Discussion Paper No. 13-061

Do Trademarks Diminish the Substitutability of Products in Innovative Knowledge-Intensive Services?

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Non-technical summary

Trademarks are treated negligent in the scholarly innovation discourse. In contrast to other intellectual property rights, trademarks are not intended traditionally to protect immediately valuable information. Trademarks protect distinctive commercial signs which stand for something else.

Trademark protection encompasses two dimensions: signifier protection and dilution protection. The protection of distinctive signifiers facilitates customers to identify product source. Identifiable producers may compete on delivering reliably satisfying products. Traditional trademark law protects customer. In contrast, anti-dilution regulation protects the capacity of famous mark to identify and distinguish. Both dimensions of trademark protection might differentiate the signed products; either on quality characteristics or on product meaning.

Diminishing product substitutability should foster product innovation incentives. Trademarks are therefore supposed to supplement the appropriation of innovation rents. This should be particularly the case for knowledge-intensive services in which other intellectual property rights are considered as little effective due to the intangible and interactive service production.

Trademarks are often supposed to reduce substitutability and imitability of product innovations. Using German CIS data for 2010, we provide empirical evidence that trademarking firms assess easy product substitutability as less characteristic for their competitive environment. This correlation between the ease of product substitutability and trademark protection is present for product innovators, for firms in knowledge-intensive services and for firms which consider trademarks as important intellectual property rights. The correlation does not appear to reflect superior functional product characteristics from the application of new technological knowledge. This suggests trademarks as important complementary asset for the commercialization of innovative products in knowledge-intensive services.

Das Wichtigste in Kürze

Bisher ist wenig bekannt über die Bedeutung von Markenrechten für technologische Produktinnovation. Im Gegensatz zu anderen Schutzrechten schützt der Kern des Markenrechts geistiges Eigentum nicht unmittelbar. Marken schützen unterscheidungskräftige gewerbliche Zeichen, mit denen Kunden eine gewisse Vorstellung in Verbindung bringen.

Das Markenrecht umfasst den Verwechslungsschutz und den Bekanntheitsschutz. Der Schutz unterscheidungskräftiger Zeichen erlaubt es Kunden, die Herkunft von Produkten zu identifizieren. Markenunternehmen können dann einen Ruf für verlässlich zufriedenstellende Produkte aufbauen. Das traditionelle Markenrecht dient also dem Kundenschutz. Im Gegensatz dazu schützt der Bekanntheitsschutz die Unterscheidungskraft oder Wertschätzung bekannter Marken. Beide Formen des Markenschutzes ermöglichen eine Differenzierung der gekennzeichneten Produkte; entweder auf Grund von Qualitätsvorstellungen oder der Wertschätzung für bekannte Marken.

Die Anreize zu Produktinnovation steigen mit geringerer Substituierbarkeit der Produkte. Markenrechte könnten daher den Schutz von Innovationsrenten unterstützen. Marken sollten vor allem für wissensintensive Dienstleistungen wichtig sein, da andere Schutzrechte hier aufgrund der intangiblen und interaktiven Produktion als wenig effektiv angesehen werden.

Marken könnten die Substituierbarkeit und Imitierbarkeit von Produktinnovationen erschweren. Daten der deutschen Innovationserhebung 2010 zeigen, dass Markenunternehmen ihr Wettbewerbsumfeld seltener durch einfache Produktsubstituierbarkeit charakterisieren. Diese Korrelation besteht für wissensintensive Dienstleister, Produktinnovatoren und für Firmen, die Marken als wichtiges Schutzrecht ansehen. Sie scheint nicht durch technologisch neue und überlegene funktionale Produktmerkmale hervorgerufen zu werden. Markenrechte scheinen also die Kommerzialisierung innovativer Produkte in wissensintensiven Dienstleistungen zu komplementieren.

Do Trademarks Diminish Product Substitutability in Innovative and Knowledge-Intensive Services?[1]

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September 2013

Abstract

Trademarks are often supposed to reduce substitutability and imitability of product innovations. Using data of the German innovation survey, we provide empirical evidence that trademarking firms in manufacturing and services assess easy product substitutability as less characteristic for their competitive environment. This is particularly the case for service firms which are knowledge-intensive, product innovators and which consider trademark protection as important. This suggests that trademarks are an important complementary asset for commercializing innovations in knowledge-intensive services.

JEL classification: O32, O34

Keywords: Trademarks, product differentiation, innovation, services

[1] For helpful comments, we thank Birgit Aschhoff, Bruno Cassiman, Dirk Czarnitzki, Katrin Hussinger, Georg Licht, Tanja Hennighausen, Hanna Hottenrott, Christian Köhler, Christian Rammer and Reinhilde Veugelers. All remaining errors are our own. We thank the scientific board of ZEW for granting the project which led to this paper (see www.zew.de/fsc or www.zew.de/dcr for further information).

1. Introduction

With regard to intellectual property rights, trademarks are treated negligent in the scholarly innovation discourse. Intellectual property rights are granted in order to provide incentives to invest in the production of information (Besen and Raskind, 1991). Patents or copyrights for instance grant legal protection for disclosed inventive or original information. In return, their owners have the right to exclude others from commercial use of the protected information. On the other hand, trademarks protect distinctive, commercial signs which stand for information.

