finding this to be rather limited (Section 3.2). I then (in Section 3.3) outline the legal background to design protection in Europe, discussing its emergence and how it has recently been harmonized across the European Union. This section includes a summary of the various options available to creators of designs with regard to their protection. Section 3.4 then presents a descriptive analysis on patterns of RCD use across various countries, industries and firms. To complement this statistical data, I engaged in an exploratory study of how and why RCDs are actually used by firms. To this end, Section 3.5 reports a qualitative study undertaken across three industries (footwear, car manufacturing and tool-making) and here I discuss the findings of interviews with managers of German firms and their legal advisors. This qualitative study indicates that while RCDs have potential as an indicator of design innovation (amongst other things), they need to be examined with caution, and ideally with an understanding of the prevailing industry and firm level norms, as well as of legal issues. This section includes a set of testable propositions derived from my findings that concern the utilization of RCDs by firms. Section 3.6 then outlines a set of issues for further research on design protection in general, and the use of RCDs in particular. I perceive that there are a number of rich and practically important topics that can be examined in relation to RCDs, and invite others to join me in this endeavor. Brief conclusions close the chapter (Section 3.7).

3.2 Existing empirical research on design protection

In contrast to the substantial literature on technological innovation and patent protection, design innovation and design protection have attracted little scholarly attention from economists and management scholars. To my knowledge, the first systematic empirical studies examining the use of design protection were published in 2011 (Bascavusoglu-Moreau and Tether, 2011; BOP, 2011; Moultrie and Livesey, 2011) and 2012 (Ahmetoglu and Chamorro-Premuzic, 2012; Thompson et al., 2012). These studies are preliminary and focused on the UK, but they point to the as yet untapped

potential of design rights as an empirical tool, as well as the need for further research in this area.

In an initial attempt to understand how design rights are used, Moultrie and Livesey (2011) surveyed a cross-sectoral sample of 32 UK firms and 10 design agencies. They report the level of awareness and utilization of design rights in the UK to be relatively low. Ahmetoglu and Chamorro-Premuzic (2012) extended this by conducting a psychometric analysis of survey data drawn from 63 UK companies, and finding that attitudes toward design rights were related to firms' design innovation activities. They interpret their findings as showing the importance of effective design protection for promoting design innovation. BOP (2011), meanwhile, traced differences in the extent to which French, German and UK firms protect their product designs through registration. They attribute the low level of registration in the UK to legal and cultural traditions, and to the relative weakness of the manufacturing sector. Based on a matched-pair methodology, Bascavusoglu-Moreau and Tether (2011) examined performance differences between firms holding, or not holding, designs registered nationally in the UK and designs registered at the EU-level. Interestingly, a productivity premium associated with holding registered designs disappeared a few years after the introduction of European RCDs, suggesting firms had adapted to the changing landscape of legal design protection over the period of the study (1997-2007).

Other scholars have touched on the issue of design protection. In particular, design protection has been included in studies on the use and effectiveness of various appropriability mechanisms (e.g., Arundel, 2001; Sattler, 2003), though it has been left out in others (e.g., Cohen et al., 2000; Levin et al., 1987).[20] The studies explicitly mentioning design protection (in general, rather than RCDs in particular) are mainly those based on the Community Innovation Surveys (CIS) (e.g., Gallié and Legros, 2012; Laursen and Salter, 2005; Mairesse and Mohnen, 2004; Mercer, 2004; Robson and Haigh, 2008; Robson and Kenchatt, 2010; Sattler, 2003; Thomä and Bizer, 2013). Most of this work focuses on technological innovation, and firms' choices between patents and informal modes of protection. Nevertheless, some findings with respect to the use

[20] A common finding from surveys of firms is that informal modes of protection – in particular, lead time, complementary assets, and secrecy – are considered to be more effective than legal exclusion rights, except in discrete technology industries such as chemicals, although many firms combine legal and informal modes of protection. Recent studies in industries where no form of legal IP protection (except possibly trademarks) is applicable – gourmet cuisine (Di Stefano et al., 2013; Fauchart and von Hippel, 2008), magicians (Loshin, 2010), and comedians (Oliar and Sprigman, 2008) – have extended this list to comprise social norms as an informal means of IP protection.

of design protection can be identified.

First, in terms of its effectiveness, design protection is ranked, on average, at a level similar to that of other formal IP rights, such as trademarks and patents, and there are often strong correlations between the extent of use of these different legal IP rights (Gallié and Legros, 2012; Sattler, 2003). Analysis of CIS data indicates that innovating firms make greater use of design rights than non-innovating firms (Livesey and Moultrie, 2008) – a pattern also observed for patents and trademarks. However, Mairesse and Mohnen (2004) find that design protection is the only appropriability mechanism that is used more intensively among innovating firms in "low-tech" than "high-tech" industries, while Gemser and Wijnberg's (2001) interviews with design leaders in the Dutch and Italian furniture industries suggest that design rights are the most effective legal protection mechanism in this "design-intensive" industry.

Second, citing the need for innovation indicators that emphasize creativity and design rather than technological innovation, some researchers have suggested examining registered designs. The conjecture is that the registration of a design, as a patent application, implies that the firm considers it has created something new, and attributes some value to it (Rogers, 1998). Alcaide-Marzal and Tortajada-Esparza (2007) propose that registered designs, along with other indicators, could improve the assessment of innovation in traditional sectors (such as footwear, textiles or furniture) where product aesthetics is a significant contributor to competitiveness. Along similar lines, Livesey and Moultrie (2008) criticize the dominance of patents as a proxy for innovation, as this leads to an overemphasis on technological innovation. They consider that examining both design registrations and trademarks might counteract this, and point to the virtues of these indicators – closeness to market, accessibility, and timeliness.

Third, some studies have incorporated registered designs into measures of firms' strengths in design innovation (Rubera and Droge, 2013) or the performance of countries' innovation systems (PRO INNO Europe, 2012). My empirical exploration into the use of RCDs, which is presented below, adds to this, but also points to the need to fully understand the instrument before engaging in quantitative empirical analysis.

3.3 Background: the legal protection of designs in Europe

The legal protection of product designs is inherently different from that of technological inventions. In this section, I first outline the system of design protection in

Europe, and then introduce, in more detail, the main characteristics of design registration in Europe, and Registered Community Designs (RCDs) in particular; RCDs are just one option available to owners seeking to protect their designs in Europe.

3.3.1 Design protection in Europe: the institutional setting

European design law has a long and complex history, dating back to the 18th century. In 1787 England and Scotland extended copyright protection to textile designs, the same year that France introduced a statute to protect weavings, garments, and furniture under the auspices of copyright law. During the course of industrialization, national design laws were amended to cover the shape and ornamentation of any article of manufacture. Consequently, design protection became largely decoupled from the creative or artistic requirements imposed by copyright laws. National design registries were established (e.g., in the UK in 1839 and Germany in 1876) and distinct design rights specified, such that by the late 20th century multiple different design protection schemes were operating in Europe.

Today, the landscape of design protection in the EU has been transformed by two substantial harmonization efforts. First, a Design Directive (98/71/EC) was passed in 1998 which mandated that all EU Member States provide harmonized national protection of designs by means of national registration procedures.[21] This directive also provided a unified definition of design, namely "the appearance of the whole or a part of a product resulting from the features of, in particular, the lines, contours, colors, shape, texture and/or materials of the product itself and/or its ornamentation." Designs that are new, that is, are not identical to designs already made public, and that have an individual character such that an "informed user" would perceive the design as being different from prior designs are eligible for protection. The maximum term of protection is 25 years, subject to payment of renewal fees every five years.

The Community Design Regulation (EC 6/2002) marked the second step toward harmonization. This entered into force in 2002, and created two EU-wide design rights: the RCD, which corresponds to the aforementioned national right specified under the Design Directive; and the Unregistered Community Design (UCD), which provides automatic protection of any new and individual design against copying for three years from the date of disclosure in the EU. The UCD was intended to provide short-term

[21] This fell short of a complete harmonization of EU law. For example, the protection of spare parts was left to the Member States' discretion.

protection for products with a short lifespan, such as fashionable apparel. While RCDs and UCDs share the same requirements and scope of protection, registration provides the proprietor the exclusive right to use the design, that is, there is no need to prove copying in case of infringement.

National design protection mechanisms have however been maintained alongside the European system of Community Designs. And owners can also register their designs under the Hague System for the International Registration of Industrial Designs which is operated by the World Intellectual Property Organization (WIPO). The Hague System essentially simplifies the process of obtaining design protection in a number of jurisdictions by means of a *single* application filed with WIPO. The EU became a member of the Hague System in January 2008, so EU-wide protection may be obtained by registering through WIPO, but not all Member States are signatories. Other non-members include the United States and Japan, meaning that the available design protection needs to be applied for directly in those countries.

To further complicate matters, designs (or some aspects of them) may qualify for protection under other statutes, such as trademarks, copyright, and unfair competition law. Below, I summarize the options available to an owner of a design seeking protection within the European Union.

Option 1: do not register the design

This option means not registering the design nationally or internationally, in which case the owner can draw on a combination of (i) EU protection, afforded for three years to Unregistered Community Designs; (ii) unregistered national protection where this exists (some countries, including the UK, provide unregistered design rights); (iii) relying on other legal instruments, such as (registered and unregistered) trademarks, copyrights and unfair competition laws to protect designs; (iv) relying on complementary assets (Teece, 1986), such as branding, quality of manufacturing, or reputation; (v) relying on social norms in the community against copying (e.g., Di Stefano et al., 2013; Fauchart and von Hippel, 2008; Raustiala and Sprigman, 2012).

Not registering is logically more likely if: courts are unlikely to uphold the rights or impose effective punishments on infringers; the design is considered to have a short shelf life (<4 years); unregistered national and EU protection is considered effective (or as effective as registered rights); the owner has strong complementary assets; and/or there are strong social norms against copying in the design community.

Option 2: register the design nationally

Since 1998, all EU countries have been required to maintain a national register of designs, and the protection available is very similar, although not identical, in each Member State, as well as to that provided by RCDs. An owner who wished to obtain protection in all Member States could conceivably register the design with each national office. A benefit of this is that any invalidity procedures would have to be undertaken in each Member State separately; the disadvantages are the much higher costs and complexity of doing this. Moreover, the option of registering nationally (rather than internationally) is likely to be pursued if: (i) the owner is only interested in protecting the design (beyond the protection available under Option 1) in one country. This is more likely to be the case with large than small countries, if the creator of the design only serves one national market, and where designs have a strongly national character (i.e., national tastes are idiosyncratic); and (ii) the application and renewal fees for national registration are substantially lower than for international registration (which also provides national protection).

In Germany, for example, the fee for an electronic application with up to 10 designs is 60€. This remarkably low fee for such a large country has encouraged substantial national registration of designs in Germany; a country that also makes the most extensive use of registration at the EU-level (Table 2). By contrast, registering a single design in Denmark costs 1,200DKK – approximately 160€ – almost half the cost of registering a single RCD with jurisdiction across the whole of the EU, moreover there is no discount for simultaneously registering multiple designs, and electronic filing is also not currently available. This makes national filing relatively unattractive in Denmark, and the number of designs registered nationally in Denmark has fallen from over 1,000 in 2002 (prior to the introduction of RCDs) to just 101 in 2013. Meanwhile, Denmark is one of the most prolific users of the RCD system, especially when the size of its economy is controlled for.

Option 3: register the design internationally

The third option is to register the design internationally, either directly with the European Commission's Office of Harmonization for the Internal Market (OHIM) which administrates RCDs, or indirectly through the WIPO's Hague System. Although slightly more costly, the latter has the advantage that as well as registering with OHIM, the applicant can simultaneously register the design with over 50 other jurisdictions

without the need to translate the documentation. I now discuss RCDs in more detail.

3.3.2 Registered Community Designs

OHIM, the EU's Office for the Harmonization of the Internal Market, began registering Community Designs on 1st April, 2003. Applicants may submit a single design, or multiple independent designs within the same Locarno class.[22] The key requirements for protection are "novelty" and "individual character." The novelty requirement is typically met if no identical prior design has been disclosed, where the meaning of "identical" is specified in Article 5.2 of the Community Design Regulation (EC 6/2002): "Designs shall be deemed to be identical if their features differ only in immaterial details." Whether a design has an individual character is more difficult to establish. According to Article 6.1 of the Community Design Regulation (EC 6/2002), "a design shall be considered to have individual character if the overall impression it produces on the informed user differs from the overall impression produced on such a user by any design which has been made available to the public." Article 6.2 specifies that "in assessing individual character, the degree of freedom of the designer in developing the design shall be taken into consideration." This statement formulates the concept of reciprocity in European design law (Hartwig, 2012b): In areas with a high concentration of designs and/or where there the designer has few degrees of freedom (due to the technical function of the product), minor differences in appearance may produce a different overall impression on the informed user. Conversely, in areas with a low concentration of designs and/or where designers have considerable freedom from technical constraints, major differences are required to create a different overall impression on the informed user. Analogously, the scope of RCD protection can be large or small, depending on the design's distance from the existing design corpus.

Several types of subject matters are excluded from protection by RCDs: design features that are entirely dictated by the technical function of the product[23] or that must be reproduced in their exact form to permit a mechanical connection; component parts of complex products that are not visible during their use; spare-parts; and designs

[22] The Locarno classification indicates the product categories to which the designs are intended to be applied. Protection is not however confined by the designs' classification. For a complete list of product classes (n=32) and subclasses (n=219) specified in the Locarno Classification (9th Edition) see http://www.wipo.int/classifications/nivilo/locarno (last accessed: 30 June 2014).

[23] If the same technical effect may be achieved with any different form, the design features are not excluded from protection (Schlotelburg, 2006).

contrary to public policy and accepted principles of morality.

A core feature of the RCD system (and indeed registration with individual EU Member States) is that these substantive requirements for protection are not examined prior to registration (which contrasts with U.S design patents).[24] RCDs are assumed to be valid unless and until successfully challenged, either by an invalidity proceeding put before OHIM or by a counterclaim in infringement proceedings before national courts, which have EU-wide jurisdiction. As they are not examined, RCD applications are typically published within just a few days of filing. Non-examination increases uncertainty about the validity of RCDs, both for applicants and third parties, and provides room for strategic actions as parties may register designs that should not qualify for protection.

RCDs are cheap, relative to trademarks and patents. The fees for protecting a single design for five years are 350€, with renewal fees to be paid every five years. Applicants can submit up to 99 individual designs in the same electronic filing; the 2nd to 10th design each cost 175€; while each further registration costs 80€.[25]

3.4 Patterns of RCD use

My exploration into the use of RCDs begins with a descriptive analysis of data from the OHIM register, to identify trends and peculiarities in filing activities at the level of countries, product categories, and firms. I focus on the nine-year period following the institutionalization of RCDs in April, 2003. Over that period, the number of designs submitted has grown markedly, from a little over 40,000 in 2003 (over nine months) to almost 80,000 in 2011 (see Figure 3); with a 4.9% average annual growth rate in applications per month. The modest decline in 2008/09 probably reflects the general macroeconomic downturn, after which design registration began to rise again. In total, 607,006 designs were registered until the end of 2011, including 77,663 single (49%) and 80,376 multiple (51%) applications. As each design in the register represents an independent property right, I henceforth count each design submitted, rather than applications.

[24] The difference may not be all that large, though. Crouch (2010) calculates an allowance rate for U.S. design patent applications above 90%, and argues that the examination system is operating as a de facto registration system. On the other hand, it is not clear to what extent examination deters the submission of designs for which protection would likely not be granted.

[25] See https://oami.europa.eu/ohimportal/en/rcd-fees-and-payments (last accessed: 30 June 2014).

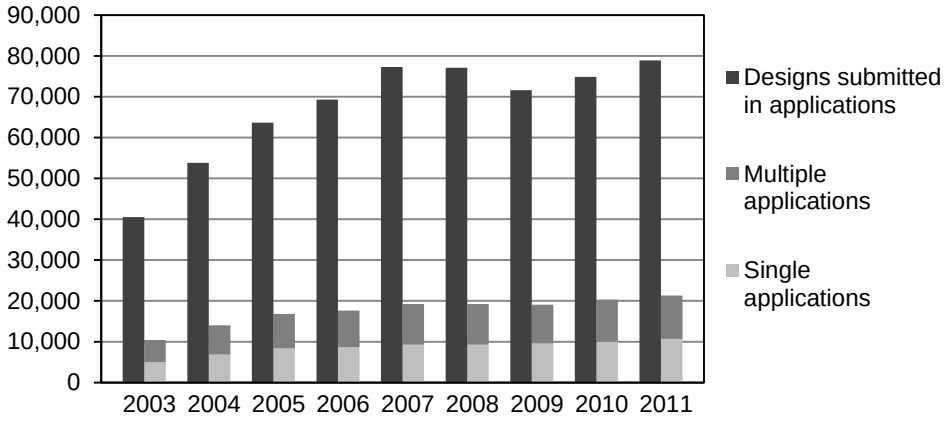

Figure 3: RCD applications, 2003–2011 (Source*:* OHIM database)

Table 2 provides a breakdown of cumulative design filings (2003–2011) by residency of applicants. As expected, the large western EU countries have been most active in registering RCDs, with Germany clearly ahead, followed by Italy and France. Together with the UK and Spain, the "Big Five" EU countries account for 60% of all registrations. Owners based in the U.S. are the most prolific amongst non-EU users of the system, while Japan, Switzerland and China also feature prominently.

In terms of RCDs per GDP, several smaller countries with populations below ten million achieve high levels of registrations. Apart from Luxembourg, which is the legal home of many multinationals, strong performers include Austria, Denmark, Switzerland, and Sweden.[26] This simple analysis begs important questions, such as why, after controlling for the size of their respective economies, do German and Italian firms register more than twice as many designs with OHIM than French firms, and three times as many as UK firms (16.67)? Explanatory factors will likely include industry structure and propensity to export, the relative costs of registering nationally or at EU-level, and the attitude of courts in each country to upholding design rights. As one reviewer of this study put it: "Germany is widely acknowledged as having the best legal infrastructure, with greater rights to the firm being copied than to the copier. This isn't the case in all countries […] In the UK for example, many firms feel that the legal system is not supportive of challenges and so the value of the right is low."

[26] The strong performance of the Scandinavian countries may partly be explained by their reputation for design innovation and the importance of design to these countries' research and policy agendas (SEE, 2011).

Table 2: Countries with highest RCD activities (Sources: OHIM database, WIPO, World Bank)

	RCD filings (2003–11)	National filings per RCD (2011)	WIPO filings per RCD (2011)	RCDs (cum., 2003–11) per GDP (avg., 2003–11)	
Germany	143,995	2.28	0.19	Luxembourg	51.83
Italy	85,865	2.79	0.06	Germany	46.37
France	50,162	2.31	0.14	Austria	44.71
United States	48,341	3.02	0.22	Italy	43.69
United Kingdom	39,189	0.73	0.02	Denmark	39.30
Spain	34,905	4.86	0.04	Switzerland	38.87
Japan	19,476	8.33	0.00	Poland	31.82
Netherlands	18,891	0.31	0.28	Sweden	27.75
Switzerland	18,117	0.82	1.04	Spain	26.98
Austria	15,612	0.55	0.08	Portugal	26.39
Poland	12,326	0.52	0.02	Netherlands	26.06
Sweden	11,727	0.40	0.06	Czech Rep.	24.14
Denmark	11,363	0.15	0.06	Belgium	23.85
China	10,499	255.69	0.01	Finland	23.67
Belgium	10,264	0.12	0.13	France	20.90

Figure 4 compares the geographic origin of design, patent and trademark applications under European schemes. The "Big Five" EU countries account for a larger share of registered designs than Community Trademarks (51%), or patents filed at the EPO (32%).[27]

Several countries – notably Italy, Spain, the new Member States, and China – exhibit significantly higher shares for design filings than for patent applications. This relative strength in terms of RCDs may in part reflect the ("lower-tech") industrial structure and orientation of businesses in these countries, but in the case of China and the new Member States I also perceive evidence for the increasing global trend toward design registrations across middle-income countries.[28] In China and the new Member States (except Hungary and Lithuania) annual growth in RCD applications surpassed annual GDP growth over the period 2004–2011, and, according to experts interviewed in my field study (see Section 3.5), companies in middle-income countries increasingly perceive registered designs as an easy-to-handle alternative to patent protection, providing an inexpensive form of legal exclusion right for new product offerings.

[27] RCDs, Community Trademarks, and patents granted by the EPO are largely, but not fully comparable in terms of their regional scope. The EPO can grant patents also for states that are not members of the EU, among them Norway, Switzerland, and Turkey.

[28] The global list of top 20 offices in terms of design applications includes nine offices located in middle-income countries. Especially in China design patent filings have increased dramatically over the last decade, accounting for more than half of total design right applications worldwide in 2011 (WIPO, 2012).

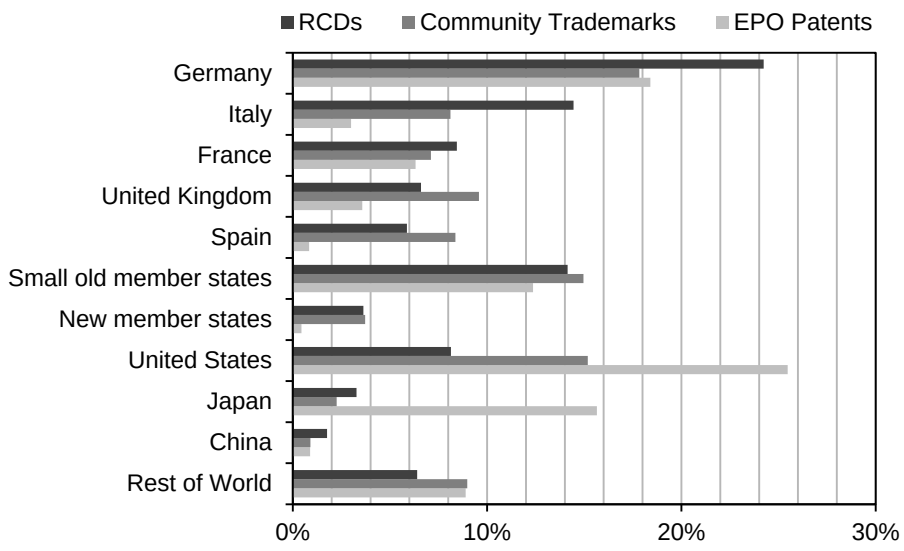

Figure 4: Origin of applications of RCDs, Community Trademarks, and EPO Patents, 2003–2011 (Sources: OHIM, EPO) [29]

Variations in RCD usage are also evident in terms of the distribution of applications across product categories. Table 3 shows the ten most-cited Locarno classes accounting for two-thirds of total applications over the period 2003–2011. Three design-intensive categories top this list: furnishing (Class 6), clothing (Class 2), and packaging (Class 9). The clothing category, which is dominated by footwear, stands out as the most dynamic, with annual growth in applications exceeding 10% between 2004 and 2011. This is surprising, as the category is dominated by typically short-lived fashion items, for which Unregistered Community Design protection was intended.

Interestingly, the use of RCDs seems to be particularly widespread in so called "low-tech," or "supplier dominated" (Pavitt, 1984) industries, characterized by low R&D intensities and mature markets (Robertson et al., 2009). The furniture (Class 6), clothing (Class 2), packaging (Class 9), sanitary appliance (Class 23), and household goods (Class 7) industries are all "low-tech" (Hirsch-Kreinsen et al., 2006), and this pattern of registration suggests that design-related activities may be a significant driver of firms' innovation in these sectors (Santamaría et al., 2009). "Higher-tech" industries are however still prominently represented, with designs attributed to Classes 14 (electronic equipment) and 12 (transportation), indicating that the significance of design is not confined to "low-tech" sectors.

[29] "Small old member states" include Austria, Belgium, Denmark, Finland, Greece, Ireland, Luxembourg, Netherlands, Portugal, and Sweden. "New member states" include Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia, and Slovenia.