Trademark stocks have been shown to contribute to firm performance and firm value (Griffiths et al., 2005; Krasnikov et al., 2009; Sandner and Block, 2011). This might seem surprising in view of comparably low costs to invent and protect a new sign. We draw on recent studies of the economics and law of trademarks in order to discuss the importance of trademarks for innovating service firms (Landes and Posner, 1986; Lemley, 1999). Trademark protection encompasses two dimensions: signifier protection and dilution protection (Dinwoodie, 1999; Beebe, 2004). Traditional trademark law protects distinctive signifiers in order to permit identifiability of product source. Source identifiability shall induce producers to deliver reliably satisfying products. In contrast to traditional trademark law, which protects consumers, anti-dilution regulation protects producers of differentiating brand meaning. Competitors shall be prohibited to exploit a famous mark's capacity to identify and distinguish.

Hence, trademarks might differentiate the signed product on quality characteristics and product meaning. Source distinctiveness allows customers to include prior experiences in their purchase decision. It facilitates producers to differentiate their products on unobserved quality characteristics (Schmalensee, 1982). The differential distinctiveness of famous marks distinguishes it from other marks. This distinction creates the cognitive meaning of the sign which customers might value (Ramello and Silva, 2006; Verganti, 2008). Hence, firms that use trademark protection should perceive their competitive environment as being less characterized by easy substitutability of their products with rival ones.

Our empirical approach relates surveyed firm information on the perceived ease of product substitutability with their use of trademark protection. Traditional measures of competition intensity based on industry statistics have been found to perform poorly as proxies for

competitive pressure (Boone, 2001). In contrast, ease of product substitutability is expected to diminish robustly product innovation incentives (Vives, 2008). In line with Schumpeterian arguments and endogenous growth models, the prospect for rents from imperfectly substitutable product innovations should create incentives to invest in innovation (Schumpeter, 1943; Aghion and Howitt, 1992). Various empirical studies using qualitative information on the competitive environment confirm the theoretical prediction of lower product innovation propensities in the presence of easy product substitutability (Tang, 2006; Wörter et al., 2010; Beneito et al., 2011). This suggests trademarks as important differentiating device for product innovators as they limit the substitutability of their products and augment the rents to be gained from product innovation.

Trademarks are often supposed to be important supplementary mechanisms to protect innovation if other formal mechanisms are little effective. This is particularly the case in knowledge-intensive services (Amara et al., 2008). The intangible and interactive service production might complicate the protection of the knowledge content in service provision from imitating rivals. Trademarks statistics appear, indeed, to reflect industrial change towards knowledge-intensive services which might indicate that they are important complementary assets for service innovation (Teece, 1986; Mendonca et al., 2004; Fosfuri et al., 2006). This suggests that reference to prior experiences is particularly valuable for customers when (service) production is interactive and intangible (Schmoch, 2003; Lemley, 1999). Hence, trademarks should diminish the ease of product substitutability in knowledge-intensive service sectors.

Our empirical approach relies on 4,154 observations obtained from the 2011 German innovation survey. Surveyed firms have been asked to evaluate various qualitative dimensions of their competitive environment. Furthermore, they have been asked about formal mechanisms to protect intellectual property and the importance of respective rights. We find that trademarking firms in manufacturing and services perceive their products as less substitutable by rival ones. Further measures of competitive pressure are positively correlated with the ease of product substitutability. The negative effect of trademark protection on product substitutability is particularly pronounced for service firms that are knowledge-intensive and product innovators. However, technological advance might result in superior functional characteristics of trademarked product innovations. When controlling for newly created technological knowledge,

we still find trademarks to reduce perceived product substitutability. Hence, trademarks appear as important complementary asset to benefit from innovation in knowledge-intensive services where the knowledge content of products is difficult to protect.

We proceed in the following way. Section 2.1 draws on recent studies on the economics and law of trademarks in order to discuss the differentiating dimensions of branding. Section 2.2 discusses the relation of competitive pressure and product innovation incentives. Section 2.3 focuses on the peculiarities of innovation and production in knowledge-intensive services. Section 3 describes the data and variables. Section 4 provides the econometric evidence and section 5 concludes.

2. Hypothesis development

2.1. Trademarks as intellectual property rights

According to the WTO Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS, Art. 15 No. 1),[2] a trademark can be defined as `[a]ny sign, or any combination of signs, capable of distinguishing the goods or services of one undertaking from those of other undertakings […]´. In contrast to other intellectual property rights, trademarks are not thought to protect immediately valuable information. Trademarks protect signs which stand for something else. Signs are capable to stand for something else if they are distinctive. Following Beebe (2004), semiologic insights help to clarify the scope of trademark protection.[3] A sign can be defined as `a relational system consisting of a "signifier" (the tangible form of the mark), a "signified" (the semantic content of the mark, its meaning), and a "referent" (the product to which the mark is affixed).' Thus, trademarks protect, in the first place, only the tangible form of a mark, i. e. the name, word, symbol, design or something else which is distinctive. The

[2] The TRIPS Agreement is part of the Marrakesh Agreement (1994) which establishes the World Trade Organization.

[3] Semiology is the science which `explores the nature and function of signs as well as the systems and processes underlying signification, expression, representation and communication' (Beebe, 2004).

distinctiveness of the sign implies that it is different from other signs. It has therefore the capability to identify and provide meaning.

In order to be eligible for trademark protection, the sign has to be used in commerce (Economides, 1998). Hence, the tangible form of the mark has to be affixed to goods or services. Accordingly, trademarks protect `nothing more nor less than one's commercial signature to his goods' (Browne, 1873). Distinctiveness enables customers to associate the sign with a particular combination of functional and semantic attributes of the product and origin. The distinction between the signifier and the signified cognition of customers clarifies that trademarks are means to an end. They shall identify. Trademarks shall neither stimulate the production of signs per se nor are they intended to protect the signified cognition itself.

Source distinctiveness

The legal prerequisites of signs to be distinctive and to be used in commerce guarantee source identifiability of products. Source distinctiveness allows meaning with regard to a particular object to be conveyed. This permits informational efficiencies to be leveraged (Landes and Posner, 1987). At first, costs of communication and search costs are reduced (Shannon and Weaver, 1962). Secondly, dynamic informational efficiencies might be leveraged when promised product attributes cannot be verified by customers before use or consumption. Source identifiability allows customers to retaliate when their expectations have not been met. Trademarks provide a signal for product quality then and may prevent market breakdowns due to adverse selection (Akerlof, 1970). Identifiability allows producers to compete on experience characteristics and reduces their incentives to deceive.

Source distinctiveness allows customers to include prior experiences in their purchase decision. This facilitates producers to compete on unobserved product characteristics. Trademarks may, thus, differentiate the signed products on experience characteristics. Imitating firms will find it harder to persuade customers on experience characteristics once customers have been convinced that the initial innovator delivers reliably satisfactory quality (Schmalensee, 1982).

Differential distinctiveness

Evidence for pharmaceuticals supports the view that branding differentiates product innovations on unobserved quality characteristics (Caves et al., 1991). However, in view of the demonstrably identical quality between generic and branded drug, their limited substitutability is puzzling. Product substitutability, as perceived by customers, is apparently not exclusively determined by functional product attributes. The socioeconomic product meaning seems also important for the valuation of consumers and industrial clients (Baudrillard, 1970; Lancaster, 1971; Ramello and Silva, 2006; Verganti, 2008).

Differentiation against other products creates product meaning. Recent developments in trademark law reflect the increasing importance of brand's `commercial magnetism' (Schechter, 1927). Anti-dilution regulations expanded fundamentally the scope of trademark protection (Dinwoodie, 1999; Lemley, 1999).[4] Dilution protection is neither restricted to product categories nor does it necessitate consumer confusion.[5] It protects famous marks from lessening their capacity to identify and distinguish due to other's use of similar marks. The traditional trademark protection of source distinctiveness has expanded to the protection of trademark's differential distinctiveness from other marks (Beebe, 2004). Trademarks have evolved from a protection of signs, which stand for something else, to intellectual property rights on the signified meaning of signs.

Hence, trademarks are distinctive signs of product origin. Source distinctiveness facilitates product differentiation on unobserved quality characteristics. Differential distinctiveness facilitates differentiation on product meaning. Firms with registered trademarks should perceive correspondingly their products as less easily substitutable by rival ones. This is summarized in the following hypothesis:

[4] In European Union, the directive 89/104/CE of the European Commission and its implementation in national laws enacted anti-dilution regulation. In the US, the Federal Trademark Dilution Act amended the Lanham Act in 1995 (McCarthy, 2004).

[5] Besides this protection from `dilution by blurring', famous marks are especially protected from `dilution by tarnishment', i. e. when lower quality products are marked similarly which could diminish favorable consumer perceptions of the famous mark.

H1: Trademarks reduce the ease with which firm products are substitutable by rival ones.

2.2. Substitutability, trademarks and product innovation

Innovation incentives in different competitive environments are debated at least since Schumpeter (1934). The plethora of model specifications and empirical measures for market structures and innovation yields ambiguous results for the relationship of innovation and competition (Gilbert, 2006). Schumpeter (1942) for instance concludes that perfectly competitive markets may not be the most effective coordination mechanism to provide of innovation incentives. The prospect for rents from imperfectly substitutable product innovations induces firms to invest in R&D and innovation and increased competition from rival substitutes would reduce these rents and innovation incentives (Romer, 1990; Grossman and Helpman, 1991; Aghion and Howitt, 1992).

Theoretical models frequently predict a negative relation between competitive pressure and innovation. However, incentives to innovate are determined by the difference of post-entry rents from innovation and pre-innovation profits (Arrow, 1963). Increasing competitive pressure among firms with similar cost structures may foster innovation incentives if pre-innovation profits are more sensitive to competition than post-innovation profits. This positive escape competition effect has to be balanced against negative Schumpeterian effects of competition (Aghion et al., 2005).

In view of this multitude of modeling and measurement choices, Vives (2008) identifies robust relationships between measures of innovation and competitive pressure. These hold for various market structures and competition modes. Thereby, it is crucial to distinguish between different types of innovation. Investments in process innovation shall primarily reduce costs. Product innovation, on the other hand, shall stimulate demand by introducing a new variety. Incentives to invest in product and process innovations are affected differently by the various dimensions of competitive pressure. Vives (2008) identifies three robust dimensions of competitive pressure: market size, ease of entry and product substitutability. Increasing the size of the market increases

per-firm output and the number of entering firms (Schmookler, 1962; Acemoglu and Linn, 2004). If the first effect dominates the latter, product innovations are more likely with expanding markets. Secondly, decreasing entry costs increases the number of introduced varieties (Sutton, 1991; Aghion et al., 2005). Thirdly, increasing the degree of product substitutability induces cost-reducing process innovations. This increases per-firm output and decreases the numbers of introduced varieties if the demand for varieties does not expand (Syverson, 2004).