Table 3: Most-cited Locarno classes, including top three subclasses (Source: OHIM database)

Class	Description	Applications (2003–2011)	Share of total applications [%]	CAGR appl. (2004–2011) [%]
6	Furnishing	73,566	12.3	1.4
6.01	Beds and seats	26,304	4.4	2.5
6.06	Other furniture and furniture parts	10,980	1.8	17.3
6.04	Storage furniture	10,408	1.7	-0.3
2	Articles of clothing and haberdashery	57,771	9.7	11.1
2.04	Footwear, socks and stockings	33,368	5.6	9.1
2.02	Garments	15,339	2.6	19.3
2.07	Haberdashery and clothing accessories	2,961	0.5	7.1
9	Packages and containers for the transport or handling of goods	41,334	6.9	0.7
9.03	Boxes, cases, containers, (preserve) tins or cans	21,175	3.5	2.3
9.01	Bottles, flasks, pots, carboys and demijohns	11,261	1.9	-2.0
9.07	Caps and lids	3,120	0.5	5.3
23	Fluid distribution equipment, sanitary, heating, and ventilation	38,443	6.4	4.0
23.02	Sanitary appliances	17,387	2.9	4.4
23.01	Fluid distribution equipment	10,252	1.7	3.3
23.03	Heating equipment	6,413	1.1	2.7
14	Recording, communication or information retrieval equipment	35,868	6.0	5.6
14.03	Com. equipment, wireless remote controls and radio amplifiers	12,840	2.2	0.4
14.02	Data processing equipment and peripheral apparatus and devices	7,793	1.3	7.0
14.04	Screen displays and icons	7,235	1.2	16.5
26	Lighting apparatus	35,465	5.9	5.7
26.05	Lamps, standard lamps, chandeliers, wall and ceiling fixtures	25,200	4.2	4.5
26.04	Luminous sources, electrical or not	2,785	0.5	14.4
26.06	Luminous devices for vehicles	2,759	0.5	1.8
7	Household goods	34,094	5.7	2.6
7.01	China, glassware, dishes and other articles of a similar nature	12,274	2.1	0.9
7.02	Cooking appliances, utensils and containers	8,662	1.5	5.0
7.04	Appliances and utensils, hand-manipulated, for preparing food or drink	3,053	0.5	7.7
25	Building units and construction elements	27,322	4.6	2.5
25.02	Prefabricated or pre-assembled building parts	10,826	1.8	1.3
25.01	Building materials	10,706	1.8	6.6
25.03	Houses, garages and other buildings	4,415	0.7	-2.8
8	Tools and hardware	26,109	4.4	2.7
8.06	Handles, knobs & hinges	6,373	1.1	-1.2
8.08	Fastening, supporting or mounting devices	6,155	1.0	6.2
8.05	Other tools and implements	4,032	0.7	4.9
12	Means of transport or hoisting	25,479	4.3	5.4
12.16	Parts, equipment and accessories for vehicles	9,903	1.7	1.5
12.11	Cycles and motor cycles	3,331	0.6	6.3
12.08	Motor cars, buses and lorries	2,948	0.5	5.4

Discerning sectoral patterns from the analysis of Locarno classes is challenging because individual categories are highly aggregated and do not map easily into SIC defined industries. To more accurately identify the frequent users of RCDs, I therefore

use firm-level application numbers after consolidating applicant names.[30] Table 4 is derived from this, and ranks the top 25 owners of RCDs by total registrations between 2003 and 2011. Rieker, one of Europe's biggest shoe manufacturers, heads the list, with 4,482 filings (although it did not start registering RCDs until 2006). Three other footwear companies are also in the top 25 (Nike, Gabor, Jimmy Choo). Rieker and Gabor in particular make extensive use of multiple applications. Also prominent among the top 25 are large electronics companies (Samsung, Sony, Philips, Apple, Panasonic), and to a lesser extent manufacturers of apparel (Creations Nelson, Miniconf, Pierre Balmain). The sudden decrease in Procter & Gamble's registrations after 2007 is explained by that company's switch to the indirect registrations via WIPO.[31]

Various questions arise from the firm-level data. In particular, why do some owners make so heavy use of RCDs, while others do not? To what extent do product and industry parameters determine the use of RCDs, and to what extent are firm-specific behavioral factors the driver? While factors such as home country size, the relative cost of national versus EU registration, and distinctiveness of national tastes may explain some of the variation, they are unlikely to provide a full explanation. Furthermore, given that applications are not examined, how does the quality of RCDs vary between designs submitted by heavy users (usually as multiple applications) and more selective applicants (who often submit single applications)? To gain some insight into these questions, and to more generally understand firms' use of RCDs I undertook a qualitative study of German firms active in three different industries.

[30] Of initially 61,051 distinct names in the OHIM database, 4,595 duplicates were identified and harmonized. Variations in spelling of applicant names result from inconsistent naming conventions, spelling mistakes, or abbreviations. This problem occurs routinely within large datasets of IP rights (e.g., Thoma et al., 2010). I consolidated applicant names following a three-step procedure based on (i) an automatic cleaning code (the sequence of cleaning operations builds on work by Thoma et al. (2010, p. 18) and was implemented in VBA), (ii) a process of manual harmonization of spelling variants (owner names were manually screened for duplicates in alphabetical order; additional database records, such as address details, were taken into account), and (iii) an approximated string matching technique (the textual similarity between each pair of applicant names was calculated using a token-based Jaccard similarity function (Chaudhuri et al., 2003); records were manually checked for being duplicates if their similarity was above a certain threshold).

[31] Applications via WIPO are not recorded in the OHIM database, but make up less than 5% of total RCD filings. I exclude them from the analysis.

Table 4: Top applicants of RCDs (Source: OHIM database)

	Applicant	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total	Designs per appl. (Ø)
1	RIEKER	0	0	0	237	869	786	802	841	947	**4482**	121
2	BSH	113	151	337	936	204	925	520	538	266	**3990**	10
3	CREATIONS NELSON	0	0	351	511	549	570	809	763	404	**3957**	27
4	PROCTER & GAMBLE	120	135	551	1198	1185	653	67	1	0	**3910**	4
5	SAMSUNG	111	195	436	704	433	470	331	418	484	**3582**	2
6	SONY	291	314	278	293	303	346	298	321	554	**2998**	4
7	EGLO LEUCHTEN	0	191	280	558	642	381	261	215	446	**2974**	27
8	THUN	0	93	309	468	573	545	675	58	145	**2866**	45
9	NIKE	242	397	489	543	326	157	232	159	316	**2861**	19
10	MICROSOFT	72	110	278	359	254	231	232	176	606	**2318**	8
11	INTERIORS	105	248	278	248	435	324	212	185	222	**2257**	9
12	DAIMLER	269	224	285	319	283	211	116	267	212	**2186**	4
13	BLANCO	12	104	305	335	376	303	373	135	112	**2055**	29
14	VILLEROY & BOCH	338	215	248	219	239	241	125	111	104	**1840**	12
15	PHILIPS	63	98	136	94	238	239	271	341	308	**1788**	2
16	MINICONF	0	0	160	213	250	305	260	234	211	**1633**	96
17	SCHWINN BESCHLAGE	133	229	242	154	182	166	201	161	157	**1625**	17
18	GABOR	87	137	151	163	203	238	227	213	191	**1610**	77
19	APPLE	3	5	23	31	293	697	99	207	212	**1570**	12
20	ELECTROLUX	63	107	51	124	211	181	62	245	481	**1525**	7
21	J. CHOO	184	167	174	233	197	164	130	116	130	**1495**	19
22	BOSCH	41	86	126	128	141	150	170	318	313	**1473**	4
23	PIERRE BALMAIN	1	1	0	0	0	0	213	783	437	**1435**	32
24	PANASONIC	76	181	158	167	171	154	95	159	219	**1380**	2
25	RECKITT BENCKISER	150	216	300	201	204	115	26	48	82	**1342**	4

3.5 A cross-industry study of the use of RCDs by German firms

Here, based on a qualitative analysis of a cross-industry sample of German firms, I explore the use of RCDs in greater detail. I emphasize that this is an exploratory study, based on owners in one country – Germany – which, Luxembourg aside, has the highest level of European design registrations even after controlling for the size of the economy. I focus on German firms only to provide a consistent setting (while noting the good legal infrastructure and relatively high levels of awareness and knowledge regarding legal design protection in Germany (BOP, 2011)). The extent to which the behaviors found among German owners are also found in other Member States is a matter for further research.

I use a case study approach because it is particularly appropriate for supplementing or illuminating quantitative data gathered from the same empirical setting (Edmondson and Mcmanus, 2007) and for understanding as yet underexplored phenomena within

their real-life context (Eisenhardt, 1989; Yin, 2009). Specifically, my fieldwork provides some early insights into how product and industry parameters as well as firm-specific behavioral motives interact with properties of the legal instrument in influencing firms' use of RCDs.

3.5.1 Case selection and method

Consistent with the recognized standards of qualitative research, I selected cases (in this context firms, active in three diverse industries) and informants purposefully (Pratt, 2009), choosing to focus on firms in the footwear, automotive, and power & gardening tools (henceforth: tools) industries. I anticipated that behavior with regard to RCDs would vary among firms both within and between industries, and followed a strategy of diverse sampling in order to increase the scope of the findings and to facilitate clear pattern recognition (Eisenhardt, 1989).

The footwear industry was included as a design-intensive sector which is an extreme case in terms of its use of RCDs (over 33,000 filings in Class 2.04, making it the largest subclass in terms of RCDs filed). While design-intensive, the high level of design registration activity in this sector is particularly interesting because shoe designs are typically short lived, being replaced after only a few months, and therefore unregistered design protection should be appropriate. By contrast, furniture products – the largest top-level Locarno class (see Table 3) – tend to be longer lived, making the registration of designs more understandable.

I also included two more technology-oriented industries: automotive and tools. Car manufacturers are now frequent users of RCDs, with 15,000 filings in Classes 12.08, 12.16 and 26.06. While the appearance of cars has a long-appreciated role in product market success, tool manufacturers have typically been slower to appreciate the benefits of industrial design. However, to date over 5,000 RCDs have been filed in Classes 8.01, 8.02, 8.03 and 15.03. As evidenced in my study, imitation of product appearance is considered a serious problem in all three industries, showing that RCDs are potentially relevant.

Data was primarily gathered through semi-structured interviews held with company executives and IP lawyers, and the guiding questions concerned firms' own use of RCDs and the behavior of other firms in their respective industries. Aspects covered included application and enforcement behaviors, filing motives, and the perceived effectiveness of RCDs. To put the RCD-related statements into perspective, I also asked

about alternative means of appropriation and the role that design plays in innovation and competition. The semi-structured approach allowed me to pursue a consistent line of inquiry, while leaving flexibility to address promising topics and themes as these arose during conversations (Rubin and Rubin, 2005).

I sought responses from key informants who were knowledgeable about legal design protection and who participated in strategic decisions regarding this form of IP protection within their organizations. Most interviewees held senior roles, such as directors of IPR departments, or partners in law firms. From the RCD database, I selected firms that were among the top German owners (or their legal representatives) of RCDs in the three focal industries. A group of less active applicants was also included for comparison. Of the 50 potential informants contacted, 23 participated in the study.

Informants reported their insights into certain occurrences. However, these reports may be subject to sources of systematic bias and random errors, and several tactics were employed to alleviate these problems (Huber and Power, 1985; Kumar et al., 1993). First, I cross-checked the information obtained from company representatives and IP lawyers against each other, as the two types of actor view the focal phenomenon from different perspectives. Second, I triangulated interview and RCD data for cross validation (Jick, 1979). To ensure a tight connection between qualitative and quantitative evidence, all informants were presented with a detailed, individual benchmark analysis of RCD statistics during the course of the interview. Moreover, interview statements were challenged against a range of secondary source materials, including court decisions on design protection cases, company and industry reports, conference presentations, and newspaper articles. Finally, informants were provided with the opportunity to review the transcripts in order to support a free flow of information.

A total of 23 interviews were conducted over a period of six months (see Appendix, A.2), including eight representatives of the footwear industry, seven from automotive, four from tools, and four general experts. Twice, informants invited colleagues to the interviews who brought additional expertise. Five of the interviews involved two researchers to mitigate interviewer bias and to enhance the creative potential of the study. All conversations were held in German, seven in person, and 16 by telephone; they lasted between 48 and 105 minutes. In total, 27 hours of interviews were recorded and transcribed.

Throughout the fieldwork, I engaged in an iterative process of data collection, data condensation, and drawing conclusions to guide further data collection (Edmondson and Mcmanus, 2007; Eisenhardt, 1989). The interview transcripts were coded at different levels of analysis, ranging from the descriptive to the inferential (Miles and Huberman, 1994). In accordance with the iterative nature of the analysis, codes were continuously reassessed and refined. The final coding scheme, which was implemented in the NVivo 10 software package, consisted of 207 categories on six hierarchical levels, hosting nearly 1500 text segments. The inferential codes facilitated the identification of patterns, regularities, and relationships, building toward an integrated understanding of each firm's behavior with regard to RCDs and IP protection more generally. When the local dynamics of the diverse industrial settings became apparent, I moved to cross-case comparisons by organizing coded text segments in matrices, looking for similarities, differences, and overarching patterns across industries and different types of actors (Eisenhardt, 1989; Miles and Huberman, 1994).

3.5.2 Results and discussion

I present my findings in four parts: (i) a brief characterization of the use of RCDs within each industry; (ii) product and industry parameters; (iii) how prevalent filing motives affect their usage, and (iv) offering a set of propositions concerning the use of RCDs by firms. I summarize the core aspects of the analysis, along with additional quotes, in Table 5.

Characterization of RCD usage

There is substantial variation in firms' propensities to register designs, both across and within industries. Based on the fieldwork I was able to better understand these differences (Table 5, A).

The footwear industry can be divided into two camps, each representing a fundamentally different approach toward RCD usage: one group registered – independent of quality considerations – virtually all of their designs, and did so in multiple applications several times per year. One IP lawyer characterized a client's application strategy:

> *They register more or less their entire collections, once in spring and once in winter. Because you can't make a choice, actually. […] And if you register all of it, then at least you haven't forgotten anything.*

This group included some of the heaviest registrants of RCDs, and acknowledged design protection, and RCDs in particular, held a central role in their IPR portfolios. The second group of footwear companies registered very few items, and relied heavily on unregistered protection.

Car manufacturers showed much less variation in registration behavior across firms. Differences mainly arose from how the multiple individual design characteristics of a car (covering the exterior, interior, partial views, wheels, etc.) were protected through filings. Generally, these firms were driven by the desire to secure strong, "bulletproof" proprietary rights, which they perceived as important complements to trademark and patent protection.

Among tool-makers, a strong norm had emerged regarding the role of RCDs in IPR portfolios and related filing strategies. Here, the widely diffused practice is to make a few carefully considered RCD applications for each new product to gain "backup" rights – most valuable when other forms of IPRs are ineffective. For both car- and tool-makers, RCD protection was primarily directed toward protection against copying by lower-end firms, as imitation of product designs among direct competitors was typically not an issue.[32]

Below, I shed light on how firms' divergent behaviors regarding RCD usage, and in particular the choice between an "all-you-can-file" strategy (which can result in vast portfolios of registered designs) and the more parsimonious approach, can be linked to product and industry characteristics, and the behavioral motives underlying the registration activity.

Effects of product and industry parameters

My findings suggest that the influence of product and industry parameters on RCD usage becomes particularly apparent through the concentration of designs in a particular product category (Table 5, B). Whether design spaces are crowded or not affects ambiguity and effort associated with assessing the novelty of a design and, consequently, the most effective way to use RCDs. Design spaces may contain a vast number of similarly looking product variants for several reasons. Among the potential causes are frequent product introductions, intense competition between numerous firms,

[32] Interviewees emphasized that in higher-market segments the need to differentiate through design, and the fear of sanctions when disregarding fairness norms held by rivals and consumers act as powerful barriers to design imitation. The fashion industry, including footwear, is special in the sense that imitation is arguably a core activity of the industry. In fact, most designers, at all levels of practice, accept imitation to some extent (e.g., Hilton et al., 2004).

and dominant product architectures which typically specify a product's archetypical form and thus force firms to differentiate along the (limited) remaining degrees of freedom (e.g., Bijker, 1995; Eisenman, 2013). Moreover, convergence on designs that are in fashion (e.g., Hemphill and Suk, 2009) or best comply with technical, ergonomic, and regulatory constraints (e.g., Bloch, 1995) frequently contributes to the crowding of a design space.

In such crowded design spaces – of which footwear is a prominent example – searches for prior art are inherently difficult and costly. Because of the unexamined nature of RCDs, applicants have to decide whether or not to conduct pre-registration searches in order to increase certainty about the validity of the design right they seek. Among the footwear companies, many applicants did not do this, instead registering blindly:

> *But when I'm confronted with such a heap, I just can say: Okay, blind, let's do it. (Lawyer)*

Proponents of this "all-you-can-file" approach generally agreed that it is easy to register designs without identifying prior art, as registration shifts the burden of proof to opponents. Proving invalidity, particularly of shoe designs, was described as difficult and resource-intensive. As a result, the RCD register in footwear has become cluttered with designs that do not fulfill the novelty requirement and even more with designs that are unused (i.e., registered seasonal shoe designs already withdrawn from the market). To some extent, the problem of cluttering is mitigated by the concept of reciprocity which implies that the scope of protection is narrow in this context.

In the car and tool-making industries, searches for prior art were mainly considered effective and are indeed performed, though difficulties were experienced for some component parts, including wheels, tires, and saw blades – fields characterized by a high concentration of designs.

> *We do, of course, verify beforehand whether such parts exist. Not doing so would be reckless. (Company)*

Car manufacturers typically pursue international design protection strategies. Besides registering an RCD, they would often file a new design in jurisdictions that have an office examination (such as the U.S. or Japan) that checks its uniqueness, in particular compared to the applicant's own earlier designs:

> *In fact, we are our own greatest enemy. [Before filing in the U.S.] we analyze, in particular, our own prior designs. And hence become more confident in our European or German design rights. (Company)*

The upfront effort devoted to searches for prior art in the automotive and tool-making industries made informants feel more confident about the validity and scope of protection of their own RCDs, and the validity of rivals' RCDs.

Effects of filing motives

Firms intending to selectively register high-quality RCDs unanimously emphasized the prevention of imitation as their primary filing motive (Table 5, C). This suggests that for these firms the development of unique designs is an important precursor to the act of filing RCDs, and that the existence of RCDs encourages the development of unique designs. These companies reported good experiences with enforcing RCDs; indeed, even the possibility of legal action against infringement of RCDs deterred imitators to a significant extent.

In footwear, registration alone was not expected to deter imitators, since the cluttered register of designs is rarely monitored. Thus, firms did resort to enforcement of RCDs as a frequently used means to exclude both direct rivals and lower-end companies from adopting successful shoe designs. Without exception, interviewees noted that the harmonization of European design law had ushered in an era characterized by stronger, more easily enforced design rights.

While the "prevention of imitation" motive for filing dominated, I also heard about other motivations – mainly in combination with the "all-you-can-file" approach. Specifically, the inherent difficulty in identifying prior art in crowded design spaces combined with the unexamined nature of registration facilitated "strategic," arguably abusive, uses of RCDs. For example, some footwear companies knowingly registered and sought to enforce designs that they knew did not qualify for RCD protection:

> *In some cases, we've protected old shoes as new again, and then admonished others. And no one could prove that this has been more or less a classic 20 years ago. That's the old problem, because no one has access to the archives. (Lawyer)*

One large footwear company was even accused by several informants of filing imitated shoe designs to preempt infringement suits from third parties. Another put retailers under pressure by using RCDs, as one lawyer explained:

> *[…] and one goes to the retailer and says: It's protected by design rights, you can only buy it from us. The retailer is afraid and answers: Okay, […] I don't want to get into trouble, I buy it from you. (Lawyer)*

I could not however affirm that the low cost of RCD applications encourages companies to register more broadly than is necessary to protect their designs – for example, encouraging the registration of designs that the company has no intention of producing, and registering instead to block or inconvenience competitors. Informants made clear that such attempts are generally ineffective because alternative designs can usually be developed quite easily. As one interviewee explained concerning the tools industry:

> *It's amazing – and that's what we always see when we're too close to our competitors' designs – how the ambition and fantasy of our designers are suddenly spurred. Two days later we get a marvelously drawn, alternative design that we can approve without any doubt. (Lawyer)*

Finally, several informants pointed to the growing interest in registered designs for improving the firm's bargaining position in legal disputes. Other strategic motives are conceivable, but – at least in the empirical context studied – not prevalent.

Summary and propositions

While my interview sample is exploratory, and may not be representative of firms either in the industries studied, of firms in other industries, or of RCD owners in other countries, I found strong evidence that there are two types of RCD users: firms that compile large, even vast portfolios of registered designs – no matter if valid or not; and firms seeking to selectively register truly new and unique designs. One factor that looms large in explaining this heterogeneity is the massing of designs in a particular product category. Remarkably, in fields with crowded design spaces (e.g., footwear), some firms see an incentive to register each design indiscriminately because searches for prior art are difficult and costly, which also makes the invalidation of registered designs difficult for third parties and thus increases their enforceability (recall, RCDs are assumed to be valid unless proven otherwise; in other words, the onus is on the alleged infringer to prove that his/her design does not infringe, or that the original RCD was invalid). The low cost of (multiple) registration and lack of office examination encourages such "all-you-can-file" strategies, which further reduces transparency in already crowded design spaces. While conceivable in less crowded design spaces, the "strategic" (and arguably

abusive) use of RCDs (i.e., filing invalid designs), only came to light in crowded design spaces, where the low cost of registration and the lack of office examination could be exploited to this end.

Other firms are, however, reluctant to file RCDs without being confident about their validity, and used RCDs for their intended purpose: to prevent imitation of distinctive, "novel" designs with "individual character" – as defined in Section 3.3.2 above – that are put into production by their owner. Among the car and tools firms studied, searches for prior art are a common practice, and exclusivity is achieved through legal enforcement of RCDs and/or the deterrence effect of registrations in domains where prior art is commonly, and relatively easily monitored. As a result, filing strategies, and the quality of designs registered, have become more selective.

Hence, in summary, I propose:

Proposition 1: *The enforceability of design protection against copying has a u-shaped relationship with the stock of registered designs, being higher at the low stock end where registered designs tend to be valid, and at the high stock end where the difficulty of proving invalidity favors the right owner over the alleged infringer.*

Proposition 2: *The quality, or distinctiveness, of registered designs in terms of "novelty" and "individual character" is greater where the stock of designs is relatively low and the average number of designs registered per application is low (as this is associated with more judicious filing behavior).*

Proposition 3: *The "strategic" registration of designs known by the applicant to be invalid is greatest in already crowded design spaces where there is a strong tendency to submit multiple designs per application.*

Taken together, my initial and exploratory analysis suggests that the total volume of registered designs provides a poor indication of the extent of design innovation in a field. Much work also remains to be done to comprehend how country-, industry-, and firm-level determinants interact to influence firms' use of RCDs. However, my findings indicate that future studies should go beyond traditional determinants well-known from high-tech patenting (e.g., Brouwer and Kleinknecht, 1999), as factors such as firm size and age or market power seem to be less relevant.

Table 5: Summary of core aspects of analysis with illustrations

	Footwear	Automotive	Power & gardening tools
A) RCD usage			
Registration propensities	Divergent between firms • High propensity ("all-you-can-file"): *So far, we've registered all of our models.* (Company) • Low propensity: *In 90 percent of the cases, we rely on unregistered design protection. That's all we need.* (Lawyer)	Mainly consistent between firms *[The application numbers in our industry] follow a normal, reasonable trend. Also, when I have a look at the other statistics, deferred publications etc., one observes quite similar behaviors.* (Company)	Highly consistent between firms *It's now established practice in our industry to register new product designs.* (Company)
Role in IPR portfolios	"Central" *What's apparent is that it's practically the only possibility for the footwear industry to protect their intellectual property [with a registered right].* (Lawyer)	"Complementary" *Design, that's the icing on the cake. That's nice to have, and often we also must have it. Where we can't use patents or trademarks to stop infringement, or to improve our legal and economic position.* (Company)	"Backup" *For us design rights essentially provide flanking protection.* (Company)
B) Industry and product parameters			
Concentration of designs	High	Generally low (exceptions: e.g., wheels and tires)	Generally low (exceptions: e.g., saw blades and drill bits)
Search for prior art	Considered impracticable *You don't dwell on pre-registration searches, alone for economic reasons. The vast number and high concentration of designs make them utterly expensive.* (Lawyer) *It's easier to just register, and to hope being first. And then the others have the problem to figure out whether they infringe or not. That's always the biggest problem. Registration is the easiest and cheapest in practice.* (Lawyer)	Considered practicable and indispensable *We do it due to the mere fact that we track of course the designs disclosed by our competitors.* (Company) *The Japanese design patent is interesting for us as a kind of litmus test. If you get it in Japan, it won't be proven wrong.* (Company)	Considered practicable and indispensable *The search we conduct is that we permanently monitor the designs being published.* (Company) *Searches are compulsory! […] We put much time and effort into it.* (Company)
C) Filing motives			
Prevent imitation	Enforcement of RCDs is perceived as an effective means to prevent imitation from both direct competitors and lower-end companies. *No, registration alone doesn't deter, but rather enforcement.* (Company)	Registration and enforcement of RCDs is perceived as an effective means to prevent imitation from lower-end companies. *Design rights as searchable rights are also a good defense mechanism. So that competitors know in advance what works, and then don't do it at all.* (Company)	Registration and enforcement of RCDs is perceived as an effective means to prevent imitation from lower-end companies. *That's primarily a deterrent against counterfeiting.* (Company)
Strategic uses	Some firms wittingly file invalid design rights to prevent infringement suits from third parties and/or to improve bargaining power over retailers.	Not prevalent	Not prevalent

3.6 Research agenda for RCDs

My exploratory study has provided some insights into the use, abuse and effectiveness of RCDs. It has also raised new questions, which I have organized into a research agenda that I intend to pursue, and invite others to join me. This includes issues concerning: 1. understanding the adoption and use of RCDs; 2. the suitability of RCDs as innovation indicators; 3. their effects on firm behaviors, including appropriation and creativity; 4. their interaction with other intellectual property rights; 5. their actual and potential misuse and inefficiencies; and 6. their role in competition.

3.6.1 Adoption and use of RCDs

RCDs were introduced to further harmonize design protection in the EU. However, despite the introduction of a common legal instrument, the actual use of design registration by applicants differs markedly between Member States due to a number of factors, including differences in national unregistered protection, differences in national filing cost and arrangements (such as the availability of electronic filing),[33] industry structures, the extent of multinationals' presence and international trade in different design categories, and the distinctiveness of national tastes in these.

However, even in a single EU country, I found pronounced differences in the use of RCDs across and within three industries. While some of this variation can be linked to characteristics of their respective products, it is not readily apparent why some firms make much heavier use of RCDs than others. For example, how do firms decide between not using registered protection, registering nationally, and registering internationally? Furthermore, some firms change their behaviors, but why? Beyond the practical importance of these questions for policy makers, understanding these behaviors may offer an opportunity to study the emergence of norms regarding the use of a legal institution.

Furthermore, a systematic comparison between the adoption of RCDs and European trademarks and of patent applications submitted to the European Patent Office would provide insights into the relative pace of harmonization and integration of

[33] While all Member States are required to provide national registration of designs, some appear to be effectively encouraging EU filing through OHIM by making national filing unattractive. Others provide national registration as a lower cost option. These differences need to be more fully understood.

registered IP protection.

3.6.2 RCDs as indicators of design-innovation

At first glance, RCDs appear to be potential indicators of design innovation, as the registered designs should be both novel, and of "individual character." Moreover, data on RCDs is readily accessible, timely, and available in large quantities across many countries. In particular RCDs offer the prospect of better understanding how firms in "low-tech" domains apply creativity and design to innovate, and how firms in "high-tech" activities combine protection related to both form and function (i.e., design rights and patents).

However, my exploratory analysis suggests the interpretation of RCDs as indicators of design innovation faces significant challenges, both inherent and procedural. Inherent challenges arise from the nature of designs. While to be patentable, technical inventions need to be non-obvious and an improvement over the state of the art, a design qualifying for protection as an RCD just has to be sufficiently different, not "better." It is surely easier to create a different design than a better invention, and so the barriers to acceptance are lower. Furthermore – yet another dissimilarity to patents – how different a design needs to be for an RCD to be valid depends on the existing design corpus ("reciprocity"), which therefore has to be taken into account in interpreting RCDs as indicators. Finally, functionally new designs ("design leaps" as, for example, the design of the first robotic lawn mower) cannot be monopolized with RCDs, making it more difficult to tell significant design innovations from lesser ones. A further issue is that RCDs have no value indicator such as forward citations for patents, so although registered designs will vary enormously in degree of creativity and economic value, it is not easy to identify the most valuable among them.

Procedural challenges also exist, as they do for patents. As my interviews have shown, the propensity to file RCDs varies strongly between firms and industries; not all designs are registered, and not all registered designs are new and individual. However, my evidence indicates that design novelty tends to be higher when more selective filing is used, rather than when owners submit mass applications. A comparison of RCDs with U.S. design patents (cf. Rubera and Droge, 2013) regarding their suitability as indicators might yield interesting insights since, due to examination, procedural challenges should be fewer for U.S. design patents.

To conclude, I concur with Alcaide-Marzal and Tortajada-Esparza (2007) and

Livesey and Moultrie (2008) that RCDs offer some potential as indicators of design innovation. However, they appear applicable especially in particular segments or sectors rather than across all industries, and they need to be used with care. Certainly it would be naïve to perceive RCDs as a perfect goldmine of data on design innovations. My exploratory findings suggest that researchers need to first understand how RCDs are used in their sector(s) of interest before examining the data in detail. More generally, further research is needed to clarify in which industries and under what conditions RCDs are informative as an indicator of design innovation.

3.6.3 Effects of RCDs on creativity and appropriation

Legal design protection is intended to protect the right holder from imitation, and thereby enable him to reap the rewards of his creative work. This in turn should increase incentives for engaging in creative work, as expressed in the Community Design Regulation (EC 6/2002, Preamble, §7): "Enhanced protection for industrial design not only promotes the contribution of individual designers to the sum of Community excellence in the field, but also encourages innovation and development of new products and investment in their production." An important question is to what extent this goal is achieved?

An interesting observation is that a sizable share of designs (12.5%) are registered by individuals, rather than by enterprises, implying that design rights may facilitate individual creativity and a possible division of labor between designer and producer. However, as with patents, protection through the registration of designs may be much more effective in some industries than others; and indeed it may be wholly ineffective in some. Where it is effective, the registration of designs may be used "strategically" to increase barriers to entry or to otherwise hamper innovation (I discuss this further under 3.6.5).

Two questions are particularly pertinent: Do RCDs provide effective protection against imitation, and do they encourage creativity and thus lead to more design innovation as suggested by Ahmetoglu and Chamorro-Premuzic (2012)? As the answers to both questions will likely vary with industry and other factors, it is important to understand the various contingencies (cf. Fischer and Henkel, 2013 with respect to patents). Earlier findings from surveys indicate that design rights are rather ineffective (Arundel, 2001; Sattler, 2003), but this may be misleading, as these surveys often ask about the use of design rights in isolation, rather than in conjunction with other forms of

protection (see Section 3.6.4 below).

The fact that RCDs are not examined deserves particular attention. One might conjecture that, as a result, they are less likely to be upheld in court, harder to enforce, and less effective in promoting design innovation than an examined right would be. A comparison between RCDs and corresponding U.S. design patents (as performed for patents by, e.g., Graham et al., 2003) might provide valuable insights in this regard. I discuss these matters further in relation to misuse and inefficiencies (Section 3.6.5).

3.6.4 RCDs and other intellectual property rights

A recent and growing body of literature examines the degree of legal overlap between design protection and other exclusion rights, such as trademarks (Carboni, 2006; Crouch, 2010), utility patents (Schlotelburg, 2006), and copyright protection (Cook, 2013), as well as other laws, such as on unfair competition. Layers of protection through different forms of IP rights may create synergies, which suggests adopting a portfolio perspective (Orozco, 2009; Parchomovsky and Siegelman, 2002). My interviews involved discussion of such combined use of IPRs, especially in technology-intensive industries. But this picture is incomplete, and I perceive the need for more research, similar to studies that have established synergies between other pairs of appropriability mechanisms (Fischer and Henkel, 2013; Laursen and Salter, 2005; Somaya and Graham, 2006). Furthermore, concurrent use and interactions effects between design protection and informal appropriability mechanisms such as lead-time, complementary assets and social norms should be analyzed.

Given that design rights and patents are sometimes used in combination, the question arises whether and how such pairs or clusters of rights can be identified automatically, such as through cross-referencing design and utility patent applications under the U.S. scheme. As with the analysis of pairings of patents and scholarly articles (Huang and Murray, 2009; Murray and Stern, 2007), such research should provide deeper insights into the use and effects of design protection in combination with technical advances.

A rather different link between patents and RCDs concerns the distinction, for patents, between discrete and complex technologies (Cohen et al., 2000). Products based on discrete technologies (e.g., pharmaceuticals) contain few individually patentable inventions, while products based on complex technologies (e.g., electronics) contain large numbers. Arguably, such a distinction can also be made for designs (e.g.,

cars vs. shoes). The question is, are the implications for the management of designs, and the registration of designs similar to those of patents? And which products would be "discrete" and "complex," respectively, for RCDs?

3.6.5 Misuse and inefficiencies

Various authors have criticized an excessive or "strategic" use of patents in a manner that hinders innovation and competition. Among the causes are, especially in the U.S. patent system, the extreme ease of obtaining patents and a lack of transparency (e.g., Bessen and Meurer, 2008; Jaffe and Lerner, 2007).

My exploratory study suggests that RCDs may experience similar problems. Obtaining RCD protection is easy, and perhaps too easy, and moreover numerous designs can be filed in a single application, at low cost. This, combined with the inherent difficulty of searching for prior art in designs, dramatically reduces transparency, and may invite deliberate misuse of the RCD system; for example, the deliberate filing of designs that were not new or even designs created by competitors. I have learnt about some indication of such misuse, and while the negative impact on creativity and competition appears limited hitherto, it is undesirable to allow an instrument of public policy to be systematically abused. Research could be undertaken aimed at reducing the abuse of RCDs.

For example, the unexamined nature of the design registration process is often highlighted as a weakness, with comparisons made with U.S. design patents (cf. Graham et al., 2003, and Graham and Harhoff, 2006, for pairs of patent applications). However, it is not clear that the U.S. approach is better: more than 90% of U.S. design patent applications are granted (Crouch, 2010), indicating that the U.S. system approximates to a registration system, and moreover a large share of the granted patents entering opposition procedures (Harhoff et al., 2003) or litigation (Allison and Lemley, 1998; Henry and Turner, 2006; Mann and Underweiser, 2012) are overturned. Essentially, the lack of examination in the EU system means it operates on the basis of presumed validity. But steps could be taken for those found to persistently break the rules; such as having their entire portfolio examined (at their own expense), or being barred from making further applications. Some strong sanctions would reduce the abuse of the system and increase the proportion of truly novel designs with individual character.

Another step that would presumably reduce abuse is to reduce or remove the

discount for simultaneously filing multiple designs. While some discount for a small number of closely related designs makes sense, it is less clear why the 11th and subsequent design in a multiple application requires fees of only 80€ per design in return for five years of protection, particularly as each design is an independent legal entity. Such a low fee for mass applications seems to invite abuse, and make searches for prior art considerably more difficult, which in turn invites more abuse. Research could and indeed should be undertaken aimed at optimizing the system in the public's interest.

3.6.6 Design rights and competition

While the size of a firm's portfolio of registered designs is likely to be an imperfect indicator, the fact that firms increasingly file and defend their RCDs, sometimes at considerable expense, surely indicates an increasing importance of design, and design-related innovation. Effective RCDs may allow firms to compete on design (as opposed to, or alongside, technological innovation); they may also encourage the development of a division of labor, between design specialists and technology specialists. RCDs may therefore allow us to study industrial dynamics of this type, and they may be useful in tracing interactions between design-related and technological innovation. Such interactions have recently been described theoretically by Eisenman (2013), who argues that there are two situations in which firms are most likely to benefit from aesthetic innovation: first when new technologies or product categories emerge, and where design can help to "explain" the underlying new technological ideas by reducing incongruence (cf. Rindova and Petkova, 2007); and second when they are mature, design can excite users and provide differentiation opportunities for products that are increasingly technologically standardized.

Beyond the filing of RCDs, infringement litigation may be informative about competition. My interviews in the car industry suggest interesting dynamics: with lower-quality firms deliberately seeking design similarity to benefit from "spill-overs" if buyers take design similarity as an indicator of similarity in quality (see Chapter 2). Overall, studying the filing and enforcement of RCDs holds promise for a deeper understanding of design-related innovation and competition.

3.7 Conclusions

This study has provided an introduction to design protection, and specifically Registered Community Designs (RCDs), a harmonized legal instrument introduced in the European Union in April 2003. Since then, roughly three-quarters of a million individual designs have been registered. This indicates the importance of RCDs in design-related markets, innovation and competition, and at the same time appears to offer a rich opportunity for the study of design, and design innovation, to which scholars of innovation have given very little attention hitherto.

In the study I first outlined the legal nature of design protection in Europe, including that offered by RCDs, before providing a descriptive overview of the use of RCDs in terms of which countries, industries and firms are most active in registering them. However, prior to further data analysis, I was concerned to understand better the nature of the instrument, and how firms are making use of it. I therefore undertook an exploratory qualitative study that examined the use of RCDs by firms in three different industries: footwear, car manufacturing and tool-making. I did this in the context of one EU country – Germany, which even after controlling for the size of its economy is amongst the countries with the highest number of registered designs. My study revealed striking differences between industries and indeed firms within them. These differences could not have been easily anticipated without undertaking the study. In footwear in particular, a sector in which the registration of designs is especially prevalent, firms sometimes abuse the system by registering designs that they know not to be new and even designs of their competitors.

As is evident from my research agenda section, I am enthusiastic that design protection in general, and RCDs in particular, offers a rich avenue of potential research opportunities into design, design-innovation and how firms use these as part of their competitive arsenal. This study has sought to provide some groundwork upon which a set of further studies can be undertaken, and I hope others will join me in this endeavor.

4 Single market; same practices? The use of intellectual property rights by German and UK firms[34]

4.1 Introduction

The system of intellectual property rights (IPRs) is an important element of an economy's institutional structure (e.g., Barbosa and Faria, 2011; Nelson, 2008; North, 1990), as IPRs affect the rate of production and diffusion of innovations, and the allocation of returns to innovations. With innovations being difficult to identify and quantify directly, IPRs are often used as proxy indicators of a country's fecundity for innovation (see e.g., European Commission, 2014; OECD, 2005; WIPO, 2014). For the UK, such indicators can make distressing reading because the UK number of patents, trademarks or registered designs per head (or relative to GDP) lags significantly behind those of other rival countries, such as Germany. Such comparisons are, however, much more problematic than many seem to realize – arguably, because countries are "playing the game" by (slightly) different sets of rules, which can have substantial effects on actual behavior (cf. Arundel et al., 1995; Cohen et al., 2002).

By analogy, the game of rugby is played according to two codes: rugby union and rugby league, which split from each other in 1895. The two codes have many things in common including the ovoid shape of the ball, the duration of the game (80 minutes), rules concerning how the ball can be moved (e.g., no forward passes), and there being four different ways to score: tries, conversions (or goal kicks), penalties and drop goals. But there are also differences. A union team has 15 players while a league team has 13. Moreover, and with one exception, the points awarded for each way of scoring is

[34] This chapter is based on a joint working paper with Bruce Tether, which is accepted for presentation at the 2015 Academy of Management Meeting (Vancouver), the 2015 DRUID Conference (Rome), and the 2015 ZEW/MaCCI Conference on the Economics of Innovation and Patenting (Mannheim). The author is grateful to the following organizations for providing database access: the bck GmbH, Munich, the Office of Harmonization for the Internal Market, the German Patent and Trade Mark Office, and the UK Intellectual Property Office. I also gratefully acknowledge the funding from the European Community's Seventh Framework Programme under grant agreement CRE8TV.EU–320203.

different.[35] In the 2013/14 season, the average number of points per game in union's English Premiership (the top professional league) was 41, with an average of 4.3 tries per game. In the corresponding Super League, 50 points were on average scored per game in the 2013/14 season, with roughly twice as many tries per match. Advocates of league might see this as indicating their code is more productive, while advocates of union would say nonsense, all it shows is that it is easier to score points and tries in league. The argument is likely to be endless, but might just be settled if (i) the teams were playing by exactly the same rules; and (ii) the teams were permitted to field the same quality of players.

The same logic can be applied when comparing the practices of German and UK firms with regard to their registration of IPRs. To do this we need to (i) appreciate the differences in the "rules of the game" between the two countries; and (ii) compare like with like in terms of the quality of the firms compared, at least on observed characteristics. The choice of comparison countries is by no means random: first, both Germany and the UK are part of the European Union, which is seeking to develop a single European market, with harmonized institutions. In recent decades, a series of major reforms have been undertaken with the principle aim of aligning patent, trademark and design protection across Member States. This regulatory effort has leveled the playing field to some extent (remaining differences are discussed in Section 4.2 below), and therefore a certain degree of behavioral convergence in the use of these rights can be expected.

On the other hand, there are reasons to expect that firms will behave differently when based in different institutional contexts (e.g., Crouch, 2005; Hall and Soskice, 2001; Whitley, 1999). At a broad level, Hall and Soskice (2001), for example, discuss "varieties of capitalism" and contrast the liberal market economies – which include the UK as a prime example –, with coordinated market economies – of which Germany is a prime example –, emphasizing differences in across a range of phenomena likely to affect firms' IPR behaviors (Carlsson, 2006; Foray, 1995), including the extent of inter-firm competition versus cooperation, orientation to radical or incremental innovation, and the functioning of the legal system. This view suggests that more pronounced differences in the utilization of IPRs between German and UK firms should be anticipated.

[35] A try in league is worth 4 points, but 5 in union; while a successful penalty kick is worth 2 in league and 3 in union, the same as a drop goal in union, which is awarded one point in league. Only the reward for a successful conversion, or goal kick, is the same: 2 points.

I examine this empirically by drawing on a novel database that integrates information on a variety of registered IPRs at the firm level: patents, trademarks and registered designs – each of which may be filed at the national, European or WIPO's international office. To separate cross-country variation in IPR usage due to differences in firm characteristics from differences attributable to the national environment, I apply an econometric matching method. Adjusted differences are quantified for nine types of IPRs over a period of up to eight years (2004-2011), both in terms of activity and count gaps. *Activity gaps* capture the difference in the proportion of German and comparable UK firms with at least one filing in a year, *count gaps* examine the difference in average annual filing numbers. An interesting aspect of my study is that it includes both established and new IPRs; the new rights being the relatively recently introduced Community Trademarks and Registered Community Designs.

My results suggest that on average German firms generally "outperform" their UK counterparts in their propensity to use IPRs and in the extent of their use, which, I argue, is at least partly due to greater incentives to register intellectual properties in Germany than the UK. But interestingly, the magnitude of these differences is rather modest, and moreover, the activity gaps for Community Trademarks and Registered Community Designs are not significant. This appears to support the idea that once we control for the quality of the players and have them play according to the same rules, German and UK firms differ little in their IPR behaviors.

The remainder of this chapter is structured as follows. Section 4.2 briefly outlines how the incentives to register IPRs differ between Germany and the UK, and how the European Union has sought to harmonize some of the IPR instruments available in Europe; Section 4.3 introduces the database of firms; Section 4.4 presents the methods, and Section 4.5 the results. Section 4.6 discusses the findings, while Section 4.7 concludes the chapter.

4.2 Understanding the incentives to register intellectual property rights in Germany and the UK

Germany and the UK share three different types of registered IPRs: patents, trademarks and registered designs. However, the incentives to register intellectual

properties differ between the two countries.[36]

4.2.1 Patents

When considering whether or not to take out a patent, the prospective applicant should consider the cost of obtaining (and maintaining) protection, relative to both the effectiveness of the protection provided and the value of the invention for which protection is sought.

The cost of obtaining a patent involves the fees payable to the patent office and professional fees to patent drafters, which are considerably larger. In Germany, fees tend to start around €2,500 for the simplest national patents, while in the UK they tend to start around £3,000 (circa €4,500).[37] In part, the difference is likely to reflect the size of the market for patent drafting services, which is much larger in Germany. This cost difference may have some influence on the extent of patenting, because (i) it is only rational to obtain patents the value of which exceeds the cost of obtaining them; (ii) the distribution of patents by value is understood to be extremely skewed with many low-value and a few high-value patents (Schankerman and Pakes, 1986; Scherer and Harhoff, 2000); (iii) if higher costs deter patent filing, then the cost to rivals of searching through patent information is lower, increasing the true cost of disclosure. Relatively small differences in the cost of obtaining patents may therefore have a substantial impact on the extent of patenting activity.

This said, firms should not only consider the cost of patenting, but also the effectiveness of the protection provided. Ultimately, any right is only as effective as the ability of the holder to assert it. This has to do with (i) the cost of defending a patent considered to have been infringed; and (ii) the likelihood of winning a contest against an alleged infringer. Here, Germany has two significant advantages over the UK (or more specifically, England and Wales[38]): first, the cost of litigation is substantially lower; second, the likelihood of the patentee winning is significantly higher.

---

[36] Note that this section is necessarily somewhat simplified. My aim is to outline the essence of the differences, rather than provide a full account of the legal frameworks in both countries, which would run to hundreds of pages.

[37] See http://www.dehns.com/cms/document/the_financial_realities_of_patent_protection.pdf and https://www.hu-berlin.de/research/transfer/patente_lizenzen/pl_pat_frag_html (last accessed: 27 November 2014).

[38] Within the UK, Scotland and Northern Ireland have separate legal systems from that of England and Wales, but here I consider only the latter for simplicity and because the vast majority of legal actions with regard to IPRs are within the jurisdiction of England and Wales.

With regard to costs, Graham and Van Zeebroeck (2014) state that the average cost of litigation in Germany ranges between €50,000 and €250,000, whereas in the UK the typical range is €150,000 to €1.5m, that is, between three and six times that in Germany (see also Mejer and van Pottelsberghe de la Potterie, 2012). The higher chances of the patentee winning in Germany are partly because Germany operates a dual (or bifurcated) system, with invalidity challenges brought before the Federal Patent Court, while infringement cases are brought before any of twelve competent district courts.[39] This gives the patentee two advantages: first, he/she can choose the court most sympathetic to his/her case; and second, and more significantly, the split between courts in responsibilities for infringement and validity allows the patent claims to be interpreted differently. According to Cremers et al. (2013), the district courts tend to interpret the claims generously, increasing the probability of infringement, whereas the Federal Patent Court tends to interpret the claims narrowly, reducing the chances of revocation. Furthermore, possible invalidity is not a defense in the district court; defendants who wish to overturn the validity of the patent they are accused of infringing must take a separate action to the Federal Patent Court. Only about a third of alleged infringers take this course of action in Germany (Cremers et al., 2013). It is possible for the district court to find that the defendant has infringed a patent which the Federal Patent Court later finds invalid. District court proceedings are also typically fairly quick, with expert opinions being ordered only in exceptional cases, and there is a tendency to trust the judgment of the patent examiner (Cremers et al., 2013). These features make it harder for the defendant to disprove infringement, or to invalidate the patent.

The setup in the UK is rather different. During the period of this study, England and Wales had two specialist courts for IP matters: the then Patents County Court (for simpler, lower cost cases), and the Patent Court, a division of the High Court.[40] In practice, the overwhelming majority of cases were heard at the High Court. Significantly, both courts could hear infringement and validity issues in the same action, and in more than half the cases of alleged infringement the defendant counter-claims for invalidity (Helmers and McDonagh, 2013). The UK courts also have wide ranging powers to obtain evidence and hear from witnesses, which leads to longer cases and

[39] In practice, Düsseldorf handles most, and together with Mannheim and Munich, deals with 80% of infringement cases in Germany.

[40] Note that the system has since been reformed, with the reforms beginning in 2010, shortly before the end of my period of study.

escalating costs: cases typically last several days or even weeks, much longer than in Germany.

Although many disputes are settled privately before judgment is reached, both Graham and Van Zeebroeck (2014) and Cremers et al. (2013) find that the patentee is much more likely to win in Germany than in the UK. Graham and Van Zeebroeck (2014, p. 695) report that "among infringement actions […] German courts find significantly more in favor of the patentees (52%) than in favor of the defendants (44%)," whereas in the UK the outcome is more even, with 45% found to be infringed, 43% not infringed, and 12% ambiguous outcomes. In validity actions, the German courts revoked patents in 37% of cases, but upheld validity in 43% of cases, with 20% having ambiguous outcomes. These outcomes were more favorable to the patentee than those in the UK, where Graham and Van Zeebroeck (2014) found 35% were upheld and 33% revoked, with 32% ambiguous outcomes.

Cremers et al. (2013) show that when the courts settle cases, the outcomes in Germany tend to be much more favorable to the patentee than the outcomes in the UK. Indeed, the most likely outcome for a German patentee making an infringement claim is that the patent is found to have been infringed. The least likely outcome is that the patent will be revoked. By contrast, the most likely outcome for a UK patentee in an infringement case is that the patent is revoked, with this outcome being almost twice as likely as the patent being found to be infringed. In other words, the most likely outcome for a UK patent holder alleging that someone else is using his/her property is the finding that he/she does not have any property! Among invalidity cases that reach a verdict, 42% end with patents being revoked in the UK, which is more than twice the share in Germany.

This suggests that a first-approximation best course of action for any firm accused of infringing a patent in the UK is to quietly comply if the cost of doing so is low; or, if the cost of compliance is high, to hit back by threatening a revocation procedure and then hope the plaintiff will settle by offering a license on favorable terms. In Germany, patent holders have significantly greater incentive to assert their rights, although in the case of low-value patents it may be more cost effective to settle. Because it is harder to invalidate the patent they are accused of infringing, German firms can hit back in another way, which is to counter-claim that their accuser is infringing one of their patents. To do this, German firms need to build up an arsenal of patents to be used should the need arise. In other words, German firms have a stronger incentive to patent

for strategic reasons than is the case in the UK (cf. Blind et al., 2006).

All this however suggests that for any particular invention, German firms are much more likely to seek domestic patent protection than comparable firms in the UK. Because European patents are essentially bundles of national patents (subject to national rules of the contracting states designated in the application), these same arguments also apply at that level.[41]

4.2.2 Trademark and design protection

With both trademarks and design rights, the European Commission has made greater progress towards the harmonization of protection across Europe than in terms of patents. Harmonization of regulations is an important objective of the European Commission because it recognizes that the objective of a single market cannot be achieved if every country is playing by a different set of rules. While the European Patent Convention of 1973 has established a central system for granting bundles of national patents, it is only for trademarks and design rights that IP instruments with unitary effect throughout the European Union were available over the period of my study. These provide EU-wide protection and may only be granted and invalidated for all Member States at the same time, according to the same rules.[42]

Trademarks were the first of the IPRs to be harmonized in the European Union, with the Trademark Directive of 1989 leading to the introduction of Community Trademarks in 1994. However, a parallel system of national trademarks and their registration also exists. In Germany, around 60,000 applications are still made for national trademarks annually (reference year: 2011).[43] Although this number has been declining in recent years, it is higher than the number of domestic trademark applications submitted in the UK, which is around 35,000 per annum. German-based applicants also apply for far more Community Trademarks than do UK applicants (16,000 vs. 8,000 in 2011).

---

41 Once granted by the European Patent Office (EPO) and validated at the respective national offices, European patents turn into national property rights, which have to be enforced and invalidated separately in each jurisdiction. Accordingly, national courts have jurisdiction over infringement and validity issues concerning both national patents and national validations of EPO-granted patents (e.g., Mejer and van Pottelsberghe de la Potterie, 2012).

42 Note that by 2015 the EPO will issue "unitary patents," providing protection for all participating Member States on the basis of a single application and examination. The new Unified Patent Court decides over revocation and infringement of the unitary patent as a whole.

43 See http://ipstats.wipo.int (last accessed: 27 November 2014).

With regard to designs, the European Commission's Design Directive of 1998 required that all Member States provide harmonized national protection of designs through national registration procedures. Then the Community Design Regulation of 2002 created two EU-wide design rights: the Registered Community Design (RCD), which corresponds to the national right specified previously under the Design Directive, and the Unregistered Community Design (UCD), which provides automatic protection of any new and individual design against copying for three years from the date of disclosure in the EU. Since the introduction of the RCD, the total number of designs registered by UK-based registrants has remained stable, but half are now registered in Europe (BOP, 2011). However, German-based registrants submit around seven times the number of designs, with approximately three-quarters of these being domestic registrations.

While the basic setup is similar in Germany and the UK, the incentives for registering trademarks and designs are not the same, especially for businesses that are only active in their domestic markets. This is partly because the UK common law provides protection against "passing off," which protects goodwill, something that does not necessarily accrue to registered trademarks. Germany, meanwhile, has laws against unfair competition, which are not available in the UK. Aside from the much lower cost of litigation than in the UK, according to Cohen et al. (2004), an advantage to the plaintiff of the German system is that he/she can choose the forum, and plaintiffs tend to gravitate to the court which has the strictest view on IP infringement and/or is most likely to grant a preliminary injunction. Also notable is that if proven, design infringement is a civil offence in the UK, but may be a more serious criminal offence in Germany (Eichmann and Kur, 2009).