The empirical evidence for limited competition to spur innovation appears weak (Geroski, 1990). Evidence of Blundell et al. (1999) suggests that entry threats render innovations of firms with large market shares particularly valuable. Nickell (1996) finds that the number of competitors and low price-cost margins are positively related with productivity growth. However, these measures for competitive pressure may not be adequate in any circumstance (Boone, 2001). Qualitative information on different dimensions of competition is frequently more adequate than traditional industry statistics (Czarnitzki and Kraft, 2004; Tang, 2006).

Tang (2006) finds lower R&D and product innovation propensities when firms assess their competitive environment as characterized by easy product substitutability. Using data on Spanish manufacturing firms, Beneito et al. (2011) study the relation between qualitative information on product substitutability, ease of entry and market size on the one hand and propensities to innovate in products or processes on the other and provide evidence which is consistent with the predictions of Vives (2008). Wörter et al. (2010) provide similar evidence for Germany and Switzerland. Hence, easy product substitutability should be robustly negatively related with product innovation activities. Firms using trademark protection should then have higher product innovation propensities as trademarks should diminish product substitutability.

Milgrom and Roberts (1986) envision that quality signals of trademarks might best apply to the branding of product innovations whose unobserved quality characteristics might be improved by R&D. Imitators will find it harder to persuade customers on experience characteristics once customers have been convinced that the initial innovator delivers reliably satisfactory quality (Schmalensee, 1982). This suggests that long-lived first mover advantages could be leveraged when pioneering product innovations are branded in markets of imperfect information. Evidence

on the branding of patent-protected drugs supports this view. Appelt (2009) shows that trademark-protected drugs are less substituted than unbranded ones after patent expiry.

In industries with established architectural designs in which products offer similar functional attributes, product and packaging design are frequently the main mean for differentiation.[6] Product and packaging design are means to articulate product meaning (Verganti, 2008). Design strengthens brands and diminishes competitive pressure when the functional characteristics of competing products are similar (Talke et al., 2009; Candi and Saemundsson, 2011). In view of blurring boundaries between intellectual property rights, the differential distinctiveness of design is frequently considered as eligible for trademark protection (Lemley, 1999; Dinwoodie, 1997).

The differentiating effects of trademarks should be particularly important for product innovators. It reduces the similarity of rival products, fosters product innovation success and may prolong the product life cycle of the radical product innovation (Bloom et al., 2010; McGahan and Silverman, 2006; Sanderson and Uzumeri, 1995; Aaker, 2007; Czarnitzki and Thorwarth, 2012). The importance of trademarks for product innovators is summarized in the following hypothesis:

H2: Trademarks of product innovators reduce the perceived ease of product substitutability.

2.3. Trademarks in knowledge-intensive services

The differentiating role of trademarks might be particularly important for knowledge-intensive service providers. Innovation in service sectors tends not to deliver physical artefacts. The applicability of new technologies in service production might appear limited. Services rely also seldom on formalized R&D processes. The effectiveness of formal mechanisms to protect innovations appears accordingly limited. Hence, service innovations are often protected in similar ways as process innovations (Levin et al., 1987; Cohen et al., 2000).

[6] Product design is not exclusively associated with manufacturing sectors. With regard to service design, the UK Department of Trade and Industry states, for instance: `Service design affects how customers will experience the delivery of a service, such as a bank or a fast food restaurant.' (DTI, 2005)

Innovation in services is greatly diverse (Sundbo and Gallouji, 2000; Tether, 2003; Howells and Tether, 2004). Service firms are in large parts little innovative (Hipp and Grupp, 2005; Amable and Palombarini, 1998). Innovation in these service sectors can be considered as supplier-dominated, i. e. as dependent on the supply and adoption of innovative products from other (manufacturing) sectors (Pavitt, 1984). However, services are increasingly innovative in recent years. According to Miozzo and Soete (2001), innovation activities in service sectors may be classified as supplier-dominated, technology-intensive or scale-intensive (Evangelista, 2000). Specialized technology suppliers or science-based services are highly innovative. Their services could be considered as outsourced R&D or design activities. Service production in scale-intensive sectors relies on physical (e. g. transport, wholesale) or IT networks (e. g. banking, insurance, communications). The emergence of new information and communication technologies appears to have fostered process efficiency and to have facilitated the customization of services in these scale-intensive sectors (Barras, 1986; Brynjolfsson and Hitt, 2000, 2003).

The resemblance of Pavitt's (1984) taxonomy in the Miozzo-Soete classification of innovation in services suggests that innovation behaviors in services and manufacturing share more similarities than distinctions (Drejier, 2004; Gallouji and Savona, 2009). They may, however, emphasize organizational innovations and human capital more than technological advance (Gallouji and Weinstein, 1997; Sirilli and Evangelista, 1998; Hitt et al., 2001; Teece, 2003). The intangibility and co-terminality of production and consumption in knowledge-intensive services suggest an important role for interaction between service providers and users (Oliveira and von Hippel, 2011, but Tether et al., 2001). The intangible nature of service output and the critical role of skills and expertise in production suggest that the knowledge content in services might not be easy to protect from imitating rivals (Saviotti, 1998).

The limited effectiveness of other formal mechanisms to protect knowledge and innovation in services might point to an important role for trademarks there. Indeed, trademarks statistics contribute to the measurement of industrial change towards knowledge-intensive services (Mendonca et al., 2004). Trademarks appear as important complementary assets in knowledge-intensive services when production is intangible, tacit knowledge contents are high and other

protection mechanisms are weak (Lemley, 1999; Schmoch, 2003; Blind et al., 2003; Fosfuri et al., 2006; Amara et al., 2008). This summarized in the following hypothesis:

H3: Trademarks of knowledge-intensive service providers reduce perceived ease of product substitutability.