Although I am not aware of any studies which have systematically examined infringement and revocation cases with regard to either trademarks or designs in Germany and the UK, the UK legal system should be most favorable to very high-value trademarks and designs, whereas the cost of defending a low-value trademark or design is prohibitive. The German system, by contrast, is more favorable to owners who wish to assert their rights with respect to trademarks and designs of modest value. These differences in the legal setup suggest that overall the incentives to register trademarks and designs are greater in Germany than the UK. In other words, for any potentially registrable trademark or design, owners in Germany have greater incentives to register

than do owners in the UK.[44]

Having established that overall the "rules of the game" are slightly different in the UK and Germany, I now aim to shed light on the extent of any behavioral differences between German and UK firms by undertaking a detailed comparison of their IPR application activities. To do this, I draw on a novel database which is discussed next.

4.3 Construction of the dataset: comparing apples and "Äpfel"

To allow for a detailed comparison of firms' IPR choices with regard to registrable rights in Germany and the UK, I compiled a dataset by integrating observable company data and a variety of IPR sources. Company data was obtained from Bureau van Dijk's ORBIS database (August 2014 version) which contains basic information on all firms recorded, including name, ownership, and industry. Availability of financial and accounting data, such as revenues, profits and number of employees, varies substantially however. Because of this, I included only relatively large firms, with annual revenues ≥€10m in at least one year of the 2004-2012 period.[45] This provided a total of 47,856 German and 47,832 UK companies.

Patent data was extracted from PATSTAT (October 2013 version), the worldwide statistical patent database of the European Patent Office (EPO). PATSTAT provides, amongst others, standardized access to patent applications submitted to the German Patent and Trade Mark Office (DPMA), UK Intellectual Property Office (UKIPO), EPO, and the International Bureau of the World Intellectual Property Office (WIPO), including filings under the Patent Cooperation Treaty (PCT). Information on national trademarks and design registrations was taken from the registries maintained by the DPMA and UKIPO, while data on Community Trademarks and Registered Community Designs was supplied by the European Commission's Office of Harmonization for the Internal Market (OHIM). Finally, data on international trademark and design registrations (filed respectively under the Madrid and Hague systems) were obtained

[44] Note that the permitted national trademarks are, or at least have been, also narrower in the UK than Germany. I say "have been," because the difference in the two systems has narrowed, following changes in the process of applying for trademarks in the UK, which were introduced in 2007. This moved the UK system to a "light touch" approach similar to that in Germany, with the search (as far as third parties' rights are concerned) becoming advisory, and removing the ability of the UKIPO to unilaterally block applications.

[45] Historical currency rates were used to generate consistent Euro values for financial variables.

from the WIPO databases. All IPR databases other than PATSTAT were last updated between December 2013 and April 2014.

I restrict my analysis to 2004 to 2011, as 2004 was the first year for which financial data is available and 2011 is used to allow for the delay in the publication of patents.[46] IPR data is assigned to firms in the year of filing.[47] Using a longitudinal approach increases the robustness of the findings, and allows for the identification of potential changes in firm behaviors over time.

The assignment of patents, trademarks and registered designs to individual firms in a particular year involved a major challenge: firms file IPRs under a variety of names, and there is no unique identifier that can be used to link the datasets.[48] Consequently, major efforts have previously been undertaken to harmonize the names in IPR databases and match them to entries in business registers, including the NBER patent data project (Hall et al., 2001), the Oxford firm-level intellectual property database (Helmers et al., 2011), and the OECD HAN database (Thoma et al., 2010). Building on the methods of those studies, and for both countries, I implemented a three-step procedure to consolidate IPR data at the firm level. First, I extracted all applicant names associated with filings between 2004 and 2011 from the various IPR databases and removed those applicants that could be identified as non-legal entities.[49] Second, I applied a set of automatic cleaning algorithms, originally developed by Magerman et al. (2009), to reduce variations in name spellings.[50] The final phase involved matching cleaned applicant names to cleaned company names extracted from ORBIS using a token-weighted approximate string matching technique (Chaudhuri et al., 2003).[51] Perfect matches were accepted; matches below a certain similarity threshold were disregarded. Matches in the grey area – more than 30,000 for each country – were manually verified with the help of research assistants. The advantage of this semi-automated procedure is

[46] Trademarks and design registrations are typically processed faster than the average 18-months delay between the filing and publication of a patent.

[47] For trademark and design registrations at the WIPO receiving dates rather than filing dates were used since the latter are not recorded for international applications.

[48] Variations in spelling of applicant names result, for example, from inconsistent naming conventions, typographical errors, or abbreviations.

[49] OHIM applicants are classified by type of assignee upon registration. For patent data, I relied on the sector allocation by Du Plessis et al. (2009). Further confinements were hampered by lack of information.

[50] Names were harmonized in several hundred consecutive steps, related to character and punctuation cleaning, legal form treatment and common word removal.

[51] Not only a firm's current name but also previous company names and acronyms (as documented in ORBIS) were considered in the matching process.

that both high levels of accuracy (correct allocation) and completeness (extent to which a firm's different name variants are captured) can be achieved (Peeters et al., 2009).

4.4 Methods

Here, I first explain my rationale for applying econometric matching estimators, before introducing the variables of the model and the actual matching protocol. I conclude with a description of the baseline sample.

4.4.1 Matching approach

My two-country comparison is based on an econometric matching method which seeks to estimate the difference in IPR registration behaviors between German and UK firms controlling for all observable factors except country location. In other words, by finding its UK "twin," I can estimate the extent to which a German firm would have behaved differently if it were in the UK. I define the *activity gap* of an IP instrument to be the average difference in the proportion of German firms making at least one filing of a particular instrument in a particular year against the corresponding proportion of comparable UK firms. Analogously, the *count gap* of an IP instrument is the average difference in the average number of yearly filings made by German firms compared with the average number of filings made by their matched UK counterparts. Positive gaps indicate, respectively, higher propensities to file, and greater average filing numbers by German firms.

Matching techniques have been developed to replicate randomized experiments in observational studies, where the treatment status is confounded by systematic differences in covariate distributions between the treated and control groups (e.g., Heckman et al., 1998; Imbens, 2004; Imbens and Wooldridge, 2009; Rosenbaum and Rubin, 1983). The two groups are first balanced on a set of a priori defined and observable covariates, before the outcomes of the two sets are compared. Observed differences in the outcomes between treated subjects and their matched controls are attributed to the treatment. Here, "the treatment" is being based in Germany, relative to being located in the UK.

While matching is typically used to estimate causal effects, recent work has demonstrated its usefulness for investigating inter-group disparities (Aggarwal et al., 2010; Czarnitzki, 2005; Schneider et al., 2004). In this study, I follow the latter

approach, applying matching estimators to adjust for observable differences in the characteristics of German and UK firms (e.g., industry, size, and productivity). In analyzing the residual differences at the population level I focus on activity and count gaps of the various IPRs defined above. Formally, these gaps are described by $E(Y_1\text{-}Y_0 \mid S = 1, X)$, where Y is the outcome measure of the IP instrument (either as a binary variable indicating at least one filing in a particular year, or as a continuous variable denoting the number of annual filings). S refers to the country status (S=1: DE, S=0: UK), and X to the vector of measured covariates. While the mean $E(Y_1 \mid S = 1, X)$ can be identified from the data collected for German firms, $E(Y_0 \mid S = 1, X)$ corresponds to a hypothetical situation which cannot be observed and thus is approximated by $E(Y_0 \mid S = 0, X)$, the mean outcome in the control group of matched UK firms.

I employ matching techniques instead of multivariate regression models for several reasons. First, matching is a non-parametric approach and, therefore, the actual relation between firms' IPR choices and potential covariates does not need to be specified. Explicitly estimating IPR choices would require functional and distributional assumptions that are difficult to justify. Secondly, matching avoids comparing incomparable subjects (on observed characteristics) by highlighting areas of the covariate distribution without sufficient overlap between groups. Regression analysis, in contrast, does not provide standard diagnostics to assess this overlap, and would therefore rely heavily on extrapolation given marked inter-group differences in firm characteristics. Finally, when outcomes are binary, matching allows estimation of absolute differences in proportions.

While differences may arise in the behavior of matched German and UK firms, I cannot know exactly why these differences arise. Strictly, causality would imply that the outcome variables are statistically independent of the treatment assignment (here: country status) once German and UK firms have been balanced with respect to X. As I cannot entirely preclude that the observed covariates are independent of national parameters and, moreover, there might be other (unobserved) variables that either or both differ between countries and relate to firms' IPR choices, it is not certain that any differences that arise are due to "real" national difference. This said, it is normal to draw inferences from results of statistical modelling; inferences that the reader may accept or reject based on the quality of the argument, data and modeling.

4.4.2 Variables

I evaluate cross-country differences in IPR filings along 18 outcome variables – two for each individual IP instrument. The dual approach of characterizing firms' IPR behaviors by the probability of at least one filing *and* the number of applications is in line with prior research (e.g., Brouwer and Kleinknecht, 1999; Engel and Keilbach, 2007; Peeters and van Pottelsberghe de la Potterie, 2006). For all three types of IPRs – patents, trademarks, and registered designs – I consider filings at (i) the respective national office (i.e., DPMA or UKIPO), (ii) the European office (i.e., EPO or OHIM), and (iii) WIPO's International Bureau.

To avoid double counting of patents in the same family, I use a classification based on priority filings and transfer histories (cf. de Rassenfosse et al., 2013; de Rassenfosse and van Pottelsberghe de la Potterie, 2007). Specifically, any priority filings at the national office not subsequently transferred to the EPO or PCT route are coded as "national filings." National priority filings transferred to the EPO (but not to the PCT), and filings at the EPO not transferred to the PCT, are identified as "European filings," while "international filings" include all priority filings made via, or transferred into, the PCT route. Since trademarks and design rights families are relatively rare, I do not restrict their analysis to priority applications but account for first and second filings – those at the domestic office are considered "national filings," OHIM applications are designated as "European filings," and WIPO applications correspond to "international filings." For simplicity, full ownership is attributed to every applicant associated with a particular IPR. In other words, I do not adjust for partial or co-ownership.

German and UK firms are balanced on a set of key covariates known to affect IPR choices and essentially independent of a firm's national environment. While the determinants of patenting have been studied extensively in theoretical and empirical contributions (for a recent review, see Hall et al., 2014), research on the drivers of trademarking (e.g., Mendonça et al., 2004) and design registrations (see Chapter 3) is relatively scarce.

First, differences in the industrial mix of firms are captured by standard industrial classification codes (here NACE codes) at the 2-digit level (note that as a robustness check – reported later – I also matched firms by their 3-digit classification). Since the seminal studies by Levin et al. (1987) and Cohen et al. (2000) it is well established that the use and perceived effectiveness of different protection mechanisms varies

significantly across industries, with patents known to be particularly effective in "discrete" technology industries, such as pharmaceuticals or chemicals. For strategic reasons, the use of patents is also high in "complex" technological fields, including telecommunications equipment and semiconductors.[52] Heterogeneous filing motives across industries are closely linked to the sectoral variation in firms' propensity to patent (e.g., Arundel and Kabla, 1998). Not surprisingly, patenting is particularly widespread in sectors characterized by high R&D intensities (e.g., Brouwer and Kleinknecht, 1999; Peeters and van Pottelsberghe de la Potterie, 2006). More surprising is that trademarks are also more heavily used in "high-tech" rather than "low-tech" industries (Greenhalgh and Rogers, 2006; Mendonça et al., 2004), yet, in contrast to patents, they are also widely used in service sectors (Amara et al., 2008; Schmoch and Gauch, 2009). Finally, there is some evidence that design registrations are concentrated in a limited number of design-intensive sectors, which includes some R&D-intensive and some traditional, "low-tech" activities (Alcaide-Marzal and Tortajada-Esparza, 2007; Mairesse and Mohnen, 2004).

Second, I use two measures to control for differences in firm size – the log of the number of employees (*LEMPL*), and the log of revenues (*LREV*). Most studies have reported a positive relationship between firm size and the use of patents (e.g., Arundel and Kabla, 1998; Hanel, 2006), trademarks and registered designs (Amara et al., 2008; Gallié and Legros, 2012). Explanations usually include scale advantages of large IPR departments, and the financial barriers to filing and enforcing legal protection mechanisms faced by smaller firms. By matching on both the number of employees and revenues, I effectively control for firm-level differences in labor productivity or "the quality" of firms. Some of the variation due to unobserved covariates correlated with productivity is therefore captured as well. For example, productivity is a strong predictor of firms' degree of internationalization (e.g., Girma et al., 2005; Helpman et al., 2004) – a variable also shown to be positively related to the use of IPRs (Hall et al., 2014; Hanel, 2006).

In addition, I adjust for differences in company age, measured by the log of years (plus one) since incorporation (*LAGE*), and external ownership or group affiliation, as captured by a dummy variable (*GROUP*). Both variables are standard in studies modelling IPR choices. Profit measures, in contrast, are usually considered endogenous

[52] Strategic uses of patents include, for example, blocking others' patents, and use in negotiations to prevent infringement suits.

rather than exogenous to firms' IPR decisions (e.g., Durand et al., 2008; Narin et al., 1987). However, to rule out any significant effect on my findings, I performed a robustness test that includes profit margins in the vector of balancing covariates (see Section 4.5.2). As regards firms' R&D expenditures, an important determinant of patenting (e.g., Hausman et al., 1984) and – potentially – the use of other registered IPRs as well, I had to resort to the differences captured by industry dummies, as coverage of R&D spending is poor in company accounts data (and ORBIS in particular).[53] As a robustness check, I re-ran the matching for the small sample of firms for which R&D data is available (see Section 4.5.2).

4.4.3 Matching protocol

The matching procedure described in this section was chosen as the result of an iterative process that aimed to minimize systematic differences in the distribution of observed covariates between German and UK firms (cf. Austin, 2011; Rosenbaum and Rubin, 1984). I combine three distance measures to decide whether a UK firm from the pool of potential matches is a good match for a particular German firm.

First, I applied exact matching by industry by implementing the matching separately within subgroups of industries and then aggregating industry-specific effects to estimate an overall effect. This approach puts greater emphasis on one or more specific covariates – here principal activity, or industry (e.g., Caliendo and Kopeinig, 2008).

Second, propensity scores are estimated to define the region of common support, that is, the subset of firms for which at least one sufficiently similar observation in the comparison group is available (e.g., Dehejia and Wahba, 1999). In my application, the propensity score is the probability that a firm with given characteristics is a German firm. This probability is calculated using the measured covariates of both German and UK firms in a probit regression. Conditional on the propensity score, the distribution of observed covariates is similar between firms in each group (Rosenbaum and Rubin, 1983). I discard observations with propensity scores for which there is no good match in

[53] In any case, the incentives to undertake and report R&D expenditures may differ significantly between the two countries, depending for example on the tax breaks available.

the comparison sample.[54]

Third, I perform one-to-one nearest neighbor matching within subgroups of industries based on the Mahalanobis distance. The latter metric defines the distance between two subjects i and j as $d_{i,j} = (X_i - X_j)D^{-1}(X_i - X_j)^T$, where X_i and X_j are covariate vectors and D the corresponding covariance matrix based on the sample of potential controls. Mahalanobis matching works particularly well where there are few (<8) matching arguments (Gu and Rosenbaum, 1993; Rubin and Thomas, 2000; Zhao, 2004). For each German firm I select the most similar UK firm according to the lowest Mahalanobis distance. UK firms may be matched to more than one German firm; that is, I perform matching with replacement.

Once the matched sample has been formed, activity gaps (i.e., the inter-group difference in proportions of firms with at least one filing) and count gaps (i.e., the average difference in the mean number of filings) are estimated. To account for the matched nature of the data, I use McNemar's test on the (binary) activity gaps and paired t-tests on the (continuous) count gaps[55] to assess the statistical significance of the outcomes (Austin, 2009, 2011). The matching protocol is summarized in Table 6 (for similar approaches see Czarnitzki et al., 2007 and Czarnitzki et al., 2011).

[54] In other words, for each observation in both groups I calculate propensity scores, the summary measure of similarity incorporating all covariates into one scalar. I then discard German firms with propensity scores that are smaller (larger) than the minimum (maximum) in the UK comparison group – that is, those for which there is no good comparator. The same is also done for UK firms. This is a standard approach; for alternative approaches to define the region of common support see, for example, Stuart (2010).

[55] Paired t-tests might not adequately account for the potentially skewed distribution of the IPR count variables. I therefore perform alternative (non-parametric) tests to double-check the significance of the count gaps.

Table 6: Matching protocol

Step 1	Estimate a probit model to obtain the propensity scores.
Step 2	Restrict the sample to common support: delete all observations of German (UK) firms with propensity scores outside the range of the UK (German) comparison group in the same industry.
Step 3	Estimate the counterfactual outcomes within subgroups of industries. The following steps are performed: a) Choose one observation from the subgroup of German firms and delete it from that pool. b) Calculate the Mahalanobis distance between this firm and all UK firms in the same industry to identify the most similar control observation. Do not remove the selected controls from the pool of potential controls. c) Repeat a) and b) for all observations in the subgroup of German firms. d) Using the matched sample, calculate the difference in proportions of binary outcomes and, respectively, the difference in means of continuous outcomes between the two groups.
Step 4	Compute overall activity and count gaps by aggregating industry-specific gaps weighted by the number of matched pairs formed in each industry.

4.4.4 Baseline sample and descriptive statistics

In the baseline model, I apply matching estimators to six cross-sections of my integrated dataset for the period 2006-2011 and a subsample of 9,696 DE and 14,547 UK firms. Three criteria led to the trimming of the initial data.

First, most of the literature on matching assumes fully observed covariates and, therefore, observations with missing data had to be excluded. To draw from constant pools of DE and UK firms in each cross-section, only observations with complete time-series data were considered. Note also that the actual pairings of firms may differ across years. As coverage of financial and accounting data of German firms was substantially expanded from 2006 onwards, I decided to initially drop 2004 and 2005 from the analysis. In a robustness test reported later, I relax the requirement of complete time-series data and match all firms with fully observed covariates in a particular cross-section, including the years 2004 and 2005.

Second, further loss of observations was due to the exclusion of three non-activity specific NACE classes that reflect the practice of concentrating IPR registrations at head offices.[56] Where possible, companies were reassigned to the distinctive NACE class that occurred most frequently in their corporate group (cf. EPO and OHIM, 2013). Third, only NACE classes with at least 20 observations for each country were included,

[56] These include *activities of head offices* (7010), *activities of holding companies* (6420), and *other business support service activities* (8299).

leaving me with a total of 61 2-digit industries.

Table 7 provides descriptive statistics of the baseline sample, averaged over the period 2006-2011. The German firms exhibit statistically significantly higher filing probabilities for each type of IPR, and dividing the German propensity to register IP with the corresponding UK propensity shows that overall German firms were about six times more likely to apply for European patents, three times more likely to apply for national patents, international (Madrid) trademarks and to register designs nationally, and twice as likely to apply for international (PCT) patents. Only with national and European trademarks, and European designs, was the overall propensity to register IP by German firms less than double that of the UK firms.

Furthermore, when it comes to the average number of filings, overall the German firms had a significant lead, most especially in patents.[57] The average German firm was likely to register almost 15 times as many patents nationally, ten times as many patents at the EPO, and seven times as many patents internationally as the average UK firm. German firms also typically registered almost eight times the number of designs nationally and nearly five times the number of designs in Europe with OHIM as the average UK firm. The pattern is similar but less pronounced with trademarks. Relative differences – both in terms of the probability to file and application numbers – are largest for international (Hague) design registrations, as this instrument is extremely rarely used among UK firms.

However, as noted earlier, there is an obvious problem when simply comparing country averages – we are comparing firms with different characteristics, that is like comparing two different baskets of fruits, rather than apples with apples. Some of these differences in firm characteristics may reflect structural differences between the two countries, while other variation may be due to the fact that the coverage of UK firms is broader and, therefore, a more diverse set of firms is included in my dataset. The analysis presented below will shed light on the question whether the marked cross-country differences in IPR usage persist when controlling for observable company characteristics.

[57] The significance of the differences in annual filing numbers was confirmed by two alternative tests – a two-sided t-test based on the geometric means of the log (plus one) of the variables (all p-values < 0.001), and a non-parametric Wilcoxon rank-sum test (all p-values < 0.05).

Table 7: Descriptive statistics of the baseline sample, time-averaged (2006-2011)

Description	Variable	DE N=9,696		UK N=14,547		Diff. of means	Relative diff. of means
		Mean	s.d.	Mean	s.d.		
Filing probability (per year):							
National patents	*NAT-PAT-ACT*	0.054	0.179	0.020	0.097	0.034***	2.65
European patents	*EUR-PAT-ACT*	0.048	0.170	0.008	0.058	0.041***	6.40
International patents	*INT-PAT-ACT*	0.047	0.171	0.021	0.107	0.026***	2.26
National trademarks	*NAT-TM-ACT*	0.093	0.209	0.070	0.171	0.024***	1.34
European trademarks	*EUR-TM-ACT*	0.059	0.170	0.050	0.147	0.010***	1.19
International trademarks	*INT-TM-ACT*	0.046	0.150	0.014	0.074	0.031***	3.20
National designs	*NAT-DES-ACT*	0.008	0.061	0.003	0.035	0.005***	2.52
European designs	*EUR-DES-ACT*	0.020	0.107	0.012	0.074	0.008***	1.68
International designs	*INT-DES-ACT*	0.003	0.040	0.000	0.004	0.003***	34.00
Number of filings (per year):							
National patents	*NAT-PAT-CNT*	0.974	24.891	0.066	0.988	0.908***	14.86
European patents	*EUR-PAT-CNT*	0.380	6.723	0.037	1.555	0.343***	10.25
International patents	*INT-PAT-CNT*	0.707	18.295	0.099	1.480	0.608***	7.17
National trademarks	*NAT-TM-CNT*	0.438	3.478	0.209	1.245	0.229***	2.10
European trademarks	*EUR-TM-CNT*	0.212	1.757	0.122	0.612	0.091***	1.74
International trademarks	*INT-TM-CNT*	0.166	1.707	0.029	0.243	0.137***	5.79
National designs	*NAT-DES-CNT*	0.157	2.451	0.020	0.406	0.137***	8.04
European designs	*EUR-DES-CNT*	0.404	5.339	0.084	1.563	0.320***	4.83
International designs	*INT-DES-CNT*	0.086	2.562	0.000	0.018	0.086***	286.00
Revenues (1000 EUR)[a]	*LREV*	11.042	1.343	10.642	1.323	0.400***	1.04
Employees (1000s)[a]	*LEMPL*	5.318	1.509	5.086	1.495	0.232***	1.05
Company age (yrs+1)[a]	*LAGE*	3.232	0.910	3.025	0.815	0.207***	1.07
Group dummy[b]	*GROUP*	0.878	0.328	0.943	0.231	-0.066***	0.93
Industry dummies[b,c]							

***(**,*) indicates a significance levels of 0.1% (1%, 5%) based on two-tailed t-tests on diff. of means

[a] Means and standard deviations of the log are shown for these variables.

[b] No time-series data was available for group and industry dummies. Values as reported in ORBIS (August 2014).

[c] Industry dummies (NACE, 2-digit level) are not presented. With few exceptions, the means of these 61 variables differ significantly across groups, too.

4.5 Results

I begin by presenting the matching results for the baseline model. Subsequently, I report various robustness tests and then explore potential sources of heterogeneity in the distribution of gaps in more detail.

4.5.1 Baseline model

Before turning to the outcome measures of interest – the activity and count gaps of the various IPRs – I demonstrate that the matching routine as described in Table 6 has

indeed been adequately specified. Table 8 shows that the number of matched pairs formed in each cross-section ranges between 9,487 and 9,546. Accordingly, for a small percentage of the 9,696 German firms in the baseline sample no suitable UK "twin" could be identified, owing to propensity scores outside the value range of the potential control group.[58] As the lost observations amount to only about 2% of the German sample, there is sufficient overlap between groups to apply matching estimators (Dehejia and Wahba, 1999; Heckman et al., 1997). Moreover, it can be assumed that the impact of the common support restriction on my results is fairly low (e.g., Czarnitzki et al., 2011).

Table 9 reports the "standardized bias," a common measure of covariate balance, before and after matching. For each covariate, this is defined as the inter-group difference in means, divided by the square root of the average of the sample variances in both comparison groups (Rosenbaum and Rubin, 1985). Matching reduces in each instance the standardized bias to an acceptable difference of below 10% (Austin, 2011), indicating that the whole matched sample is well-balanced with respect to the observed covariates. Since I imposed an additional restriction, namely exact match by industry, covariate balance within subgroups of industries was also examined. This was done by estimating propensity scores as outlined in Section 4.4.3, yet on the matched sample and separately for each NACE class and cross-section. The requirement for successful balancing is that the likelihood ratio test on the joint significance of all regressors in the probit model is rejected after matching (e.g., Czarnitzki et al., 2007; Sianesi, 2004). This condition was ultimately met in 97% of all cases. Taken together, the applied balancing diagnostics suggest that systematic differences in observable covariates have been greatly reduced between comparison groups. Hence, I can now proceed with an outcome analysis based on the assumption that the country-specific industry and firm mix is controlled for.

Table 8: Common support analysis

	2006	2007	2008	2009	2010	2011
Matched pairs	9,487	9,504	9,524	9,543	9,546	9,519
DE firms off support	2.2%	2.0%	1.8%	1.6%	1.5%	1.8%

[58] I omit the detailed presentation of the probit regressions to obtain the propensity scores, because the estimated coefficients are of no particular interest for the purpose of this study.

Table 9: Standardized bias [%] of covariates before (i) and after (ii) matching

Variable	2006		2007		2008		2009		2010		2011	
	(i)	(ii)	(i)	(ii)	(i)	(ii)	(i)	(ii)	(i)	(ii)	(i)	(ii)
LREV	19.5	3.0	23.1	3.7	37.5	5.8	32.7	5.2	31.7	4.4	31.2	4.3
LEMPL	13.6	1.2	13.6	1.2	13.9	1.9	16.4	2.2	16.8	1.6	17.1	1.3
LAGE	23.2	1.8	23.6	2.4	23.9	3.5	24.1	4.0	24.4	3.9	24.6	4.2
GROUP	-23.2	-0.1	-23.2	-0.1	-23.2	0.0	-23.2	-0.5	-23.2	-0.5	-23.2	-0.1

Note: The distribution of firms across industries is identical after matching.

The matching results are presented in Table 10 (activity gaps) and Table 11 (count gaps). It is immediately clear that matching has an impact on the size of the cross-country differences in IPR indicators, since the adjusted gaps are generally smaller than the unadjusted, time-averaged differences reported in Table 7. Indeed, even the maximum absolute values of 4% higher propensity to register ($EUR\text{-}PAT\text{-}ACT_{2008}$) and 0.493 filings per year ($NAT\text{-}PAT\text{-}CNT_{2010}$) could be considered relatively modest. However, with some notable exceptions (discussed below), most gaps remain positive and statistically significant, suggesting that variation in firm demographics can partly, but not fully, explain German firms' higher preference for registered IPRs. With regard to the activity gaps, the following results stand out:

- First, German firms are more likely to file (1+) patents than similar UK firms, independent of application path or year. The stronger proclivity for patent protection across German firms has been reported in prior work and is likely to be related to Germany's patent-owner-friendly legal system which I discussed earlier (Cremers et al., 2013; Graham and Van Zeebroeck, 2014), as well as its generally pro-patent business culture, and high-levels of R&D productivity (Arundel and Kabla, 1998). Interestingly, the patent activity gap is not largest for national patenting, but for European patenting, with the gap peaking at 4% in 2008; this is almost twice the gap of national (2.4%) and international filings (2.1%) in that year. Possible explanations for this include a home-bias effect since the EPO is located in Germany and that the non-unitary character of European patents still reflects national differences because EPO patents are essentially bundles of national patents subject to national rules of the contracting states designated in the application.

- Interestingly, the situation is different for trademarks and design registrations. For these, the European route features nearly identical filing propensities in Germany and the UK, whereas differences in national and international filings tend to be more pronounced, with German firms more likely to use these routes. Strikingly,

over the whole period, a statistically significant activity gap is not found for European trademarks, and, with the exception of 2008 and 2009 – years of financial crisis that may have induced some variation – the same is true of European design registrations. These findings are notable, because Community Trademarks and Registered Community Designs constitute the most harmonized forms of registered IPRs available in Europe. They provide EU-wide protection with one application, and may only be granted, transferred or declared invalid for all Member States at the same time, according to the same rules. Moreover, the administering office (OHIM) is on neutral ground, being located in Spain.

- The evolution of the activity gap in national trademarking is also interesting. While most activity gaps are relatively stable over time, that for national trademarking drops from a level above 2% in favor of German firms between 2006 and 2009 to almost zero in 2010 and 2011. One explanation for this is that the substantive amendments to UK trademark law in 2007, which included the introduction of a fast-track application process and less restrictive examination procedures, have increased the attractiveness of UK trademark filings. Similar features had previously been incorporated into German trademark law in the mid-1990s, and therefore UK and German national trademark systems have converged to some extent.

So far, I have considered disparities in the proportions of firms with at least one filing of each particular IPR in a given year. I now turn to the mean differences in number of annual filings between German and matching UK firms (Table 11).[59] Here, I find that:

- With regard to patents, the evidence is clear: each count gap – independent of application path and year – remains positive and statistically significant after adjusting for company characteristics and industry of activity. Absolute differences are largest for national patents, with an average German firm in the sample outperforming its UK counterpart by almost 0.5 filings per year. European patent filings, for example, just differ by roughly 0.2 filings per year, despite markedly higher activity gaps. Because only a minority of firms patent at all, another way of

[59] Two alternative tests were performed to double-check the statistical significance of the count gaps reported in Table 11. Paired t-tests based on the geometric mean of the log (plus one) of the variables yield very similar results (exception: insignificant gap – i.e., p-value > 0.05 – for $EUR\text{-}TM\text{-}CNT_{2008}$). Wilcoxon signed-rank tests produce more conservative results, with additional insignificant gaps for $NAT\text{-}TM\text{-}CNT_{2010}$, $EUR\text{-}TM\text{-}CNT_{2008\text{-}2011}$, $NAT\text{-}DES\text{-}CNT_{2010}$ and $EUR\text{-}DES\text{-}CNT_{2006,2007,2010}$.

viewing this is in relative terms; in relative terms, German firms apply for between twice and nine times as many patents, with the largest difference being for national patents, followed by European patents. However, later I will show that the count gap in national patenting is essentially driven by a subgroup of large companies in the medium high-tech sector (see Section 4.5.3).

- Also notable is the magnitude of count gaps for national and European design filings, given the relatively low prevalence of these protection mechanisms. While both comparison groups have a similar propensity to use European design registrations, German firms file more designs.[60] A similar pattern applies to European trademarks, although absolute differences in filing numbers are smaller in this case. Indeed, among the matched pairs of companies where both file at least one European design, 65% exhibit greater annual filing numbers for the German firm, with the corresponding figure for European trademarks being 60%. That is, even if a German and a comparable UK firm both decide to use these EU-wide instruments, the German firm will generally register more designs or trademarks.

I interpret the above findings as showing evidence that even when matched to their UK "twin," German firms tend to compile larger portfolios of IPRs, although the magnitude of the differences are in general much more modest than when the overall samples are compared. While it is possible that this is because German firms are more productive in terms of producing a higher number of protectable "pieces" of intellectual property than their UK counterparts (Arundel and Kabla, 1998), I consider this to be at best only part of the explanation. For the reasons discussed in Section 4.2, German firms are more likely to seek formal protection for any given piece of protectable IP, because they have stronger incentives to do so.

[60] This is in line with my study reported in Chapter 3 where I interviewed German IP managers on design registration behaviors and found that certain companies file at a very high rate, either due to low internal standards of what should be protected by legal means ("all-you-can-file" approach) or because of highly sophisticated, multi-layered filing strategies. Evidence from the UK, in contrast, does not report such patterns (Moultrie and Livesey, 2011).

Table 10: Matching results, activity gaps

Variable	2006	2007	2008	2009	2010	2011
NAT-PAT-ACT	0.026***	0.025***	0.024***	0.025***	0.028***	0.023***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
EUR-PAT-ACT	0.035***	0.036***	0.040***	0.036***	0.031***	0.033***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
INT-PAT-ACT	0.015***	0.018***	0.021***	0.018***	0.012***	0.012***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
NAT-TM-ACT	0.031***	0.023***	0.025***	0.024***	0.002	0.001
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
EUR-TM-ACT	-0.004	-0.002	0.005	0.002	0.004	0.003
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
INT-TM-ACT	0.028***	0.034***	0.035***	0.025***	0.026***	0.028***
	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
NAT-DES-ACT	0.004***	0.004***	0.005***	0.005***	0.002	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
EUR-DES-ACT	0.003	0.001	0.007***	0.005**	0.000	0.003
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
INT-DES-ACT	0.002***	0.002***	0.003***	0.003***	0.004***	0.004***
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)

Note: Standard errors in parentheses. ***(**,*) indicates a significance levels of 0.1% (1%, 5%) based on McNemar's test.

Table 11: Matching results, count gaps

Variable	2006	2007	2008	2009	2010	2011
NAT-PAT-CNT	0.455***	0.400***	0.460**	0.463*	0.493**	0.465*
	(0.119)	(0.115)	(0.162)	(0.186)	(0.180)	(0.191)
EUR-PAT-CNT	0.236***	0.228***	0.229***	0.199***	0.194***	0.202***
	(0.030)	(0.029)	(0.031)	(0.028)	(0.026)	(0.026)
INT-PAT-CNT	0.277***	0.266***	0.216***	0.204***	0.205***	0.226***
	(0.065)	(0.067)	(0.051)	(0.048)	(0.053)	(0.054)
NAT-TM-CNT	0.257***	0.272***	0.231***	0.161***	0.104***	0.046
	(0.044)	(0.052)	(0.043)	(0.033)	(0.028)	(0.026)
EUR-TM-CNT	0.020	0.039	0.057*	0.082***	0.093***	0.069***
	(0.021)	(0.021)	(0.026)	(0.019)	(0.014)	(0.018)
INT-TM-CNT	0.117***	0.126***	0.133***	0.098***	0.106***	0.100***
	(0.020)	(0.019)	(0.021)	(0.016)	(0.015)	(0.012)
NAT-DES-CNT	0.152***	0.130**	0.170**	0.115***	0.121**	0.071**
	(0.037)	(0.042)	(0.054)	(0.029)	(0.044)	(0.026)
EUR-DES-CNT	0.156*	0.150*	0.256***	0.245***	0.205**	0.144*
	(0.062)	(0.062)	(0.069)	(0.062)	(0.065)	(0.059)
INT-DES-CNT	0.043**	0.053*	0.074*	0.041***	0.060**	0.082**
	(0.016)	(0.024)	(0.036)	(0.011)	(0.019)	(0.029)

Note: Standard errors in parentheses. ***(**,*) indicates a significance level of 0.1% (1%, 5%) based on paired t-tests.

4.5.2 Robustness checks

To examine the robustness of the results, I conduct a variety of tests, considering alternative assumptions and additional covariates. Some of the results of these investigations are shown in the Appendix, A.3. To improve clarity, I aggregate gaps over time. The pooled estimates of the baseline model (column 1) serve as a comparison standard.

First, to address the concern that the impact of sectoral differences on firms' IPR choices is not adequately captured by 2-digit industry (NACE) codes, I re-ran the matching on the baseline sample using the more refined 3-digit NACE codes (column 2). Because the exclusion criterion requiring at least 20 observations per industry and country applied more frequently, the total number of matched pairs formed over the period 2006-2011 is somewhat smaller (47,865 vs. 57,123). However, the results, both in terms of the magnitude and the statistical significance of gaps, are very similar, suggesting that the 2-digit classification is sufficient for my purpose.

Second, to incorporate profitability, I add – where reported – profit margins to the vector of balancing covariates in the baseline model (column 3). Some authors have argued that the relationship between a firm's financial performance and its IPR activities is reciprocal, so that performance differences could also affect IPR choices (e.g., Krasnikov et al., 2009; Lerner and Zhu, 2007). I find that introducing profit margin as an additional covariate has essentially no effect on the results.

Third, I aimed to expand the generality of the findings (column 4). In this specification, I included all firms to a cross-section (2004,…, 2011) for which I have complete data in any particular year, and thereby more than triple the total number of matched pairs (173,210 vs. 57,123); in other words, this relaxes the requirement of full time-series data and extends the time-period covered by two years. This widening of the net reduced the average size of the firms being compared,[61] and therefore the inclusion of a broader set of firms could be expected to reduce the size of most activity and count gaps. While this was indeed the case, the absolute reductions in gap sizes are small and the significance levels remain unchanged, so I can infer that my findings also hold for this wider set of firms.

Lastly, a concern is whether the results would change when information on R&D expenditures is incorporated into the analysis.[62] To address this, I re-estimate the extended model (column 4) for a small subset of firms for which R&D data is available. Specifically, I add the log of R&D expenditures to the vector of matching arguments (column 5), and compare the results with a benchmark model based on the original covariate vector (column 6). Interestingly, the estimates obtained from these two specifications differ little – especially when taking the relatively high standard errors

[61] The average number of employees of the German firms in the matched sample drops to 736 compared to 881 in the baseline model.

[62] Note that the propensity to undertake R&D may be biased by national policies, such as tax incentives for R&D, which may vary significantly between countries.

into account; the latter are partly due to the small number of matched pairs formed (about 1,000 over the period 2004-2011). I therefore assume that differences in R&D expenditures are largely captured by the other observed covariates. However, for the small subset of firms reporting R&D, pooled activity gaps are found to sometimes exceed 10% (*NAT-PAT-ACT*, *EUR-PAT-ACT*), while several count gaps are well above one filing per year. In the subsequent section, I will explore the sources of such heterogeneity in more detail.

4.5.3 Exploring heterogeneity

I have shown that – within my sample of matched firms – the typical German firm, compared to its UK "twin" (i) has, with the important exceptions of EU-wide trademarks and registered designs, a higher propensity to use registrable IPRs, and (ii) tends to file greater numbers of all types of IPRs – that is, German firms typically have larger IPR portfolios. However, there is also an indication that these aggregate level conclusions may be masking some important heterogeneity. In this section, I tackle this by relating the magnitude of IPR gaps to firm characteristics, focusing on company size and principle sector of activity. To this end, I evaluate the results of the baseline model separately for different groups of matched pairs. As in the robustness analysis, activity and count gaps are pooled over time to facilitate comparability.

Specifically, I split the sample of matched pairs into Eurostat sectors, dividing manufacturing industries by R&D intensity (HT: high-tech; MHT: medium high-tech; MLT: medium low-tech; LT: low-tech), and services according to the share of tertiary educated personnel (KIS: knowledge-intensive services; LKIS: less knowledge-intensive services).[63] Other industries (comprising primary activities, the utilities and construction) are gathered into a residual category. Moreover, I distinguish two types of firms: SMEs (<250 employees) and large firms (≥250 employees). Note that for both countries the sample of SMEs is atypical, because I include only firms with revenues of ≥€10m. Therefore the sample of SMEs is biased to high performing SMEs. The matched pairs are allocated according to the number of employees of the German firm in a particular year.

The differential activity and count gaps are presented in Figure 5 and Figure 6, respectively, and it is immediately clear that substantial heterogeneity exists across

[63] See http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/Annexes/htec_esms_an3.pdf (last accessed: 27 November 2014). I use the concordance table at the 2-digit NACE level.

sectors and size categories.[64] The largest absolute gaps all favor the German firms, and are found (i) primarily with respect to large firms rather than SMEs, (ii) particularly with respect to patenting (and national and international trademarking), and (iii) mainly in the high-tech and medium high-tech sectors of the economy. By contrast, the smallest absolute gaps exist for services, and especially knowledge-intensive services. Note that these sectors are those that are least likely to use IPRs in Germany and the UK (e.g., Greenhalgh and Rogers, 2006; Thomä and Bizer, 2013). Both count and activity gaps are smaller for SMEs than for large firms, which indicates that the SMEs behave more similarly than the large firms, but these findings must be treated with caution as the SMEs in my sample are atypical of those from both countries.

Lastly, I examined whether structural differences between industries in Germany and the UK can be related to the size of the IPR gaps. To this end, I constructed two variables. As prior research indicates that the degree of competition in an industry may affect the choice of protection mechanisms (e.g., Arundel and Kabla, 1998; Peeters and van Pottelsberghe de la Potterie, 2006), the first captured the cross-country difference in C4 ratios of an industry.[65] The second captured the cross-country difference in the share of multinational enterprises in an industry;[66] it is intended to proxy variation in the degree of internationalization of industries which could also be associated with the relevance of IPRs (e.g., Hall et al., 2014; Hanel, 2006). Based on the value distribution of the constructed variables, I split the sample of matched pairs into quartiles. As it turns out, for both variables no clear pattern can be observed (I do not report the full results for brevity); the gaps are relatively evenly distributed across categories. I therefore conclude that the observed structural industry differences are poor predictors of the magnitude of IPR gaps compared to the parameters discussed above, that is, firm size and sector of activity.

---

64 Supplementary statistics for the differential gaps (number of matched pairs, significance levels, etc.) are available from the author upon request.

65 C-4 ratios were calculated based on the full dataset (see Section 4.3) as the total market share of the four largest firms (in terms of revenues) in a country, industry (2-digit NACE level), and year.

66 A company is classified as multinational if it either (directly or indirectly) owns more than 50% of a foreign firm, or is (directly or indirectly) owned by more than 50% by a foreign company. Industry shares were calculated based on the full sample of German and, respectively, UK firms (see Section 4.3).

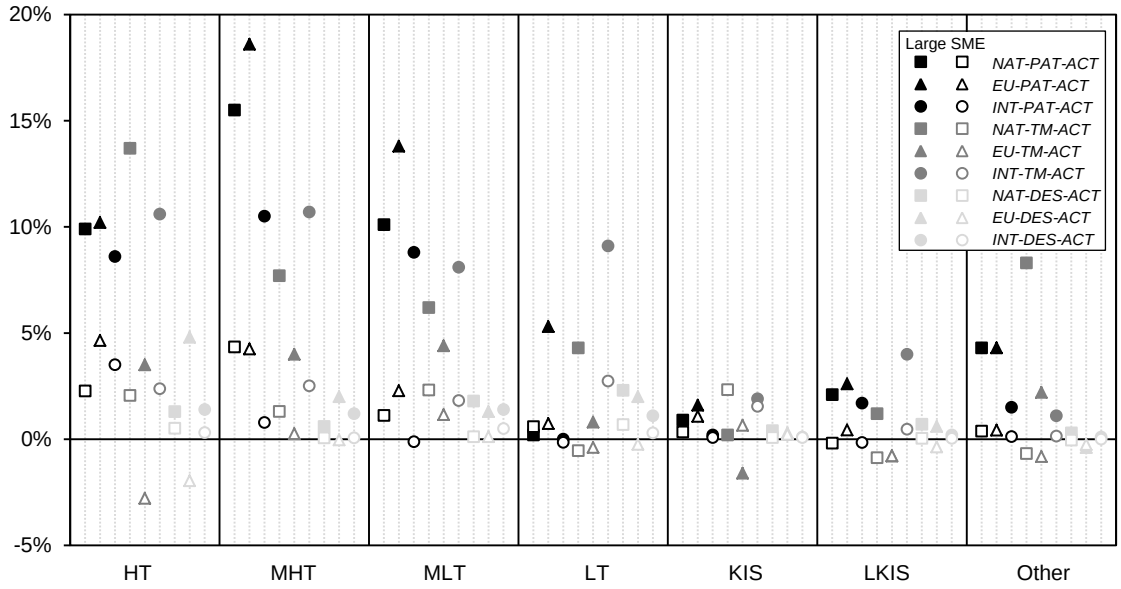

Figure 5: Activity gaps by company size and industry sector (pooled over years)

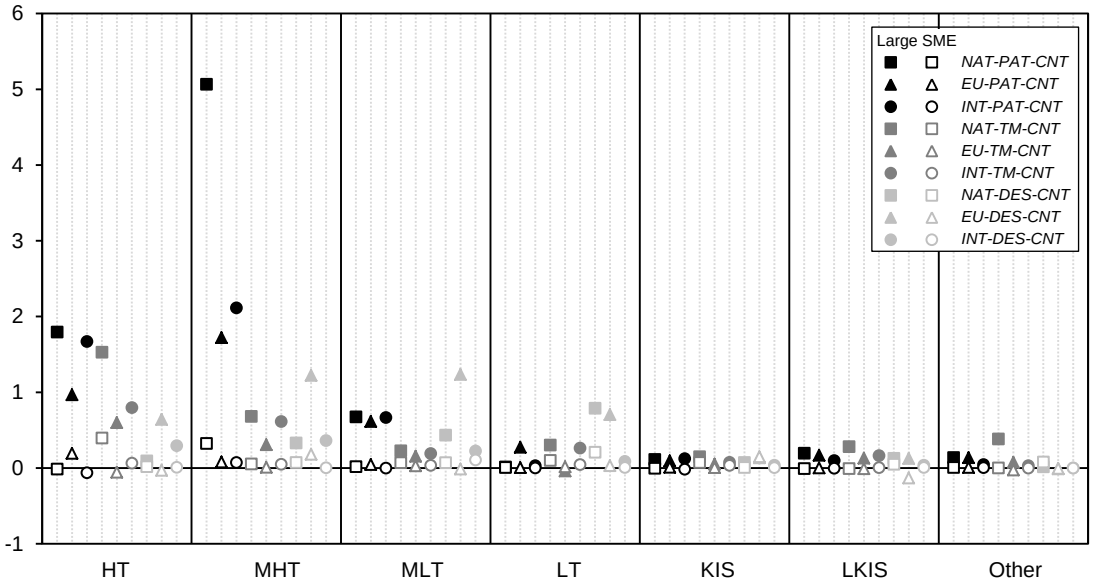

Figure 6: Count gaps by company size and industry sector (pooled over years)

4.6 Discussion

Do similar firms in different contexts behave in similar or different ways? A substantial literature has developed on "varieties of capitalism" (Hall and Soskice, 2001), "divergent capitalisms" (Whitley, 1999), or "capitalist diversity" (Crouch, 2005), which argues that firms will behave differently in different context because their behavior is shaped by institutions (including the financial system, the labor market,

legal frameworks, etc.). As is shown by the game of rugby, even relatively small differences in the rules of the game can lead to quite different patterns of behavior. Although this literature appreciates that innovation is the ultimate source of economic growth, and makes broad assertions about the types of innovation most attuned to the different "varieties of capitalism" (for a critical analysis, see Taylor, 2004 and Akkermans et al., 2009), this literature is perhaps surprisingly quiet on the details of the legal systems and instruments intended to support innovation.

This study has sought to address this by empirically examining the use of various types of registered IPRs by firms in Germany and the UK. Importantly, I have matched the firms, so that I am comparing like with like. Although this comes at a cost of generalization – the matched firms are not necessarily typical of firms in Germany or the UK –, the choice of comparison countries is not arbitrary. On the one hand, both Germany and the UK are members of the European Union, which is seeking to develop a single market. A single market can only really exist if the pertinent institutions are homogeneous. The European Commission is of course aware of this, and has been working to harmonize institutions, including those related to IPRs. To date, most progress has been made with respect to trademarks and designs.

On the other hand, Germany and the UK remain significantly different. In the "varieties of capitalism" literature Germany is characterized as a prime example of a coordinated market economy, whereas the UK (alongside the U.S.) exemplifies a liberal market economy. Being two different types of economies, Germany and the UK not only host but also favor different types of firms and firm behaviors. The two countries also differ in their legal frameworks. The UK is a common law country, so – as well as by statutes – law of precedent applies and is developed by judges through the decisions of courts. The German legal system is based on civil law, which is much more extensively codified, and less open to interpretation by the judiciary. In the UK common law – such as the law against "passing off" – can be used instead of seeking damages for the infringement of IPRs.

The structure and functioning of the legal system also matters. Any right is ultimately only valuable if the owner is able to assert that right. The German legal system appears to be (or to have been) much more favorable to the owners of IPRs than the UK legal system. This is for at least three reasons. First, the German system allows the right owner to choose the forum for the fight, and naturally there is some tendency to choose the courts most favorable to right owners. The UK only has a few specialist

courts for IP matters.

Secondly, and particularly for patents, the dual system which hears infringement cases separately from invalidity proceedings favors right owners over defendants. Infringement cases proceed on the assumption that the right is valid. In the UK defendants accused of infringement are more likely than not to counter-claim that the patent is invalid, and the courts do not assume validity. Indeed, analysis by Cremers et al. (2013) shows that, after out-of-court settlements, the most likely outcome for a UK patentee in an infringement case is that the patent is revoked.[67] By contrast, and again excluding settlements, the most likely outcome for a German patentee making an infringement claim is that infringement is found.

Third, the cost of litigation in the UK is typically much higher than in Germany (Graham and Van Zeebroeck, 2014; Mejer and van Pottelsberghe de la Potterie, 2012). This raises the bar significantly in terms of the value of intellectual properties that are likely to be defended. It also greatly favors those with deep pockets. If a right owner knows that he/she cannot afford to protect his/her rights, then there is less incentive to obtain the right in the first place.

Interestingly, the UK (or more specifically England and Wales) has recently been reformed, with the Patents County Court becoming the Intellectual Property Enterprise Court in October 2013. These changes are intended to make justice more accessible as the cost of cases is capped; but it will also make justice less thorough, increasing the chances that invalid rights are upheld. These changes were made after my period of study, and it will be interesting to observe whether they influence behavior. During my period of study, the incentives to register IPRs were greater in Germany than the UK, especially for properties of low to moderate values. It was therefore to be expected that German firms would register more; the interesting question is how much more.

Because Germany and the UK host different populations of firms, the

[67] This may be surprising, but it is quite likely that a large share of the patent stock is in fact invalid (e.g., Lemley and Shapiro, 2005; Mann and Underweiser, 2012). This is because: 1. Patent offices are in general under considerable time pressure. Studies in the U.S. have found that examiners spend on average 18 hours per application during the three year examination process reading the application, searching for and reading prior art, comparing the prior art to the application, writing one or more provisional rejections, reviewing responses and amendments, often conducting an interview with the applicant's attorney and writing a notice of allowance. And moreover, as examiners become more senior and deal with more complex patents their productivity in processing patents is expected to increase (Lemley, 2000). 2. Patent examiners are more likely to approve a questionable patent than refuse it (and if they refuse it the inventor is very likely to appeal) – in other words, the patent office is more likely to end up accept an invalid patent than to decline a valid patent. Through a patent, the state provides a right which is presumed to be valid, rather than guaranteed to be valid. It is, however, presumed to be valid until proven otherwise, and it can be costly for opponents to achieve this.

demographics of which are at least partially attuned to the variant of capitalism that operates in each country, I opted for a matched pairs approach. This ensured that each German firm in my dataset was "twinned" to the nearest UK firm on a set of observed characteristics, including age, size, labor productivity, and industry sector. Partly because they are difficult to observe, I did not match firms on other characteristics, such as sources of finance, or labor force characteristics that the varieties of capitalism literature considers salient.

I find that, after matching, German firms tend to make, as expected, greater use of registered forms of IP protection: this is true of patents, trademarks and design rights – but that in general the absolute size of the differences is small. German firms are especially more prone to register patents and designs, with the largest absolute difference being for national patents, the instrument for which the difference in the legal systems is probably most favorable to IPR owners in Germany relative to those in the UK. A more detailed analysis found that the differences in IPR filing propensities and the numbers of rights filed are, perhaps unsurprisingly, greatest in the high-tech and medium high-tech sectors. Differences, especially in the number of registrations, tend to be much smaller in low-tech manufacturing sectors and services. Also notable is that the differences between German and UK firms are much more pronounced among large firms.