3. Empirical section

3.1. Data

Firm-level data is obtained from the Mannheim Innovation Panel (MIP). The MIP is a stratified random sample of legally independent German firms with at least five employees. The sample is stratified by 50 industry sectors, eight size classes and Eastern or Western Germany. The questionnaire is based on concepts and definitions of the OECD Oslo Manual (2005) for collecting innovation data. Extensive piloting and pre-testing supports the reliability and validity of surveyed data.[7] The gross target sample consists of 38,932 enterprises in 2011. 16,821 enterprises have been classified as neutral losses during the survey procedure. Respective enterprises could either not be contacted or ceased operation. This yields a net sample of 6,851 responses. We obtain an estimation sample of 4,154 firms after excluding 2697 observations with missing information. The estimation sample shows similar descriptive statistics of the stratifying variables and innovation success as the net sample. Hence, sample selection biases appear unlikely.

Surveyed firms are asked to assess on a 4-point Likert scale various qualitative dimensions of the competitive environment. They are asked whether `*Products/services of your company are easily substitutable by rival products*'. Firms are further asked to judge whether they perceive a `*Major threat to your market position due to entry of new competitors´*. Foreign entry has been shown to create particular pressure (Aghion et al., 2005). Therefore, firms are asked whether they perceive

[7] See Janz et al. (2001) or Rammer et al. (2005), for a more detailed description of the Mannheim Innovation Panel.

`*Strong competition from abroad´*. Ease of rival entry and foreign competition are included in the estimation as dummy variables which indicate full agreement with the respective characteristic of their competitive environment.

In addition to product substitutability and entry threats, market size is a further characteristic dimension of the competitive environment. We follow Beneito et al. (2011) when using the export status of the firm as proxy for market size. Firms have been asked about the geographic scope of their services during 2008 and 2010. Market size is included as dummy that indicates service to international markets. With regard to the competitive environment, firms are further asked about the number of major rivals in their key market. They have to choose among six items ranging from no competitors, 1 to 5, 6 to 10, 11 to 15, 16 to 50 and more than 50.

Surveyed firms have also been asked about their use of intellectual property protection during the reference period 2008-2010. Information on firm's use of trademark protection is complemented by an assessment of the importance of various intellectual property rights. They are asked to evaluate whether formal trademark protection is of high, medium or low importance for them. As a robustness check, information on firm's trademark registrations at the German trademark office has further been added to the estimation sample.

3.2. Descriptive Statistics

Table 1 presents the descriptive statistics for our sample of 4,154 firms. The descriptive statistics are also reported for product innovating firms, firms using trademark protection in the reference period and firms with more than 5 principle competitors. Roughly half of the sample firms are active in R&D-intensive industries or knowledge-intensive services.[8] The median number of major competitors ranges from 1 to 5 and 6 to 10. We choose the threshold of 5 principle competitors for a rough distinction of firms with few or many competitors.

[8] We follow the OECD classification of knowledge-intensive services which includes scale-intensive IT services (OECD, 1999).

Table 1 about here

60 percent of the sample assesses easy substitutability of their products as fully or rather applicable characterization of their competitive environment. Slightly less product innovating or trademarking firms fully agree to easy substitutability of their products. Firms with more than 5 major competitors have a 10 percent higher frequency of full or rather agreement to easy substitutability of their products.

20 percent of sample firms use formal trademark protection during 2008 and 2010. Product innovators use trademark protection more frequently. Firms with many competitors use it less. A similar picture holds for those 824 firms or 19 percent which have assigned trademark protection high or medium importance. Firms which assess formal trademark protection as important are more likely product innovators and are less likely to have more than 5 major competitors. These observations are particularly prevalent in R&D-intensive industries. Trademarking firms and product innovators perceive fewer entry threats, are larger on average and are more likely to serve international markets.

3.3. Econometric evidence

Table 2 presents ordered Probit estimations of the perceived ease of product substitutability. In addition to 21 sector dummies, firm size and location, we control for further characteristic dimensions of competitive pressures. Manufacturing firms that serve international markets perceive their products as significantly less substitutable by rival ones. This suggests larger market sizes to increase incentives to invest in differentiating product innovations (Aw et al., 2011). Easy rival entry and intense foreign competition are, both, positively correlated with high competitive pressure due to easy product substitutability.[9, 10]

[9] Vives (2008) relies on non-tournament models when he derives his robust predictions for competitive pressure on innovation. Different efficiency levels and the distance to the technological frontier might, however, have important effects on pre- and post-innovation profits (Aghion et al., 2005). We have experimented with various

Table 2 about here

Firms using trademark protection during the reference period perceive their competitive environment as significantly less characterized by easy product substitutability. We find a significant negative correlation of trademark protection and substitutability for manufacturing firms and knowledge-intensive services. The effect in knowledge-intensive services is larger than in manufacturing. This negative correlation is also significant for knowledge-intensive services when a dummy for trademark registrations at the German trademark office replaces survey information.

Table 3 about here

Table 3 splits the estimation samples into firms which consider intellectual property protection of trademarks as highly or medium important and firms which assign trademark protection only minor importance. We do not find significant effects of trademark protection on perceived product substitutability anymore for manufacturing firms. However, it verifies that diminishing product substitutability in services originates from firms which consider intellectual property protection of trademarks as important.[11]

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measures of firm distance to the productivity frontier but have not found the ease of product substitutability to be significantly affected.

[10] Instead of these qualitative measures of entry threats, we have also verified an alternative measure of sunk entry costs (Sutton, 1991). This does not change the results qualitatively.

[11] We have also studied whether subsamples with high trademark stock yields similar results. However, trademark stocks appear highly skew and provide little variation. Trademark stocks and the surveyed importance of trademark protection appear, furthermore, only modestly correlated.

Table 4 about here

The lower substitutability of products from firms using trademark protection should be particularly important for product innovators as this should increase appropriable innovation rents. Table 4 presents estimations for subsamples of product-innovating firms. Trademark protection shows no significant effects on ease of product substitutability for non-innovative firms. This is also the case for manufacturing firms irrespective of their innovation success. For product innovating firms in services, however, there is a strongly significant negative correlation of trademark protection and perceived product substitutability. This effect persists also when only knowledge-intensive firms are considered. This suggests an important role of trademarks as appropriation mechanism in services.

Table 5 about here

This negative correlation leaves open whether trademarking innovators perceive diminished product substitutability due to superior functional characteristics of their innovative products. Diminishing product substitutability would then result from technological differentiation and not from branding. In order to incorporate firm's capabilities to differentiate products technologically, Table 5 includes an indicator for patent applications in the reference period. Patenting product innovators in services and manufacturing perceive, indeed, a lower substitutability of their products. However, trademark protection of innovating service firms is still strongly negatively correlated with product substitutability. This does not suggest that diminishing product substitutability due to trademark protection results from latent technological improvements only.

4. Conclusion

Trademarks are important for firm performance and value (e. g. Sandner and Block, 2011). Trademarks are, however, not thought to protect immediately valuable information. Hence, their value to firms might seem puzzling.

Trademarks protect distinctive signs which are used in commerce. This shall protect customers by facilitating them to identify product origins. Identifyability of source permits producers to compete on experiential quality characteristics of their products. Trademark owners may build a reputation for delivering reliably satisfying products (Landes and Posner, 1986). Trademarked products may, therefore, be differentiated on unobserved quality characteristics (Schmalensee, 1982).

The scope of trademark protection has significantly expanded in recent years (Lemley, 1999). Anti-dilution regulation protects a famous mark's capacity to identify and distinguish. The capacity of a mark to be distinguishable from others creates meaning (Beebe, 2004; Verganti, 2008). Trademarks protect also famous brands nowadays which differentiate products on symbolic or aesthetic attributes (Dinwoodie, 1999; Ramello and Silva, 2006).

This suggests that trademarks limit product substitutability. The ease of product substitutability is a characteristic dimension of competitive pressure. Vives (2008) shows that increasing substitutability diminishes robustly the expected rents from product innovation. Trademarks are, therefore, frequently supposed as important supplementary mechanism to protect innovation rents. This is particularly the case for knowledge-intensive services (Amara et al., 2008). Here, the intangible and interactive service production complicates the protection of its knowledge content by other formal protection mechanisms.

Using German CIS data referring to 2008 through 2010, we find that trademarking firms in manufacturing and services perceive their products as significantly less substitutable by rival ones. This negative effect is particularly pronounced for knowledge-intensive services and for product innovators. We do not find evidence that this reflects spuriously superior functional characteristics of trademarked product innovations. Trademarks appear less important as protection mechanism for product differentiation in manufacturing. This suggests that trademark

protection facilitates production and innovation in knowledge-intensive services. However, we are cautious to interpret the negative correlation of trademark protection and product substitutability as causal.

Trademarks protect investments in brand awareness and functional, experiential or symbolic associations of customers to the brand. This reduces product substitutability which is crucial for firm productivity and survival (Syverson; 2004). This suggests trademarks as important complementary asset for the commercialization of new products if the knowledge content is difficult to protect (Teece, 1986; Fosfuri et al., 2008). Hence, policymakers and management practitioners should not neglect the strategic importance of trademark protection for appropriation even though trademarks do not protect technological innovation per se but activities in subsequent stages of the value chain.

This study leaves the relative importance of investments in reputation or brand meaning during different stages of the product life cycle open (Schmalensee, 1982; Aaker, 2007; Talke et al., 2009). Branding and innovation are still studied to a large extent in distinct scholarly discourses. This is surprising as leading scholars of branding and innovation, both, acknowledge the importance of branding for innovation success (Aaker, 2007; Teece, 1986, 1992). The expanding boundaries of trademark protection, which include often aesthetic product design, would, however, provide an interesting conjecture to studies of architectural design of product functions during early stages of the product life cycle (Tether and Massini, 1998; Verganti, 2008).