Unfortunately, I do not and cannot know to what extent German firms tend to register more IP because they have greater incentives to do so, and to what extent the observed differences between German and UK firms are due to other factors, such as differences in their productivity of creating "pieces" of registrable intellectual property (cf. Arundel and Kabla, 1998). I suspect that, among this matched sample of firms, the former explanation plays a preeminent role. One possible way to examine this in future research would be to link my matched sample to the German and UK innovation surveys, and compare their reported innovation activities, including the share of sales arising from innovative products. However, such comparisons may be problematic, as innovation survey data is subjective, and it is possible that different understandings of innovation may prevail in both countries. Another set of potentially relevant variables pertains to the country-specific, IPR-related norms, habits and management attitudes (Pitkethly, 2001), the understanding of which would benefit from cross-national in-depth fieldwork and targeted surveys.

Very interesting findings that arise from my study are that the differences between

German and UK firms in the use of EU-wide Community Trademarks and Registered Community Designs are in general small, and in fact statistically insignificant. While the use of these instruments is presumably biased towards firms that are, or wish to be, active in several European countries as opposed to confining themselves to their domestic markets, the finding that German and UK firms are behaving in similar ways with regard to these single-market instruments (and in more similar ways than with yet to be harmonized patents) indicates that the European Commission has succeeded in introducing instruments which are perceived, ceteris paribus, as equally attractive by firms that originate from rather different institutional contexts. Another interpretation is that it shows that when formal institutions are harmonized, firms' observed behavior – after controlling for other observed characteristics – will converge.

Ultimately, the European Commission has a major challenge in creating a single set of rules which are a necessary underpinning for a single market. This is particularly challenging because, like the advocates of rugby union and rugby league, each tribe tends to celebrate the apparently positive aspects of their game, and the set of rules that underpin this, while placing less value on the features valued by the other side. With regard to IPRs, the UK system is less likely to be granting rights which are invalid, but access to justice has been expensive, and the system favors the rich. The German system, by contrast, is more likely to grant rights for low-value properties, and to uphold rights which, if subject to scrutiny, would be found invalid. Justice is more accessible, but less thorough, and tends to favor right owners. Although not as open to strategic abuse as the U.S. system (largely because punitive damages are not permitted), it is more open to abuse than the UK system (cf. Blind et al., 2006). The delay in introducing a European patent with unitary effect is understandable in light of the difficulty in finding common ground. What is clear is that the use of IPRs as indicators of innovation performance is extremely hazardous.

4.7 Conclusions

This study examined the extent to which firms in two different, but possibly converging national contexts – Germany and the UK – behave similarly or differently with regard to their use of registered forms of IP protection. I find that overall, and after matching firms, German firms still make greater use of IPRs, but that the absolute differences are much more modest than when the unmatched samples are compared.

However, especially in high-tech and medium high-tech sectors, German firms are likely to have considerably larger IPR portfolios. I argue that the differences are, at least in part, because the institutional framework in Germany provides greater incentives to register IPRs than is the case in the UK. Notable among my findings is that German and UK firms are making similar use, and extent of use, of harmonized European instruments, including Community Trademarks and Registered Community Designs. Institutional harmonization appears to encourage behavioral convergence.

5 Summary and conclusions

The focus of this dissertation was on an important, yet relatively neglected, aspect of product innovation and differentiation – visible product design –, and particularly the competitive choices and challenges it encompasses. Specifically, I aimed to advance theoretical and practical knowledge at the intersection of the fields of design, inter-firm competition, and legal IP protection, by conducting three studies – one conceptual, one qualitative case-based, and one quantitative. This concluding chapter summarizes the studies' main findings, reviews the implications for research and managerial practice, and highlights selected emerging issues that could be fruitfully addressed in future work.

Competing in design: differentiation, imitation, and value capture

In Chapter 2, I proposed a new conceptual framework that I hope will change the way we think about, evaluate, and study design decision making in competitive contexts. This framework integrates several areas of research to offer a holistic theory of design-based competition, covering aspects of both design-related value creation and value capture. I extended established ideas about visible product design as a strategic differentiator (e.g., Abernathy and Clark, 1985; Kotler and Rath, 1984; Verganti, 2009) and the means of protecting it (e.g., Gemser and Wijnberg, 2001; Monseau, 2012) using insights from marketing, psychology and sociology on consumers' preference formation processes (e.g., Bloch et al., 2003; Page and Herr, 2002), especially with regard to how these processes are affected by perceptions of visual similarity (e.g., Janakiraman et al., 2009; Mussweiler, 2003; Warlop and Alba, 2004).

As the organizing principle of the framework, I distinguish between three modes of differentiation through design: horizontal and vertical differentiation, which both relate to consumers' absolute preferences for certain design features, and the novel concept of relative differentiation, where preferences for a given product are formed with reference to other products. Opening the theoretical black box of the psychological processes underlying relative differentiation allowed me to develop a formal model that illustrates and generalizes the conditions under which visual resemblance to a competitor's product will positively or negatively affect consumers' evaluative judgments. Propositions were derived that link the optimal degree of design distance to key

contingency factors. For example, the model predicts that when both an exact design copy and maximum dissimilarity are unattractive, then the optimal design distance of a lower-quality follower (i) increases with higher assessment accuracy of the target product and (ii) increases (decreases) with larger perceived quality difference between reference and target product if the norms (contrast) effect is negligible. For a higher-quality follower, in contrast, the optimal design distance (i) decreases with higher assessment accuracy of the target product if consumer norms against imitation are negligible and (ii) increases when the absolute quality difference between reference and target product decreases. Finally, I advanced the idea that the demand-side effects underlying relative differentiation may act as important barriers to design imitation. These take effect when a potential imitator eschews close design copies in anticipation of unfavorable transfer of quality perceptions and/or consumer reactance.

The proposed framework contributes to organization and management research in three ways. First, it accounts for the competitive, hitherto largely neglected, role of design and, as such, advances recent work positioning design primary as a strategic challenge (e.g., Eisenman, 2013; Ravasi and Lojacono, 2005; Rindova and Petkova, 2007). Second, it recognizes the demand-side effects of design choices, thereby unveiling additional levers for creating competitive advantage. Third, it offers an explanation for why design, despite generally weak appropriability conditions, can still be a strategic asset that is not made easily obsolete by competition. For practical interest, the study's findings may help managers and designers to better exploit the strategic potential of design and anticipate competitors' responses to new product introductions.

The framework also opens up interesting angles for future research. For example, the stylized model of relative differentiation could be extended to account for heterogeneity in consumer preferences and "reverse" quality spillovers (i.e., from the follower's to the pioneer's product) to build a more comprehensive theory of design-based competition. Besides theoretical extensions, empirical work will be required to examine, in light of the propositions derived, the appropriateness of innovative and imitative design strategies in different competitive contexts. This could be done both at the consumer and the firm level.

Protecting aesthetic innovations? An exploration of the use of Registered Community Designs

In Chapter 3, I presented a foundation study on firms' legal design protection behaviors, and the use of RCDs in particular. This study is intended to provide a roadmap for future investigations addressing research questions related to design protection and/or employing registered designs as empirical tools. Because the phenomenon of interest is little understood, an exploratory research design was deemed most appropriate.

Analyzing intellectual property rights requires an understanding of the legal background. The study's first purpose was therefore to highlight the resource – to explain what RCDs are, and to place them in the wider context of design protection. This included a discussion of the various options available to creators seeking to protect their designs in Europe. RCD data provided by the administrating office (OHIM) was then examined in terms of which countries, industries, and firms are most active in registering designs. To complement this statistical data, and to gain a more detailed understanding of how and why RCDs are actually used by firms, a qualitative study was undertaken, based on a sample of German firms active in three industries.

The findings of the qualitative study are important in three respects. First, they contribute to understanding the variety of firm behaviors with respect to RCDs. In particular, it is shown how the choice between an "all-you-can-file" strategy (i.e., compiling vast portfolios of registered designs – no matter if valid or not) and a more parsimonious approach (i.e., selectively registering truly new and unique designs) can be linked to product and industry parameters and the firm-specific behavioral motives underlying the registration activity. Some of the key relationships concerning firms' utilization of RCDs are summarized in the form of testable research propositions.

As a second major insight, the qualitative analysis suggests that the total volume of registered designs provides a poor indication of the extent of design innovation in a field, especially in crowded design spaces. Future studies considering incorporating RCDs as innovation indicators should therefore examine this instrument with caution, and ideally with an understanding of the prevailing firm and industry level norms, as well as of legal issues. My study provides first guidance in this regard.

Third, the fieldwork revealed that the way in which RCDs are being used is not always in line with the intended policy objective of encouraging innovation and

creativity in design. For example, in the context of footwear, it appeared that the unexamined nature of the legal instrument, combined with the low cost of simultaneously filing multiple designs, invites deliberate misuse in that firms "dump" large numbers of design registrations in an already cluttered system – including designs that are not new, or even designs created by competitors. Suggestions were made as to how the RCD system could be reformed to limit such abusive behavior, with the aim of increasing transparency and the proportion of truly new and individual designs without the need for office examination.

Finally, to set the stage for future empirical work, a detailed research agenda was proposed. This outlines a number of theoretically and practically important topics related to RCDs and design protection more generally, which could be examined using several empirical approaches. Among others, comparative case-based research on a wider variety of sectors and in different countries would initially be helpful to develop a more solid body of knowledge on which future quantitative investigations could draw to study the phenomenon on a larger scale.

Single market; same practices? The use of intellectual property rights by German and UK firms

In Chapter 4, I examined, based on a matched pairs methodology, the extent to which firms in Germany and the UK behave similarly or differently with regard to their use of registrable IPRs. Such knowledge is particularly relevant for European policy makers, who have been working to reform the IPR system, or systems, in Europe, with the principle aim of aligning patent, trademark and design protection across Member States. Creating "a single market for intellectual property rights" (European Commission, 2011) is however challenging, because Europe is comprised of nations with different institutions and traditions, including coordinated market economies, such as Germany, and liberal market economies, such as the UK. To evaluate past reforms and to guide future policy making, it is therefore important to assess the degree of behavioral convergence in the use of various IP instruments in different national contexts.

I undertook this exercise by drawing on a novel database that integrates company data and multiple IPR sources at the firm level: patents, trademarks, and registered designs – each of which may be filed at the national, European or WIPO's international office. The matching approach ensured that German and UK firms which are similar on

observed characteristics were compared. It turned out that overall, and after matching firms, German firms still had a higher propensity to use all types of registrable IPRs, and filed higher numbers of them, although the magnitude of differences was much more modest than when the unmatched samples were compared. Interestingly, the largest differences were found in terms of patenting, and especially national patenting – the instrument for which the difference in the legal systems is arguably most favorable to IPR owners in Germany relative to those in the UK. The smallest, and in fact statistically insignificant, differences, in contrast, were observed for the two most harmonized types of registered IP currently available in Europe, that is, Community Trademarks and Registered Community Designs. This finding indicates that the European Commission has succeeded in introducing harmonized instruments that are perceived, ceteris paribus, as equally attractive by firms in rather diverse national contexts. Moreover, it appears to support the idea that once the formal institutional playing field is leveled, firms' IPR behaviors – after controlling for other observed characteristics – will converge.

From a theoretical standpoint, this study contributes to scholarly thinking in the "varieties of capitalism" tradition, which argues that firms behave differently in different contexts because their behavior is shaped by institutions (e.g., Hall and Soskice, 2001; Whitley, 1999). While this literature appreciates that innovation is the ultimate source of economic growth, it is perhaps surprisingly quiet on the details of the legal systems and the instruments to support innovation. A core argument I advance in the study, which is in line with prior work (Arundel et al., 1995; Cohen et al., 2002), is that even relatively small differences in the legal IPR framework can have substantial effects on actual behavior. In other words, convergence of formal institutions appears to substantially reduce diversity. This suggests that moving toward a more dynamic perspective – rather than contrasting different types of market economies in a static manner – may help better understand both the magnitude of behavioral differences, and the extent to which convergence is likely.

The interpretation of the results has limitations as, with the data at hand, it was not possible to empirically separate the effect of the legal framework on cross-national differences in IPR behaviors from the effect of other factors, for example, firms' productivity in terms of creating "pieces" of protectable intellectual property or the IPR-related norms, habits and management practices prevalent in each country. While beyond the scope of the present investigation, future studies may attempt to produce a

more fine-grained account of the drivers of the observed differences, and their relative importance, such as through survey-based or qualitative research.

Overall, and to conclude, I hope that the three studies presented in this dissertation have demonstrated that the study of design, and of the means of protecting it, can be a rich source of theoretical and empirical knowledge and scholarly activity for many years to come. As such, this work should provide a response to recent calls (Eisenman, 2013; Noble, 2011; Ravasi and Stigliani, 2012; Rindova and Petkova, 2007) to help elevate design further to the status of other, particularly technological, aspects of product innovation and competition.

Appendix

A.1 Proof of Propositions 1-6

Lemma 1. *If α is smaller or larger than both γ and ν, then $S(d,\Delta,\varepsilon)$ and all its derivatives with respect to d each have at most one positive root (i.e., values of d where the function equals zero). If α is between γ and ν, then $S(d,\Delta,\varepsilon)$ and all its derivatives each have at most two positive roots.*

Proof: Follows from Descartes' rule of signs, see Proposition 3.1 by Jameson (2006).

Proof of Proposition 1

(a) If S had $m > 1$ local maxima in $(0,\infty)$, then the total number of extrema would be at least $2m - 1 > 2$, contradicting Lemma 1. The case of one local maximum at 0 and one at $d > 0$ is excluded because it requires the summand with the largest and that with the smallest exponent parameter to be positive, which is excluded since only one summand is positive.

(b) If the conditions of (b) are fulfilled, then S has a local maximum at $d = 0$. Since according to (a) this is the only local maximum, it is also the global maximum of S.

(c) $S'(d=0) > 0$ implies that the global maximum, if it exists, must be located at some $d > 0$. For its existence it is sufficient that $S(0) > 0$. If $S(0) < 0$ and α is the smallest exponent parameter, then for sufficiently large d, S becomes positive because the assimilation effect dominates. Since S converges to zero with $d \to \infty$, this implies a maximum with a positive value of S at some $d > 0$. With $S'(0) > 0$, $S(0) < 0$, and α between γ and ν, the positive assimilation term becomes relatively largest for medium values of d. The requirement that a_1 be "large enough" then leads, by definition of "large enough", to a maximum.

(d) If $S(0) < 0$, $S'(0) > 0$ and α exceeds both γ and ν, then (i) S can at most have one root due to Lemma 1, and (ii) for sufficiently large d, S is negative because the positive assimilation effect decreases most quickly. Thus, S cannot take on

positive values. If S(0) < 0, S'(0) > 0 and α lies between γ and ν, then if a_1 is small enough S never reaches positive values. The lower curve in Figure 1, d2, provides prove of existence. Finally, if S'(0) < 0 then a maximum of S at finite values of d would require three or more extrema, which are excluded by Lemma 1.

Proof of Proposition 4

With Δ < 0, the assimilation effect becomes negative while the contrast effect becomes positive. The norms effect remains negative. Thus, the analysis is technically identical to that in Proposition 1, with a_1 and c_1 interchanged and α and γ interchanged.

Proof of Propositions 2 and 5

The maximum d^* of S fulfills $\partial S/\partial d = 0$ and $\partial^2 S/\partial d^2 < 0$. Writing d^* as a function of Δ and ε, differentiating the first-order condition implicitly with respect to Δ, and solving for $\partial d^*/\partial \Delta$ yields $\partial d^*/\partial \Delta = -\frac{\partial^2 S}{\partial d \partial \Delta}\left(\frac{\partial^2 S}{\partial d^2}\right)^{-1}$. The second term is negative, and so the sign of $\partial d^*/\partial \Delta$ equals that of the cross derivative. The latter can be spelled out as $\frac{\partial^2 S}{\partial d \partial \Delta} = \frac{\partial a_1}{\partial \Delta}\cdot\frac{\partial a_2}{\partial d} + \frac{\partial c_1}{\partial \Delta}\cdot\frac{\partial c_2}{\partial d} + \frac{\partial n_1}{\partial \Delta}\cdot\frac{\partial n_2}{\partial d}$. Since $a_1(0,\varepsilon) = 0$ and $a_1(\Delta,\varepsilon)$ is concave in Δ for Δ > 0 and convex for Δ < 0, we have $\frac{\partial a_1}{\partial \Delta} < a_1/\Delta$ in both cases. The same holds for $c_1(\Delta,\varepsilon)$, and so $\frac{\partial c_1}{\partial \Delta} < c_1/\Delta$. Replacing the partial derivatives of a_1 and c_1 in the above equation yields (since $\frac{\partial a_2}{\partial d} < 0$ and $\frac{\partial c_2}{\partial d} < 0$) the following inequality: $\frac{\partial^2 S}{\partial d \partial \Delta} > \frac{a_1}{\Delta}\cdot\frac{\partial a_2}{\partial d} + \frac{c_1}{\Delta}\cdot\frac{\partial c_2}{\partial d} + \frac{\partial n_1}{\partial \Delta}\cdot\frac{\partial n_2}{\partial d}$. Using the first-order condition at d^*, $\partial S/\partial d \equiv a_1 \cdot \frac{\partial a_2}{\partial d} + c_1 \cdot \frac{\partial c_2}{\partial d} + n_1 \cdot \frac{\partial n_2}{\partial d} = 0$, and factoring out yields $\frac{\partial^2 S}{\partial d \partial \Delta} > -\frac{\partial n_2}{\partial d}\left(\frac{n_1}{\Delta} - \frac{\partial n_1}{\partial \Delta}\right)$. Thus, since $\left(-\frac{\partial n_2}{\partial d}\right) > 0$, $\frac{\partial^2 S}{\partial d \partial \Delta}$ and thus $\partial d^*/\partial \Delta$ are positive if $\frac{n_1}{\Delta} - \frac{\partial n_1}{\partial \Delta} > 0$. The latter is the case if and only if Δ < 0, which proves Proposition 5. If Δ > 0, then $\frac{n_1}{\Delta} - \frac{\partial n_1}{\partial \Delta} < 0$ unless the norms effect vanishes. In the latter case, and thus also if the norms effect is small enough, the inequality $\frac{\partial^2 S}{\partial d \partial \Delta} > -\frac{\partial n_2}{\partial d}\left(\frac{n_1}{\Delta} - \frac{\partial n_1}{\partial \Delta}\right)$ implies $\partial d^*/\partial \Delta > 0$. This proves part (i) of Proposition 2. Regarding part (ii), we note that $\frac{\partial a_1}{\partial \Delta} > 0$, $\frac{\partial a_2}{\partial d} < 0$, $\frac{\partial n_1}{\partial \Delta} > 0$, $\frac{\partial n_2}{\partial d} < 0$, and so $\frac{\partial^2 S}{\partial d \partial \Delta} < 0$ and thus $\partial d^*/\partial \Delta < 0$ if the contrast effect is zero and equally if it is sufficiently small. This proves part (ii).

Proof of Propositions 3 and 6

The maximum d^* of S fulfills $\partial S/\partial d = 0$ and $\partial^2 S/\partial d^2 < 0$. Writing d^* as a function of Δ and ε, differentiating the first-order condition implicitly with respect to ε, and solving for $\partial d^*/\partial \varepsilon$ yields $\partial d^*/\partial \varepsilon = -\frac{\partial^2 S}{\partial d \partial \varepsilon}\left(\frac{\partial^2 S}{\partial d^2}\right)^{-1}$. The second term is negative, and so the sign of $\partial d^*/\partial \varepsilon$ equals that of the cross derivative. The latter can be spelled out as $\frac{\partial^2 S}{\partial d \partial \varepsilon} = \frac{\partial a_1}{\partial \varepsilon} \cdot \frac{\partial a_2}{\partial d} + \frac{\partial c_1}{\partial \varepsilon} \cdot \frac{\partial c_2}{\partial d}$. Since $a_1(\Delta,0) = 0$ and $|a_1(\Delta,\varepsilon)|$ is convex in ε, we have $\frac{\partial a_1}{\partial \varepsilon} > a_1/\varepsilon$ for $a_1 > 0$ ($\Leftrightarrow \Delta > 0$) and $\frac{\partial a_1}{\partial \varepsilon} < a_1/\varepsilon$ for $a_1 < 0$ ($\Leftrightarrow \Delta < 0$). Similarly, $c_1(\Delta,0) = 0$ and $|c_1(\Delta,\varepsilon)|$ is concave in ε, and thus $\frac{\partial c_1}{\partial \varepsilon} > c_1/\varepsilon$ for $c_1 < 0$ ($\Leftrightarrow \Delta > 0$) and $\frac{\partial c_1}{\partial \varepsilon} < c_1/\varepsilon$ for $c_1 > 0$ ($\Leftrightarrow \Delta < 0$). Replacing the partial derivatives of a_1 and c_1 in the above equation yields (since $\frac{\partial a_2}{\partial d} < 0$ and $\frac{\partial c_2}{\partial d} < 0$) the estimate $\frac{\partial^2 S}{\partial d \partial \varepsilon} < \frac{a_1}{\varepsilon} \cdot \frac{\partial a_2}{\partial d} + \frac{c_1}{\varepsilon} \cdot \frac{\partial c_2}{\partial d}$ for $\Delta > 0$, and $\frac{\partial^2 S}{\partial d \partial \varepsilon} > \frac{a_1}{\varepsilon} \cdot \frac{\partial a_2}{\partial d} + \frac{c_1}{\varepsilon} \cdot \frac{\partial c_2}{\partial d}$ for $\Delta < 0$. Using the first-order condition at d^*, $\partial S/\partial d \equiv a_1 \cdot \frac{\partial a_2}{\partial d} + c_1 \cdot \frac{\partial c_2}{\partial d} + n_1 \cdot \frac{\partial n_2}{\partial d} = 0$, yields $\frac{\partial^2 S}{\partial d \partial \varepsilon} < -\frac{n_1}{\varepsilon} \cdot \frac{\partial n_2}{\partial d}$ for $\Delta > 0$. Thus, since $\frac{\partial n_2}{\partial d} < 0$ and $n_1 < 0$, $\frac{\partial^2 S}{\partial d \partial \varepsilon}$ and thus $\partial d^*/\partial \varepsilon$ are negative for $\Delta > 0$, which proves Proposition 3. For $\Delta < 0$, we obtain the estimate $\frac{\partial^2 S}{\partial d \partial \varepsilon} > -\frac{n_1}{\varepsilon} \cdot \frac{\partial n_2}{\partial d}$. Since the term on the right-hand side is negative unless the norms effect vanishes, we can derive no general result regarding the sign of $\partial d^*/\partial \varepsilon$. However, if the norms effect vanishes and equally if it is sufficiently small, then $\partial d^*/\partial \varepsilon > 0$. This proves Proposition 6.

A.2 List of interviews

Industry	Company	Position	Clients (selection)
Footwear	Rossbach & Beier	Partner	AstorMueller, K&S, Softclox
	Gail & Kollegen	Partner	Think!, Buffalo, ara Shoes
	Adidas	Senior Patent Counsel	
	Softclox	CEO	
	Bird & Bird	Partner	Lloyd Shoes
	KLAKA	Partner	Deichmann
	Louis-Pöhlau-Lohrentz	Partner	Rieker
	Andrae-Flach-Haug	Partner	Gabor
Automotive	BMW	Head of TMs and Designs, Design Rights Specialist	
	Prinz & Partner	Partner	Volvo
	Wbetal	Partner, Partner	Toyota
	KLAKA Rechtsanwälte	Partner	BMW
	Kuhnen & Wacker	Partner	Toyota, Denso, Yokohama
	MAN Truck & Bus	Head of IPR Department	
	Daimler	Head of TMs and Designs	
Tools	Robert Bosch	Vice President IPR Department	
	Andreas Stihl	Head of IPR Department	
	Benninger & Eichler Stahlberg	Partner	
	John Deere Germany	Senior Patent Attorney	
General experts	Allen & Overy	Partner	
	Bird & Bird	Counsel	
	Hogan Lovells	Partner	
	OHIM	Head of Invalidity Division	

A.3 Robustness tests: activity and count gaps (pooled over years)

Variable	(1)	(2)	(3)	(4)	(5)	(6)
	Baseline model	Baseline model at 3-digit NACE level	Baseline model incl. profit margin	Extended model	Extended model incl. R&D	Benchmark model to (5)
NAT-PAT-ACT	0.025***	0.024***	0.026***	0.018***	0.101***	0.102***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.018)	(0.019)
EUR-PAT-ACT	0.035***	0.033***	0.036***	0.026***	0.139***	0.168***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.016)	(0.016)
INT-PAT-ACT	0.016***	0.016***	0.017***	0.011***	0.055**	0.071***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.019)	(0.019)
NAT-TM-ACT	0.017***	0.013***	0.019***	0.009***	0.061***	0.095***
	(0.002)	(0.002)	(0.002)	(0.001)	(0.017)	(0.017)
EUR-TM-ACT	0.001	0.002	0.003	0.000	-0.002	0.004
	(0.001)	(0.001)	(0.001)	(0.001)	(0.018)	(0.018)
INT-TM-ACT	0.029***	0.027***	0.030***	0.020***	0.096***	0.112***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.015)	(0.015)
NAT-DES-ACT	0.004***	0.004***	0.005***	0.004***	0.007	-0.004
	(0.000)	(0.000)	(0.000)	(0.000)	(0.006)	(0.007)
EUR-DES-ACT	0.003***	0.004***	0.005***	0.002***	0.018	0.025*
	(0.001)	(0.001)	(0.001)	(0.000)	(0.011)	(0.011)
INT-DES-ACT	0.003***	0.003***	0.003***	0.002***	0.010**	0.011**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.004)	(0.004)
NAT-PAT-CNT	0.456***	0.398***	0.460***	0.435***	3.549**	3.782**
	(0.066)	(0.075)	(0.068)	(0.040)	(1.345)	(1.326)
EUR-PAT-CNT	0.215***	0.165***	0.219***	0.188***	1.405***	1.910***
	(0.012)	(0.010)	(0.012)	(0.011)	(0.188)	(0.321)
INT-PAT-CNT	0.232***	0.167***	0.253***	0.282***	1.526**	1.545**
	(0.023)	(0.020)	(0.023)	(0.030)	(0.501)	(0.501)
NAT-TM-CNT	0.178***	0.149***	0.159***	0.113***	1.035***	1.048***
	(0.016)	(0.017)	(0.015)	(0.008)	(0.274)	(0.280)
EUR-TM-CNT	0.059***	0.056***	0.063***	0.033***	0.683***	0.649***
	(0.008)	(0.009)	(0.008)	(0.004)	(0.168)	(0.167)
INT-TM-CNT	0.113***	0.088***	0.115***	0.084***	0.763***	0.755***
	(0.007)	(0.006)	(0.007)	(0.004)	(0.172)	(0.169)
NAT-DES-CNT	0.126***	0.108***	0.128***	0.109***	0.115*	0.021
	(0.016)	(0.014)	(0.017)	(0.010)	(0.055)	(0.041)
EUR-DES-CNT	0.193***	0.180***	0.188***	0.152***	0.512*	0.585*
	(0.026)	(0.026)	(0.028)	(0.013)	(0.239)	(0.255)
INT-DES-CNT	0.059***	0.050***	0.061***	0.055***	0.101*	0.108*
	(0.010)	(0.011)	(0.010)	(0.006)	(0.050)	(0.050)

Note: Standard errors in parentheses. ***(**,*) indicates a significance level of 0.1% (1%, 5%) based on McNemar's test for activities and paired t-tests for count gaps. Gaps pooled over years 2006-2011 for models (1), (2) and (3), and years 2004-2011 for models (4), (5) and (6). The total numbers of matched pairs are 57,123 (1), 47,865 (2), 54,601 (3), 173,210 (4), 993 (5), and 1,016 (6).