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6. Data Appendix

Table 1 Descriptive statistics

				Trademarking firms			Product Innovators			Many competitors		
	Mean	Med.	Std. dev.	Mean	Med.	Std. dev.	Mean	Med.	Std. dev.	Mean	Med.	Std. dev.
1 *("Easy substitutability not applies")*	0.11	0	0.31	0.11	0	0.32	0.10	0	0.29	0.07	0	0.26
1 *("Easy substitutability hardly applies")*	0.27	0	0.45	0.34	0	0.47	0.34	0	0.47	0.19	0	0.40
1 *("Easy substitutability rather applies")*	0.41	0	0.49	0.43	0	0.49	0.43	0	0.49	0.45	0	0.50
1 *("Easy substitutability fully applies")*	0.21	0	0.40	0.12	0	0.33	0.14	0	0.35	0.29	0	0.45
1 *(Trademark)*	0.19	0	0.39	1	1	0	0.31	0	0.46	0.14	0	0.35
1 *(Trademarks important)*	0.20	0	0.40	0.92	1	0.28	0.33	0	0.47	0.15	0	0.36
1 *(Entry Threat)*	0.11	0	0.32	0.06	0	0.24	0.07	0	0.26	0.18	0	0.38
1 *(Foreign Competitors)*	0.13	0	0.34	0.18	0	0.39	0.15	0	0.36	0.17	0	0.37
1 *(Exporter)*	0.19	0	0.39	0.32	0	0.47	0.26	0	0.44	0.14	0	0.34
1 *(Product Innovator)*	0.49	0	0.50	0.81	1	0.40	1	1	0	0.39	0	0.49
1 *(Patent)*	0.20	0	0.40	0.56	1	0.50	0.35	0	0.48	0.11	0	0.31
*ln(*No.Employees*)*	3.80	3.53	1.59	4.71	4.60	1.88	4.12	3.87	1.71	3.57	3.22	1.53
1 *(Eastern Germany)*	0.31	0	0.46	0.22	0	0.42	0.28	0	0.45	0.32	0	0.47
1 *(R&D-intensive industries)*	0.22	0	0.41	0.38	0	0.49	0.34	0	0.47	0.14	0	0.35
1 *(other manufacturing industries)*	0.35	0	0.48	0.33	0	0.47	0.32	0	0.47	0.34	0	0.47
1 *(Knowledge-intensive services)*	0.25	0	0.43	0.21	0	0.41	0.24	0	0.43	0.30	0	0.46
1 *(other services)*	0.18	0	0.39	0.08	0	0.27	0.09	0	0.29	0.21	0	0.41
No. Observations	4154			786			2023			1438		

Table 2 Ordered probit estimations by industry sector

		Manufacturing	Knowledge-intensive Services	Other Services
Dependent: Own products easily substitutable				
1 *(*Trademark*)*	- 0.176***	- 0.120**	- 0.306***	- 0.157
	(0.046)	(0.058)	(0.095)	(0.146)
*ln(*No.Employees*)*	0.043***	0.052***	0.064**	0.017
	(0.012)	(0.016)	(0.025)	(0.025)
1 *(*Eastern Germany*)*	0.028	0.066	- 0.008	0.009
	(0.038)	(0.051)	(0.076)	(0.085)
1 *(*Entry Threat*)*	1.088***	1.169***	1.027***	0.972***
	(0.062)	(0.092)	(0.128)	(0.118)
1 *(*Foreign Competitors*)*	0.345***	0.400***	0.056	0.335**
	(0.055)	(0.064)	(0.161)	(0.154)
1 *(*Exporter*)*	- 0.208***	- 0.306***	- 0.126	0.047
	(0.045)	(0.056)	(0.107)	(0.121)
Sector dummies				
Cut-off 1	- 1.208***	- 1.327***	- 0.809***	- 1.025***
	(0.088)	(0.109)	(0.113)	(0.140)
Cut-off 2	- 0.200**	- 0.252**	0.274**	0.274**
	(0.087)	(0.106)	(0.110)	(0.136)
Cut-off 3	1.087***	1.177***	1.488***	0.814***
	(0.088)	(0.108)	(0.117)	(0.138)
No. Observations	4.154	2.282	1.032	758

Table 3 Ordered probit estimations by importance of trademark protection

	Manufacturing		Services	
	Trademarks not important	Trademarks important	Trademarks not important	Trademarks important
Dependent: Own products easily substitutable				
1*(*Trademark*)*	- 0.113	0.021	- 0.133	- 0.830***
	(0.174)	(0.146)	(0.217)	(0.213)
*ln(*No.Employees*)*	0.044**	0.073***	0.020	0.111**
	(0.020)	(0.027)	(0.019)	(0.044)
1*(*Eastern Germany*)*	0.089	- 0.033	- 0.017	0.117
	(0.057)	(0.116)	(0.059)	(0.171)
1*(*Entry Threat*)*	1.243***	0.783***	1.033***	0.724**
	(0.103)	(0.210)	(0.088)	(0.311)
1*(*Foreign Competitors*)*	0.413***	0.398***	0.192	0.489*
	(0.077)	(0.117)	(0.118)	(0.293)
1*(*Exporter*)*	- 0.323***	- 0.289***	- 0.067	0.132
	(0.068)	(0.100)	(0.087)	(0.197)
Sector dummies				
Cut-off 1	- 1.361***	- 1.069***	- 1.182***	- 1.376***
	(0.126)	(0.260)	(0.116)	(0.384)
Cut-off 2	- 0.299**	0.057	- 0.299***	0.004
	(0.123)	(0.257)	(0.113)	(0.377)
Cut-off 3	1.101***	1.606***	0.827***	1.350***
	(0.125)	(0.264)	(0.114)	(0.386)
No. Observations	1.701	581	1.629	243