Bibliography

Aaker, D.A., 1991. *Managing brand equity*: *Capitalizing on the value of a brand name.* Free Press, New York.

Abernathy, W.J., Clark, K.B., 1985. Innovation: Mapping the winds of creative destruction. *Research Policy* 14 (1), 3–22.

Abernathy, W.J., Utterback, J.M., 1978. Patterns of industrial innovation. *Technology Review* 80 (7), 41–47.

Abrahamson, E., 2011. The iron cage: ugly, uncool, and unfashionable. *Organization Studies* 32 (5), 615–629.

Adams, F.M., Osgood, C.E., 1973. A cross-cultural study of the affective meanings of color. *Journal of Cross-Cultural Psychology* 4 (2), 135–156.

Aggarwal, R., Erel, I., Stulz, R., Williamson, R., 2010. Differences in governance practices between U.S. and foreign firms: measurement, causes, and consequences. *Review of Financial Studies* 23 (3), 3131–3169.

Ahmetoglu, G., Chamorro-Premuzic, T., 2012. Design rights and innovation: a psychometric analysis, in: UK IPO (Ed), *The Development of Design Law: Past and Future*, London.

Akkermans, D., Castaldi, C., Los, B., 2009. Do 'liberal market economies' really innovate more radically than 'coordinated market economies'? *Research Policy* 38 (1), 181–191.

Alcaide-Marzal, J., Tortajada-Esparza, E., 2007. Innovation assessment in traditional industries. A proposal of aesthetic innovation indicators. *Scientometrics* 72 (1), 33–57.

Alexander, C., 1964. *Notes on the synthesis of form.* Harvard University Press, Cambridge, MA.

Allison, J.R., Lemley, M.A., 1998. Empirical evidence on the validity of litigated patents. *AIPLA Quarterly Journal* 26 (3), 185–277.

Amara, N., Landry, R., Traoré, N., 2008. Managing the protection of innovations in

knowledge-intensive business services. *Research Policy* 37 (9), 1530–1547.

Anderson, P., Tushman, M.L., 1990. Technological discontinuities and dominant designs: A cyclical model of technological change. *Administrative Science Quarterly* 35 (4), 604–633.

Ang, S.H., Cheng, P.S., Lim, E., Tambyah, S.K., 2001. Spot the difference: Consumer response towards counterfeits. *Journal of Consumer Marketing* 18 (3), 219–235.

Arundel, A., 2001. The relative effectiveness of patents and secrecy for appropriation. *Research Policy* 30 (4), 611–624.

Arundel, A., Kabla, I., 1998. What percentage of innovations are patented? Empirical estimates for European firms. *Research Policy* 27 (2), 127–141.

Arundel, A., van de Paal, G., Soete, L., 1995. Innovation strategies of Europe's largest industrial firms: results of the PACE survey for information sources, public research, protection of innovations and government programmes. *EIMS Publication* 23.

Austin, P.C., 2009. Type I error rates, coverage of confidence intervals, and variance estimation in propensity-score matched analyses. *The International Journal of Biostatistics* 5 (1).

Austin, P.C., 2011. An introduction to propensity score methods for reducing the effects of confounding in observational studies. *Multivariate Behavioral Research* 46 (3), 399–424.

Bagwell, L.S., Bernheim, B.D., 1996. Veblen effects in a theory of conspicuous consumption. *American Economic Review* 86 (3), 349–373.

Bain, J.S., 1968. *Industrial organization* (2nd ed.). Wiley, New York.

Barbosa, N., Faria, A.P., 2011. Innovation across Europe: How important are institutional differences? *Research Policy* 40 (9), 1157–1169.

Barlow, J., Köberle-Gaiser, M., 2008. The private finance initiative, project form and design innovation. *Research Policy* 37 (8), 1392–1402.

Barney, J., 1991. Firm resources and sustained competitive advantage. *Journal of Management* 17 (1), 99–120.

Bascavusoglu-Moreau, E., Tether, B.S., 2011. Registered designs & business performance – exploring the link, in: UK IPO (Ed), *The Economics of Design Rights*. *An Intellectual Property Office Report*, London.

Bauer, J., Franke, N., Tuertscher, P., 2014. *The seven IP commandments of a crowdsourcing community: How norms-based IP systems overcome imitation problems.* Paper presented at the Colloquium on Innovation Policy, Engelberg Center, New York University.

Beath, J., Katsoulacos, Y.S., 1991. *The economic theory of product differentiation.* Cambridge University Press, Cambridge, UK.

Bellizzi, J.A., Crowley, A.E., Hasty, R.W., 1983. The effects of color in store design. *Journal of Retailing* 59 (1), 21–45.

Berkowitz, M., 1987. Product shape as a design innovation strategy. *Journal of Product Innovation Management* 4 (4), 274–283.

Bessen, J., Meurer, M.J., 2008. *Patent failure*: *How judges, bureaucrats, and lawyers put innovators at risk.* Princeton University Press, Princeton.

Bianchi, M., 2002. Novelty, preferences, and fashion: when goods are unsettling. *Journal of Economic Behavior & Organization* 47 (1), 1–18.

Biernat, M., 2005. *Standards and expectancies*: *Contrast and assimilation in judgments of self and others.* Psychology Press, New York.

Biernat, M., Manis, M., Nelson, T.E., 1991. Stereotypes and standards of judgment. *Journal of Personality & Social Psychology* 60 (4), 485–499.

Bijker, W.E., 1995. *Of bicycles, bakelites, and bulbs*: *Toward a theory of sociotechnical change.* MIT Press, Cambridge, MA.

Black, C.D., Baker, M.J., 1987. Success through design. *Design Studies* 8 (4), 207–216.

Blind, K., Edler, J., Frietsch, R., Schmoch, U., 2006. Motives to patent: Empirical evidence from Germany. *Research Policy* 35 (5), 655–672.

Blind, K., Edler, J., Schmoch, U., Anderson, B., Howells, J., Miles, I., Roberts, J., Green, L., Evangelista, R., Hipp, C., 2003. *Patents in the service industries.* Final report prepared for the European Commission.

Bloch, P.H., 1995. Seeking the ideal form: product design and consumer response. *Journal of Marketing* 59 (3), 16–29.

Bloch, P.H., Brunel, F.F., Arnold, T.J., 2003. Individual differences in the centrality of visual product aesthetics: Concept and measurement. *Journal of Consumer Research* 29 (4), 551–565.

Blumer, H., 1969. Fashion: From class differentiation to collective selection. *The Sociological Quarterly* 10 (3), 275–291.

Bolton, L.E., Warlop, L., Alba, J.W., 2003. Consumer perceptions of price (un)fairness. *Journal of Consumer Research* 29 (4), 474–491.

BOP, 2011. Design rights, an international comparison, in: UK IPO (Ed), *The Economics of Design Rights*. *An Intellectual Property Office Report*, London.

Brouwer, E., Kleinknecht, A., 1999. Innovative output, and a firm's propensity to patent. An exploration of CIS micro data. *Research Policy* 28 (6), 615–624.

Caliendo, M., Kopeinig, S., 2008. Some practical guidance for the implementation of propensity score matching. *Journal of Economic Surveys* 22 (1), 31–72.

Campbell, M.C., Kirmani, A., 2000. Consumers' use of persuasion knowledge: The effects of accessibility and cognitive capacity on perceptions of an influence agent. *Journal of Consumer Research* 27 (1), 69–83.

Candi, M., Saemundsson, R.J., 2011. Exploring the relationship between aesthetic design as an element of new service development and performance. *Journal of Product Innovation Management* 28 (4), 536–557.

Cappetta, R., Cillo, P., Ponti, A., 2006. Convergent designs in fine fashion: An evolutionary model for stylistic innovation. *Research Policy* 35 (9), 1273–1290.

Carbon, C.-C., 2010. The cycle of preference: long-term dynamics of aesthetic appreciation. *Acta Psychologica* 134 (2), 233–244.

Carboni, A., 2006. The overlap between registered Community designs and Community trade marks. *Journal of Intellectual Property Law & Practice* 1 (4), 256–265.

Carlsson, B., 2006. Internationalization of innovation systems: A survey of the literature. *Research Policy* 35 (1), 56–67.

Carpenter, G.S., Glazer, R., Nakamoto, K., 1994. Meaningful brands from meaningless differentiation: The dependence on irrelevant attributes. *Journal of Marketing Research* 31 (3), 339–350.

Carpenter, G.S., Nakamoto, K., 1989. Consumer preference formation and pioneering advantage. *Journal of Marketing Research* 26 (3), 285–298.

Caulkins, J.P., Hartl, R.F., Kort, P.M., Feichtinger, G., 2007. Explaining fashion cycles: Imitators chasing innovators in product space. *Journal of Economic Dynamics and*

Control 31 (5), 1535–1556.

Caves, R.E., Williamson, P.J., 1985. What is product differentiation really? *Journal of Industrial Economics* 34 (2), 113–132.

Chamberlin, E., 1933. *The theory of monopolistic competition: A re-orientation of the theory of value.* Harvard University Press, Cambridge, MA.

Chan, T., Mihm, J., Sosa, M., 2014. *The evolution of product form: Identifying and analyzing styles in design patents.* INSEAD Working Paper No. 2014/34/TOM.

Chaudhuri, S., Ganjam, K., Ganti, V., Motwani, R., 2003. Robust and efficient fuzzy match for online data cleaning. *Proceedings of the 2003 ACM SIGMOD international conference on management of data*, 313–324.

Childers, T.L., Houston, M.J., Heckler, S.E., 1985. Measurement of individual differences in visual versus verbal information processing. *Journal of Consumer Research* 12 (2), 125–134.

Cillo, P., Verona, G., 2008. Search styles in style searching: Exploring innovation strategies in fashion firms. *Long Range Planning* 41 (6), 650–671.

Cohen, L., Uphoff, B., Barié, M., 2004. *Trademark and unfair competition in the UK, Germany and Italy*. Available online http://www.mondaq.com/unitedstates/x/25993/EU-Law/Trademark-And-Unfair-Competition-In-The-UK-Germany-And-Italy (accessed 23.02.15).

Cohen, W.M., Goto, A., Nagata, A., Nelson, R.R., Walsh, J.P., 2002. R&D spillovers, patents and the incentives to innovate in Japan and the United States. *Research Policy* 31 (8-9), 1349–1367.

Cohen, W.M., Nelson, R.R., Walsh, J.P., 2000. *Protecting their intellectual assets: appropriability conditions and why U.S. manufacturing firms patent (or not)*. NBER Working Paper No. 7552.

Cook, T., 2013. The cumulative protection of designs in the European Union and the role in such protection of copyright. *Journal of Intellectual Property Rights* 18 (1), 83–87.

Coombs, R., Narandren, P., Richards, A., 1996. A literature-based innovation output indicator. *Research Policy* 25 (3), 403–413.

Cremers, K., Ernicke, M., Gaessler, F.E., Harhoff, D., Helmers, C., McDonagh, L.,

Schliessler, P., Van Zeebroeck, N., 2013. *Patent litigation in Europe.* ZEW Discussion Paper No. 13-072.

Creusen, M.E.H., Schoormans, J.P.L., 2005. The different roles of product appearance in consumer choice. *Journal of Product Innovation Management* 22 (1), 63–81.

Crilly, N., Moultrie, J., Clarkson, P.J., 2009. Shaping things: intended consumer response and the other determinants of product form. *Design Studies* 30 (3), 224–254.

Crouch, C., 2005. *Capitalist Diversity and Change*: *Recombinant Governance and Institutional Entrepreneurs.* Oxford University Press, Oxford, UK.

Crouch, D.D., 2010. *A trademark justification for design patent rights.* University of Missouri School of Law Legal Studies Research Paper No. 2010-17.

Csikszentmihalyi, M., Robinson, R.E., 1990. *The art of seeing*: *An interpretation of the aesthetic encounter.* Getty Center for Education in the Arts, Malibu.

Csikszentmihalyi, M., Rochberg-Halton, E., 1981. *The meaning of things*: *Domestic symbols and the self.* Cambridge University Press, Cambridge, UK.

Czarnitzki, D., 2005. The extent and evolution of productivity deficiency in Eastern Germany. *Journal of Productivity Analysis* 24 (2), 211–231.

Czarnitzki, D., Ebersberger, B., Fier, A., 2007. The relationship between R&D collaboration, subsidies and R&D performance: Empirical evidence from Finland and Germany. *Journal of Applied Econometrics* 22 (7), 1347–1366.

Czarnitzki, D., Hanel, P., Rosa, J.M., 2011. Evaluating the impact of R&D tax credits on innovation: A microeconometric study on Canadian firms. *Research Policy* 40 (2), 217–229.

de Rassenfosse, G., Dernis, H., Guellec, D., Picci, L., van Pottelsberghe de la Potterie, B., 2013. The worldwide count of priority patents: A new indicator of inventive activity. *Research Policy* 42 (3), 720–737.

de Rassenfosse, G., van Pottelsberghe de la Potterie, B., 2007. Per un pugno di dollari: a first look at the price elasticity of patents. *Oxford Review of Economic Policy* 23 (4), 588–604.

Dehejia, R.H., Wahba, S., 1999. Causal effects in nonexperimental studies: Reevaluating the evaluation of training programs. *Journal of the American*

Statistical Association 94 (448), 1053–1062.

Dell'Era, C., Verganti, R., 2007. Strategies of innovation and imitation of product languages. *Journal of Product Innovation Management* 24 (6), 580–599.

Dell'Era, C., Verganti, R., 2010. Collaborative strategies in design-intensive industries: Knowledge diversity and innovation. *Long Range Planning* 43 (1), 123–141.

Di Stefano, G., King, A.A., Verona, G., 2013. Kitchen confidential? Norms for the use of transferred knowledge in gourmet cuisine. *Strategic Management Journal* 35 (11), 1645–1670.

Dickson, K., Coles, A.-M., 1998. Design protection and copyright issues for small textile firms. *Design Studies* 19 (2), 203–215.

Dickson, P.R., Ginter, J.L., 1987. Market segmentation, product differentiation, and marketing strategy. *Journal of Marketing* 51 (2), 1–10.

Du Plessis, M., van Looy, B., Song, X., Magerman, T., 2009. *Data production methods for harmonized patent indicators: Assignee sector allocation.* EUROSTAT Working Paper and Studies.

Dumas, A., Mintzberg, H., 1989. Managing design, designing management. *Design Management Journal* 1 (1), 37–43.

Durand, R., Bruyaka, O., Mangematin, V., 2008. Do science and money go together? The case of the French biotech industry. *Strategic Management Journal* 29 (12), 1281–1299.

Eaton, B.C., Lipsey, R.G., 1989. Product Differentiation, in: Schmalensee, R., Willig, R.D. (Eds), *Handbook of industrial organization*. Elsevier, Amsterdam, pp. 723–768.

Edmondson, A.C., Mcmanus, S.E., 2007. Methodological fit in management field research. *Academy of Management Review* 32 (4), 1155–1179.

Eichmann, H., Kur, A., 2009. *Designrecht*: *Praxishandbuch.* Nomos, Baden-Baden, Germany.

Eisenhardt, K.M., 1989. Building theories from case study research. *Academy of Management Review* 14 (4), 532.

Eisenman, M., 2013. Understanding aesthetic innovation in the context of technological evolution. *Academy of Management Review* 38 (3), 332–351.

Engel, D., Keilbach, M., 2007. Firm-level implications of early stage venture capital investment: An empirical investigation. *Journal of Empirical Finance* 14 (2), 150–167.

EPO, OHIM, 2013. *Intellectual property rights intensive industries: contribution to economic performance and employment in the European Union*. Available online http://ec.europa.eu/internal_market/intellectual-property/docs/joint-report-epo-ohim-final-version_de.pdf (accessed 23.02.15).

European Commission, 2011. *A single market for intellectual property rights*: *Boosting creativity and innovation to provide economic growth, high quality jobs and first class products and services in Europe*. Available online http://ec.europa.eu/internal_market/intellectual-property/strategy/index_en.htm (accessed 27.11.14).

European Commission, 2014. *Innovation Union Scoreboard 2014*. Available online http://ec.europa.eu/enterprise/policies/innovation/files/ius/ius-2014_en.pdf (accessed 23.02.15).

Farley, J.U., Katz, J., Lehmann, D.R., 1978. Impact of different comparison sets on evaluation of a new subcompact car brand. *Journal of Consumer Research* 5 (2), 138–142.

Fauchart, E., von Hippel, E., 2008. Norms-based intellectual property systems: the case of French chefs. *Organization Science* 19 (2), 187–201.

Fechner, G.T., 1876. *Vorschule der Aesthetik.* Breitkopf & Härtel, Leipzig, Germany.

Feldman, J.M., Lynch, J.G., 1988. Self-generated validity and other effects of measurement on belief, attitude, intention, and behavior. *Journal of Applied Psychology* 73 (3), 421–435.

Filitz, R., Henkel, J., Tether, B.S., 2015. Protecting aesthetic innovations? An exploration of the use of registered community designs. *Research Policy* 44 (6), 1192–1206.

Finn, D., 1990. Good design is good business. *Marketing News* 24 (24), 9.

Fischer, T., Henkel, J., 2013. *Contingencies of profiting from innovation: appropriability mechanisms' non-linearities.* SSRN Working Paper No. 2318065.

Foray, D., 1995. The economics of intellectual property rights and systems of

innovation: the persistence of national practices versus the new global model of innovation, in: Hagedoorn, J. (Ed), *Technical change and the world economy: Convergence and divergence in technology strategies*. Edward Elgar Publishing, Aldershot, UK, pp. 109–133.

Gabszewicz, J.J., Thisse, J.-F., 1979. Price competition, quality and income disparities. *Journal of Economic Theory* 20 (3), 340–359.

Gallié, E.-P., Legros, D., 2012. French firms' strategies for protecting their intellectual property. *Research Policy* 41 (4), 780–794.

Gemser, G., Leenders, M.A.A.M., 2001. How integrating industrial design in the product development process impacts on company performance. *Journal of Product Innovation Management* 18 (1), 28–38.

Gemser, G., Wijnberg, N.M., 2001. Effects of reputational sanctions on the competitive imitation of design innovations. *Organization Studies* 22 (4), 563–591.

Gil, N., Tether, B.S., 2011. Project risk management and design flexibility: Analysing a case and conditions of complementarity. *Research Policy* 40 (3), 415–428.

Girma, S., Kneller, R., Pisu, M., 2005. Exports versus FDI: An empirical test. *Review of World Economics* 141 (2), 193–218.

Goldsmith, R.E., Freiden, J.B., Kilsheimer, J.C., 1993. Social values and female fashion leadership: A cross-cultural study. *Psychology and Marketing* 10 (5), 399–412.

Goode, M.R., Dahl, D.W., Moreau, C.P., 2013. Innovation aesthetics: the relationship between category cues, categorization certainty, and newness perceptions. *Journal of Product Innovation Management* 30 (2), 192–208.

Graham, S.J.H., Hall, B.H., Harhoff, D., Mowery, D.C., 2003. Post-issue patent quality control: a comparative study of US patent re-examinations and European patent oppositions, in: Cohen, W.M., Merrill, S.A. (Eds), *Patents in the knowledge-based economy*. National Academies Press, Washington, DC, pp. 74–119.

Graham, S.J.H., Harhoff, D., 2006. *Can post-grant reviews improve patent system design? A twin study of US and European patents.* CEPR Discussion Paper No. 5680.

Graham, S.J.H., Van Zeebroeck, N., 2014. Comparing patent litigation across Europe: a first look. *Stanford Technology Law Review* 17, 655–708.

Greenhalgh, C., Rogers, M., 2006. The value of innovation: The interaction of competition, R&D and IP. *Research Policy* 35 (4), 562–580.

Grewal, R., Cline, T.W., Davies, A., 2003. Early-entrant advantage, word-of-mouth communication, brand similarity, and the consumer decision-making process. *Journal of Consumer Psychology* 13 (3), 187–197.

Grossman, R.P., Wisenblit, J.Z., 1999. What we know about consumers' color choices. *Journal of Marketing Practice: Applied Marketing Science* 5 (3), 78–88.

Gruber, M., de Leon, N., George, G., Thompson, P., 2015. Managing by design. *Academy of Management Journal* 58 (1), 1–7.

Gu, X.S., Rosenbaum, P.R., 1993. Comparison of multivariate matching methods: structures, distances, and algorithms. *Journal of Computational and Graphical Statistics* 2 (4), 405–420.

Hall, B.H., Helmers, C., Rogers, M., Sena, V., 2014. The choice between formal and informal intellectual property: a review. *Journal of Economic Literature* 52 (2), 375–423.

Hall, B.H., Jaffe, A.B., Trajtenberg, M., 2001. *The NBER patent citation data file: lessons, insights and methodological tools.* NBER Working Paper No. 8498.

Hall, P.A., Soskice, D.W., 2001. *Varieties of capitalism*: *The institutional foundations of comparative advantage.* Oxford University Press, Oxford, UK.

Hanel, P., 2006. Intellectual property rights business management practices: A survey of the literature. *Technovation* 26 (8), 895–931.

Harhoff, D., Scherer, F.M., Vopel, K., 2003. Citations, family size, opposition and the value of patent rights. *Research Policy* 32 (8), 1343–1363.

Hart, S.L., 1995. A natural-resource-based view of the firm. *Academy of Management Review* 20 (4), 986–1014.

Hartwig, H., 2007. *Designschutz in Europa, Band 1: Entscheidungssammlung zum Designschutz von Gerichten in ganz Europa.* Heymann, Köln, Germany.

Hartwig, H., 2008. *Designschutz in Europa, Band 2: Entscheidungssammlung zum Designschutz von Gerichten in ganz Europa.* Heymann, Köln, Germany.

Hartwig, H., 2009. *Designschutz in Europa, Band 3: Entscheidungssammlung zum Designschutz von Gerichten in ganz Europa.* Heymann, Köln, Germany.

Hartwig, H., 2012a. *Designschutz in Europa, Band 4: Entscheidungssammlung zum Designschutz von Gerichten in ganz Europa.* Heymann, Köln, Germany.

Hartwig, H., 2012b. European design law: reciprocity revisited. *Journal of Intellectual Property Law & Practice* 7 (11), 827–831.

Hausman, J., Hall, B.H., Griliches, Z., 1984. Econometric models for count data with an application to the patents-R&D relationship. *Econometrica* 52 (4), 909–938.

Heckman, J.J., Ichimura, H., Todd, P.E., 1997. Matching as an econometric evaluation estimator: Evidence from evaluating a job training programme. *The Review of Economic Studies* 64 (4), 605–654.

Heckman, J.J., Ichimura, H., Todd, P.E., 1998. Matching as an econometric evaluation estimator. *Review of Economic Studies* 65 (2), 261–294.

Helmers, C., McDonagh, L., 2013. Patent litigation in the UK: an empirical survey 2000-2008. *Journal of Intellectual Property Law & Practice* 8 (11), 846–861.

Helmers, C., Rogers, M., Schautschick, P., 2011. *Intellectual property at the firm-level in the UK: The Oxford firm-level intellectual property database.* University of Oxford Working Paper No. 546.

Helpman, E., Melitz, M.J., Yeaple, S.R., 2004. Export versus FDI with heterogeneous firms. *American Economic Review* 94 (1), 300–316.

Hemphill, C., Suk, J., 2009. The law, culture, and economics of fashion. *Stanford Law Review* 61 (5), 1147–1200.

Henderson, R.M., Clark, K.B., 1990. Architectural Innovation: The Reconfiguration of Existing Product Technologies and the Failure of Established Firms. *Administrative Science Quarterly* 35 (1), 9–30.

Henry, M.D., Turner, J.L., 2006. The Court of Appeals for the Federal Circuit's impact on patent litigation. *The Journal of Legal Studies* 35 (1), 85–117.

Herr, P.M., 1986. Consequences of priming: Judgment and behavior. *Journal of Personality and Social Psychology* 51 (6), 1106–1115.

Herr, P.M., 1989. Priming price: Prior knowledge and context effects. *Journal of Consumer Research* 16 (1), 67–75.

Herr, P.M., Sherman, S.J., Fazio, R.H., 1983. On the consequences of priming: Assimilation and contrast effects. *Journal of Experimental Social Psychology* 19 (4),

323–340.

Hertenstein, J.H., Platt, M.B., Veryzer, R.W., 2005. The impact of industrial design effectiveness on corporate financial performance. *Journal of Product Innovation Management* 22 (1), 3–21.

Hilton, B., Choi, C.J., Chen, S., 2004. The ethics of counterfeiting in the fashion industry: quality, credence and profit issues. *Journal of Business Ethics* 55 (4), 345–354.

Hirsch-Kreinsen, H., Jacobson, D., Robertson, P.L., 2006. 'Low-tech' industries: innovativeness and development perspectives – a summary of a European research project. *Prometheus* 24 (1), 3–21.

Holbrook, M.B., 1986. Aims, concepts, and methods for the representation of individual differences in esthetic responses to design features. *Journal of Consumer Research* 13 (3), 337–347.

Homburg, C., Schwemmle, M., Kuehnl, C., 2015. New product design: concept, measurement, and consequences. *Journal of Marketing* 79 (3), 41–56.

Hotelling, H., 1929. Stability in competition. *The Economic Journal* 39 (153), 41–57.

Huang, K.G., Murray, F.E., 2009. Does patent strategy shape the long-run supply of public knowledge? Evidence from human genetics. *Academy of Management Journal* 52 (6), 1193–1221.

Huber, G.P., Power, D.J., 1985. Retrospective reports of strategic-level managers: guidelines for increasing their accuracy. *Strategic Management Journal* 6 (2), 171–180.

Imbens, G.W., 2004. Nonparametric estimation of average treatment effects under exogeneity: a review. *Review of Economics & Statistics* 86 (1), 4–29.

Imbens, G.W., Wooldridge, J.M., 2009. Recent developments in the econometrics of program evaluation. *Journal of Economic Literature* 47 (1), 5–86.

Jacobsen, T., 2010. Beauty and the brain: culture, history and individual differences in aesthetic appreciation. *Journal of Anatomy* 216 (2), 184–191.

Jaffe, A.B., Lerner, J., 2007. *Innovation and its discontents*: *How our broken patent system is endangering innovation and progress, and what to do about it.* Princeton University Press, Princeton.

Jameson, G.J., 2006. Counting zeros of generalized polynomials: Descartes' rule of signs and Laguerre's extensions. *The Mathematical Gazette* 90 (518), 223–234.

Janakiraman, R., Sismeiro, C., Dutta, S., 2009. Perception spillovers across competing brands: A disaggregate model of how and when. *Journal of Marketing Research* 46 (4), 467–481.

Jick, T.D., 1979. Mixing qualitative and quantitative methods: triangulation in action. *Administrative Science Quarterly* 24 (4), 602–611.

Karjalainen, T.-M., Snelders, D., 2010. Designing visual recognition for the brand. *Journal of Product Innovation Management* 27 (1), 6–22.

Kleinknecht, A., 1993. Why do we need new innovation output indicators? An introduction, in: Kleinknecht, A., Bain, D. (Eds), *New concepts in innovation output measurement*, Macmillan Press, New York, pp. 1–9.

Kotler, P., Rath, G.A., 1984. Design: A powerful but neglected strategic tool. *Journal of Business Strategy* 5 (2), 16–21.

Krasnikov, A., Mishra, S., Orozco, D., 2009. Evaluating the financial impact of branding using trademarks: A framework and empirical evidence. *Journal of Marketing* 73 (6), 154–166.

Kreuzbauer, R., Malter, A.J., 2005. Embodied cognition and new product design: changing product form to influence brand categorization. *Journal of Product Innovation Management* 22 (2), 165–176.

Kumar, N., Stern, L.W., Anderson, J.C., 1993. Conducting interorganizational research using key informants. *Academy of Management Journal* 36 (6), 1633–1651.

Landwehr, J.R., Labroo, A.A., Herrmann, A., 2011. Gut liking for the ordinary: Incorporating design fluency improves automobile sales forecasts. *Marketing Science* 30 (3), 416–429.

Laursen, K., Salter, A., 2005. *My precious. The role of appropriability strategies in shaping innovative performance.* DRUID Working Paper 05-02.

Lawson, B., 2006. *How designers think*: *The design process demystified* (4th ed.). Elsevier, Oxford, UK.

Lee, M.P., Suk, K., 2010. Disambiguating the role of ambiguity in perceptual assimilation and contrast effects. *Journal of Consumer Research* 36 (5), 890–897.

Lemley, M.A., 2000. Rational ignorance at the patent office. *Northwestern University Law Review* 95 (4), 1495–1532.

Lemley, M.A., Shapiro, C., 2005. Probabilistic patents. *Journal of Economic Perspectives* 19 (2), 75–98.

Lerner, A.P., Singer, H.W., 1937. Some notes on duopoly and spatial competition. *Journal of Political Economy* 45 (2), 145–186.

Lerner, J., Zhu, F., 2007. What is the impact of software patent shifts? Evidence from Lotus v. Borland. *International Journal of Industrial Organization* 25 (3), 511–529.

Levin, R.C., Klevorick, A.K., Nelson, R.R., Winter, S.G., 1987. Appropriating the returns from industrial research and development. *Brookings Papers on Economic Activity* (3), 783–831.

Levitt, T., 1980. Marketing success through differentiation – of anything. *Harvard Business Review* 58 (1), 83–91.

Livesey, F., Moultrie, J., 2008. *Do trademarks and design registrations provide a better perspective on national innovation activity?* DIME Conference on the Creative Industries and Intellectual Property, London.

Loken, B., Ross, I., Hinkle, R.L., 1986. Consumer 'confusion' of origin brand similarity perceptions. *Journal of Public Policy & Marketing* 5 (1), 195–211.

Loshin, J., 2010. Secrets revealed: How magicians protect intellectual property without law, in: Corcos, C.A. (Ed), *Law and magic: A collection of essays*. Carolina Academic Press, Durham, NC, pp. 123–142.

Luchs, M., Swan, K.S., 2011. Perspective: the emergence of product design as a field of marketing inquiry. *Journal of Product Innovation Management* 28 (3), 327–345.

Magerman, T., Grouwels, J., Song, X., van Looy, B., 2009. *Data production methods for harmonised patent statistics: patentee name harmonisation.* EUROSTAT Working Paper and Studies.

Mairesse, J., Mohnen, P., 2004. Intellectual property in services: what do we learn from innovation surveys?, in: OECD (Ed), *Patents, innovation and economic performance*. Paris, pp. 227–245.

Mann, R.J., Underweiser, M., 2012. A new look at patent quality: relating patent prosecution to validity. *Journal of Empirical Legal Studies* 9 (1), 1–32.

McCracken, G., 1986. Culture and consumption: A theoretical account of the structure and movement of the cultural meaning of consumer goods. *Journal of Consumer Research* 13 (1), 71–84.

McKenna, M.P., Strandburg, K.J., 2013. Progress and Competition in Design. *Stanford Technology Law Review* 17 (1), 1–52.

McManus, I.C., Weatherby, P., 1997. The golden section and the aesthetics of form and composition: A cognitive model. *Empirical Studies of the Arts* 15 (2), 209–232.

Mejer, M., van Pottelsberghe de la Potterie, B., 2012. Economic incongruities in the European patent system. *European Journal of Law and Economics* 34 (1), 215-234.

Mendonça, S., Pereira, T.S., Godinho, M.M., 2004. Trademarks as an indicator of innovation and industrial change. *Research Policy* 33 (9), 1385–1404.

Mercer, S., 2004. *Detailed results from the third UK Community innovation survey (CIS3)*. Available online http://www.bis.gov.uk/files/file9664.pdf (accessed 09.08.13).

Miles, M.B., Huberman, A.M., 1994. *Qualitative data analysis*: *an expanded sourcebook* (2nd ed.). Sage Publications, Thousand Oaks, CA.

Milgrom, P., Roberts, J., 1986. Price and advertising signals of product quality. *Journal of Political Economy* 94 (4), 796–821.

Monseau, S., 2012. The challenges of protecting industrial design in the global economy. *Texas Intellectual Property Law Journal* 20 (3), 495–543.

Moultrie, J., Livesey, F., 2011. Design right case studies, in: UK IPO (Ed), *The Economics of Design Rights*. *An Intellectual Property Office Report*, London.

Moultrie, J., Livesey, F., 2014. Measuring design investment in firms: Conceptual foundations and exploratory UK survey. *Research Policy* 43 (3), 570–587.

Mugge, R., Dahl, D.W., 2013. Seeking the ideal level of design newness: consumer response to radical and incremental product design. *Journal of Product Innovation Management* 30 (S1), 34–47.

Mugge, R., Schoormans, J.P., 2012. Newer is better! The influence of a novel appearance on the perceived performance quality of products. *Journal of Engineering Design* 23 (6), 469–484.

Murray, F., Stern, S., 2007. Do formal intellectual property rights hinder the free flow of

scientific knowledge? *Journal of Economic Behavior & Organization* 63 (4), 648–687.

Mussweiler, T., 2003. Comparison processes in social judgment: Mechanisms and consequences. *Psychological Review* 110 (3), 472–489.

Muthukrishnan, A.V., 1995. Decision ambiguity and incumbent brand advantage. *Journal of Consumer Research* 22 (1), 98–109.

Myers, E., 2009. Justice in fashion: cheap chic and the intellectual property equilibrium in the United Kingdom and the United States. *AIPLA Quarterly Journal* 37 (1), 47–79.

Narin, F., Noma, E., Perry, R., 1987. Patents as indicators of corporate technological strength. *Research Policy* 16 (2-4), 143–155.

Nelson, P., 1974. Advertising as information. *Journal of Political Economy* 82 (4), 729–754.

Nelson, R.R., 2008. What enables rapid economic progress: What are the needed institutions? *Research Policy* 37 (1), 1–11.

Noble, C.H., 2011. On elevating strategic design research. *Journal of Product Innovation Management* 28 (3), 389–393.

Norman, D.A., 2004. *Emotional design*: *Why we love (or hate) everyday things.* Basic Books, New York.

North, D.C., 1990. *Institutions, institutional change, and economic performance.* Cambridge University Press, Cambridge, UK.

OECD, 2005. *Innovation Policy and Performance*: *A Cross-Country Comparison.* OECD Publishing, Paris.

Oliar, D., Sprigman, C.J., 2008. There's no free laugh (anymore): the emergence of intellectual property norms and the transformation of stand-up comedy. *Virginia Law Review* 94 (8), 1787–1867.

Orozco, D., 2009. Rational design rights ignorance. *American Business Law Journal* 46 (4), 573–605.

Page, C., Herr, P.M., 2002. An investigation of the processes by which product design and brand strength interact to determine initial affect and quality judgments. *Journal of Consumer Psychology* 12 (2), 133–147.

Parchomovsky, G., Siegelman, P., 2002. Towards an integrated theory of intellectual property. *Virginia Law Review* 88 (7), 1455–1528.

Pavitt, K., 1984. Sectoral patterns of technical change: towards a taxonomy and a theory. *Research Policy* 13 (6), 343–373.

Peeters, B., Song, X., Callaert, J., Grouwels, J., van Looy, B., 2009. *Harmonizing harmonized patentee names: an exploratory assessment of top patentees.* EUROSTAT Working Paper and Studies.

Peeters, C., van Pottelsberghe de la Potterie, B., 2006. Innovation strategy and the patenting behavior of firms. *Journal of Evolutionary Economics* 16 (1-2), 109–135.

Pelham, B.W., Wachsmuth, J.O., 1995. The waxing and waning of the social self: Assimilation and contrast in social comparison. *Journal of Personality and Social Psychology* 69 (5), 825–838.

Penz, E., Stottinger, B., 2005. Forget the "real" thing-take the copy! An explanatory model for the volitional purchase of counterfeit products. *Advances in Consumer Research* 32 (1), 568–575.

Person, O., Schoormans, J., Snelders, D., Karjalainen, T.-M., 2008. Should new products look similar or different? The influence of the market environment on strategic product styling. *Design Studies* 29 (1), 30–48.

Pesendorfer, W., 1995. Design innovation and fashion cycles. *American Economic Review* 85 (4), 771–792.

Pitkethly, R.H., 2001. Intellectual property strategy in Japanese and UK companies: patent licensing decisions and learning opportunities. *Research Policy* 30 (3), 425–442.

Poddar, A., Foreman, J., Banerjee, S., Ellen, P.S., 2012. Exploring the Robin Hood effect: Moral profiteering motives for purchasing counterfeit products. *Journal of Business Research* 65 (10), 1500–1506.

Porter, M.E., 1976. *Interbrand choice, strategy, and bilateral market power.* Harvard University Press, Cambridge, MA.

Porter, M.E., 1985. *Competitive advantage*: *Creating and sustaining superior performance.* Free Press, New York.

Pratt, M.G., 2009. From the editors: For the lack of a boilerplate: tips on writing up (and

reviewing) qualitative research. *Academy of Management Journal* 52 (5), 856–862.

PRO INNO Europe, 2012. *Innovation Union Scoreboard 2011*. Available online http://ec.europa.eu/enterprise/policies/innovation/files/ius-2011_en.pdf (accessed 09.08.13).

Raustiala, K., Sprigman, C.J., 2006. The piracy paradox: innovation and intellectual property in fashion design. *Virginia Law Review* 92 (8), 1687–1777.

Raustiala, K., Sprigman, C.J., 2012. *The knockoff economy*: *How imitation sparks innovation.* Oxford University Press, Oxford, UK.

Ravasi, D., Lojacono, G., 2005. Managing design and designers for strategic renewal. *Long Range Planning* 38 (1), 51–77.

Ravasi, D., Stigliani, I., 2012. Product design: a review and research agenda for management studies. *International Journal of Management Reviews* 14 (4), 464–488.

Reidenbach, R.E., Robin, D.P., Dawson, L., 1991. An application and extension of a multidimensional ethics scale to selected marketing practices and marketing groups. *Journal of the Academy of Marketing Science* 19 (2), 83–92.

Ries, A., Trout, J., 2001. *Positioning*: *The battle for your mind.* McGraw-Hill, New York.

Rindova, V.P., Dalpiaz, E., Ravasi, D., 2011. A cultural quest: A study of organizational use of new cultural resources in strategy formation. *Organization Science* 22 (2), 413–431.

Rindova, V.P., Petkova, A.P., 2007. When is a new thing a good thing? Technological change, product form design, and perceptions of value for product innovations. *Organization Science* 18 (2), 217–232.

Robertson, P., Smith, K., von Tunzelmann, N., 2009. Innovation in low- and medium-technology industries. *Research Policy* 38 (3), 441–446.

Robinson, D.E., 1961. The economics of fashion demand. *The Quarterly Journal of Economics* 75 (3), 376–398.

Robinson, D.E., 1975. Style changes: cyclical, inexorable, and foreseeable. *Harvard Business Review* 53 (6), 121–131.

Robinson, J.V., 1933. *The Economics of Imperfect Competition.* Macmillan, London.

Robson, S., Haigh, G., 2008. First findings from the UK Innovation Survey 2007. *Economic Labour Market Review* 2 (4), 47–53.

Robson, S., Kenchatt, M., 2010. First findings from the UK Innovation Survey 2009. *Economic Labour Market Review* 4 (3), 28–35.

Rogers, M., 1998. *The definition and measurement of innovation.* Melbourne Institute Working Paper No. 10/98.

Rosenbaum, P.R., Rubin, D.B., 1983. The central role of the propensity score in observational studies for causal effects. *Biometrika* 70 (1), 41–55.

Rosenbaum, P.R., Rubin, D.B., 1984. Reducing bias in observational studies using subclassification on the propensity score. *Journal of the American Statistical Association* 79 (387), 516–524.

Rosenbaum, P.R., Rubin, D.B., 1985. Constructing a control group using multivariate matched sampling methods that incorporate the propensity score. *The American Statistician* 39 (1), 33–38.

Rubera, G., Droge, C., 2013. Technology versus design innovation's effects on sales and Tobin's Q: the moderating role of branding strategy. *Journal of Product Innovation Management* 30 (3), 448–464.

Rubin, D.B., Thomas, N., 2000. Combining propensity score matching with additional adjustments for prognostic covariates. *Journal of the American Statistical Association* 95 (450), 573–585.

Rubin, H., Rubin, I., 2005. *Qualitative interviewing: the art of hearing data.* Sage Publications, Thousand Oaks, CA.

Rumelt, R.P., 1984. Towards a strategy theory of the firm, in: Lamb, B. (Ed), *Competitive Strategic Management*. Prentice-Hall, Englewood Cliffs, NJ.

Salter, A., Gann, D., 2003. Sources of ideas for innovation in engineering design. *Research Policy* 32 (8), 1309–1324.

Sanderson, S., Uzumeri, M., 1995. Managing product families: The case of the Sony Walkman. *Research Policy* 24 (5), 761–782.

Santamaría, L., Nieto, M.J., Barge-Gil, A., 2009. Beyond formal R&D: taking advantage of other sources of innovation in low- and medium-technology industries. *Research Policy* 38 (3), 507–517.

Sattler, H., 2003. Appropriability of product innovations: an empirical analysis for Germany. *International Journal of Technology Management* 26 (5/6), 502–516.

Saviotti, P.P., Metcalfe, J.S., 1984. A theoretical approach to the construction of technological output indicators. *Research Policy* 13 (3), 141–151.

Schankerman, M., Pakes, A., 1986. Estimates of the value of patent rights in European countries during the post-1950 period. *Economic Journal* 96, 1052–1076.

Scherer, F., Harhoff, D., 2000. Technology policy for a world of skew-distributed outcomes. *Research Policy* 29 (4-5), 559–566.

Schlotelburg, M., 2006. Design protection for technical products. *Journal of Intellectual Property Law & Practice* 1 (10), 675–678.

Schmalensee, R., 1982. Product differentiation advantages of pioneering brands. *American Economic Review* 72 (3), 349–365.

Schmitt, B., Simonson, A., 1997. *Marketing aesthetics*: *The strategic management of brands, identity, and image.* Free Press, New York.

Schmoch, U., Gauch, S., 2009. Service marks as indicators for innovation in knowledge-based services. *Research Evaluation* 18 (4), 323–335.

Schneider, E.C., Zaslavsky, A.M., Epstein, A.M., 2004. Use of high-cost operative procedures by Medicare beneficiaries enrolled in for-profit and not-for-profit health plans. *The New England Journal of Medicine* 350 (2), 143–150.

Schultz, M.F., 2006. Fear and norms and Rock & Roll: What jambands can teach us about persuading people to obey copyright law. *Berkeley Technology Law Journal* 21, 651–728.

Schwarz, N., Bless, H., 1992. Constructing reality and its alternatives: An inclusion/exclusion model of assimilation and contrast effects in social judgment, in: Martin, L.L., Tesser, A. (Eds), *The construction of social judgments*. Lawrence Erlbaum Associates, Hillsdale, NJ, pp. 217–245.

SEE, 2011. *Reviewing Innovation and Design Policies across Europe.* SEE Report.

Sexton, R., 1987. *American style*: *Classic product design from Airstream to Zippo.* Chronicle Books, San Francisco.

Shaked, A., Sutton, J., 1983. Natural oligopolies. *Econometrica* 51 (5), 1469–1483.

Shaked, A., Sutton, J., 1987. Product differentiation and industrial structure. *Journal of Industrial Economics* 36 (2), 131–146.

Sharp, B., Dawes, J., 2001. What is differentiation and how does it work? *Journal of Marketing Management* 17 (7/8), 739–759.

Sherif, M., Hovland, C.I., 1961. *Social judgment*: *Assimilation and contrast effects in communication and attitude change.* Greenwood Press, Westport, CT.

Sianesi, B., 2004. An evaluation of the Swedish system of active labor market programs in the 1990s. *Review of Economics and Statistics* 86 (1), 133–155.

Silvia, P.J., Barona, C.M., 2009. Do people prefer curved objects? Angularity, expertise, and aesthetic preference. *Empirical Studies of the Arts* 27 (1), 25–42.

Solomon, M.R., 1983. The role of products as social stimuli: A symbolic interactionism perspective. *Journal of Consumer Research* 10 (3), 319–329.

Somaya, D., Graham, S.J.H., 2006. *Vermeers and Rembrandts in the same attic: complementarity between copyright and trademark leveraging strategies in software.* SSRN Working Paper No. 887484.

Stapel, D.A., Koomen, W., van der Pligt, J., 1997. Categories of category accessibility: The impact of trait concept versus exemplar priming on person judgments. *Journal of Experimental Social Psychology* 33 (1), 47–76.

Stapel, D.A., Winkielman, P., 1998. Assimilation and contrast as a function of context-target similarity, distinctness, and dimensional relevance. *Personality & Social Psychology Bulletin* 24 (6), 634–646.

Steenkamp, J.B.E.M., 1990. Conceptual model of the quality perception process. *Journal of Business Research* 21 (4), 309–333.

Stuart, E.A., 2010. Matching methods for causal inference: A review and a look forward. *Statistical Science* 25 (1), 1–21.

Suthersanen, U., 2010. *Design law*: *European Union and United States of America* (2nd ed.). Sweet & Maxwell, London.

Sweeney, J.C., Soutar, G.N., 2001. Consumer perceived value: The development of a multiple item scale. *Journal of Retailing* 77 (2), 203–220.

Swinyard, W.R., Rinne, H., Keng Kau, A., 1990. The morality of software piracy: A cross-cultural analysis. *Journal of Business Ethics* 9 (8), 655–664.

Talke, K., Salomo, S., Wieringa, J.E., Lutz, A., 2009. What about design newness? Investigating the relevance of a neglected dimension of product innovativeness. *Journal of Product Innovation Management* 26 (6), 601–615.

Taylor, M.Z., 2004. Empirical evidence against varieties of capitalism's theory of technological innovation. *International Organization* 58 (3), 601–631.

Teece, D.J., 1986. Profiting from technological innovation: Implications for integration, collaboration, licensing and public policy. *Research Policy* 15 (6), 285–305.

Thoma, G., Torrisi, S., Gambardella, A., Guellec, D., Hall, B.H., Harhoff, D., 2010. *Harmonizing and combining large datasets – an application to firm-level patent and accounting data.* NBER Working Paper No. 15851.

Thomä, J., Bizer, K., 2013. To protect or not to protect? Modes of appropriability in the small enterprise sector. *Research Policy* 42 (1), 35–49.

Thompson, S., Sissons, A., Montgomery, L., 2012. *UK design as a global industry: international trade and intellectual property.* Research report conducted for the UK Intellectual Property Office.

Tirole, J., 1988. *The theory of industrial organization.* MIT Press, Cambridge, MA.

Tom, G., Garibaldi, B., Zeng, Y., Pilcher, J., 1998. Consumer demand for counterfeit goods. *Psychology & Marketing* 15 (5), 405–421.

Tomasello, M., 1999. *The cultural origins of human cognition.* Harvard University Press, Cambridge, MA.

Townsend, J.D., Montoya, M.M., Calantone, R.J., 2011. Form and function: a matter of perspective. *Journal of Product Innovation Management* 28 (3), 374–377.

Tran, Y., 2010. Generating stylistic innovation: A process perspective. *Industry & Innovation* 17 (2), 131–161.

Ulrich, K., 1995. The role of product architecture in the manufacturing firm. *Research Policy* 24 (3), 419–440.

Ulrich, K.T., 2011. *Design: Creation of Artifacts in Society.* University of Pennsylvania Press, Philadelphia.

Utterback, J.M., 1994. *Mastering the dynamics of innovation*: *How companies can seize opportunities in the face of technological change.* Harvard Business School Press, Boston, MA.

van Horen, F., Pieters, R., 2012a. Consumer evaluation of copycat brands: The effect of imitation type. *International Journal of Research in Marketing* 29 (3), 246–255.

van Horen, F., Pieters, R., 2012b. When high-similarity copycats lose and moderate-similarity copycats gain: the impact of comparative evaluation. *Journal of Marketing Research* 49 (1), 83–91.

Verganti, R., 2006. Innovating through design. *Harvard Business Review* 84 (12), 114–122.

Verganti, R., 2009. *Design-driven innovation*: *Changing the rules of competition by radically innovating what things mean.* Harvard Business School Press, Boston, MA.

Veryzer, R.W., 1993. Aesthetic response and the influence of design principles on product preferences. *Advances in Consumer Research* 20 (1), 224–228.

Veryzer, R.W., 1995. The place of product design and aesthetics in consumer research. *Advances in Consumer Research* 22 (1), 641–645.

Walsh, V., 1996. Design, innovation and the boundaries of the firm. *Research Policy* 25 (4), 509–529.

Walsh, V., Roy, R., Bruce, M., Potter, S., 1992. *Winning by design*: *Technology, product design, and international competitiveness.* Blackwell Business, Oxford, UK.

Warlop, L., Alba, J.W., 2004. Sincere flattery: trade-dress imitation and consumer choice. *Journal of Consumer Psychology* 14 (1/2), 21–27.

Wernerfelt, B., 1984. A resource-based view of the firm. *Strategic Management Journal* 5 (2), 171–180.

Whitley, R., 1999. *Divergent capitalisms*: *The social structuring and change of business systems.* Oxford University Press, Oxford, UK.

Wilcox, K., Roggeveen, A.L., Grewal, D., 2011. Shall I tell you now or later? Assimilation and contrast in the evaluation of experiential products. *Journal of Consumer Research* 38 (4), 763–773.

WIPO, 2012. *World Intellectual Property Indicators.* WIPO Economics & Statistics Series.

WIPO, 2014. *World Intellectual Property Indicators 2014*. Available online http://www.wipo.int/edocs/pubdocs/en/wipo_pub_941_2014.pdf (accessed

23.02.15).

Yin, R.K., 2009. *Case study research*: *design and methods* (4th ed.). Sage Publications, Los Angeles, CA.

Zeithaml, V.A., 1988. Consumer perceptions of price, quality, and value: A means-end model and synthesis of evidence. *Journal of Marketing* 52 (3), 2–22.

Zhao, Z., 2004. Using matching to estimate treatment effects: data requirements, matching metrics, and Monte Carlo evidence. *Review of Economics & Statistics* 86 (1), 91–107.