Table 4 Ordered probit estimations by innovation success

			Manufacturing		Services	
	No Product Innovations	Product Innovator	No Product Innovations	Product Innovator	No Product Innovations	Product Innovator
Dependent: Own products easily substitutable						
1*(*Trademark*)*	- 0.106	- 0.196***	- 0.046	- 0.110	- 0.144	- 0.408***
	(0.094)	(0.056)	(0.130)	(0.068)	(0.137)	(0.101)
*ln(*No.Employees*)*	0.020	0.075***	0.011	0.091***	0.029	0.042
	(0.018)	(0.016)	(0.029)	(0.020)	(0.024)	(0.027)
1*(*Eastern Germany*)*	0.037	0.034	0.069	0.100	0.020	0.061
	(0.051)	(0.056)	(0.078)	(0.069)	(0.068)	(0.098)
1*(*Entry Threat*)*	1.086***	1.036***	1.289***	0.899***	0.953***	1.172***
	(0.078)	(0.104)	(0.126)	(0.139)	(0.101)	(0.158)
1*(*Foreign Competitors*)*	0.362***	0.354***	0.369***	0.430***	0.373**	0.042
	(0.086)	(0.072)	(0.107)	(0.081)	(0.147)	(0.165)
1*(*Exporter*)*	- 0.122	- 0.246***	- 0.249**	- 0.301***	0.005	- 0.113
	(0.075)	(0.058)	(0.105)	(0.068)	(0.110)	(0.115)
Sector dummies						
Cut-off 1	- 1.089***	- 1.327***	- 1.202***	- 1.395***	- 0.980***	- 1.528***
	(0.118)	(0.149)	(0.163)	(0.150)	(0.138)	(0.185)
Cut-off 2	- 0.290**	- 0.083	- 0.336**	- 0.173	- 0.221	- 0.216
	(0.116)	(0.147)	(0.160)	(0.147)	(0.135)	(0.177)
Cut-off 3	0.895***	1.370***	1.021***	1.360***	0.837***	1.111***
	(0.117)	(0.150)	(0.161)	(0.150)	(0.137)	(0.181)
No. Observations	2.131	2.023	964	1.318	1.167	705

Table 5 Ordered probit estimations by innovation success and patent protection

			Manufacturing		Services	
	No Product Innovations	Product Innovator	No Product Innovations	Product Innovator	No Product Innovations	Product Innovator
Dependent: Own products easily substitutable						
*1(*Trademark*)*	- 0.064	- 0.139**	0.002	- 0.066	- 0.116	- 0.301***
	(0.098)	(0.059)	(0.137)	(0.071)	(0.141)	(0.106)
*1(*Patent*)*	- 0.162	- 0.209***	- 0.152	- 0.168**	- 0.157	- 0.444***
	(0.107)	(0.063)	(0.131)	(0.073)	(0.194)	(0.135)
*ln(*No.Employees*)*	0.023	0.089***	0.018	0.107***	0.030	0.050*
	(0.018)	(0.017)	(0.029)	(0.021)	(0.024)	(0.027)
*1(*Eastern Germany*)*	0.034	0.030	0.068	0.091	0.016	0.033
	(0.051)	(0.056)	(0.078)	(0.069)	(0.068)	(0.098)
*1(*Entry Threat*)*	1.087***	1.031***	1.292***	0.886***	0.953***	1.173***
	(0.078)	(0.104)	(0.127)	(0.139)	(0.101)	(0.158)
*1(*Foreign Competitors*)*	0.363***	0.360***	0.368***	0.431***	0.377**	0.071
	(0.086)	(0.072)	(0.107)	(0.081)	(0.147)	(0.165)
*1(*Exporter*)*	- 0.110	- 0.225***	- 0.233**	- 0.285***	0.007	- 0.079
	(0.076)	(0.058)	(0.106)	(0.068)	(0.110)	(0.116)
Sector dummies						
Cut-off 1	- 1.076***	- 1.288***	- 1.184***	- 1.386***	- 0.980***	- 1.524***
	(0.118)	(0.150)	(0.164)	(0.151)	(0.138)	(0.185)
Cut-off 2	- 0.277**	- 0.040	- 0.317**	- 0.161	- 0.221	- 0.193
	(0.116)	(0.148)	(0.161)	(0.147)	(0.135)	(0.177)
Cut-off 3	0.910***	1.418***	1.041***	1.375***	0.837***	1.144***
	(0.117)	(0.150)	(0.162)	(0.150)	(0.137)	(0.182)
No. Observations	2.131	2.023	964	1.318	1.167	705

Table 6 Correlation matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
1 ("Easy substitutability not applies")	1																	
1 ("Easy substitutability hardly applies")	-0.21 ***	1																
1 ("Easy substitutability rather applies")	-0.29 ***	-0.51 ***	1															
1 ("Easy substitutability fully applies")	-0.18 ***	-0.31 ***	-0.43 ***	1														
1 (Trademark)	0.01	0.07 ***	0.01	-0.10 ***	1													
1 (Trademarks important)	0.01	0.07 ***	0.02	-0.10 ***	0.87 ***	1												
1 (Entry Threat)	-0.08 ***	-0.17 ***	-0.09 ***	0.35 ***	-0.08 ***	-0.08 **	1											
1 (Foreign Competitors)	-0.06 ***	-0.10 ***	0.05 ***	0.09 ***	0.07 ***	0.08 **	0.22 ***	1										
1 (Exporter)	0.02	0.09 ***	-0.03 ***	-0.08 ***	0.16 ***	0.15 **	-0.03 **	0.15 ***	1									
1 (Product Innovator)	-0.04 **	0.14 ***	0.03 *	-0.16 ***	0.31 ***	0.31 ***	-0.12 ***	0.07 ***	0.18 ***	1								
1 (Patent)	0.02	0.12 ***	0.01	-0.16 ***	0.43 ***	0.42 ***	-0.10 ***	0.11 ***	0.26 ***	0.36 ***	1							
1 (Few competitors)	0.12 ***	0.15 ***	-0.10 ***	-0.14 ***	0.06 ***	0.05 **	-0.13 ***	-0.08 ***	0.07 ***	0.08 ***	0.13 ***	1						
ln(No.Employees)	-0.04 ***	0.00	0.05 ***	-0.02	0.28 ***	0.26 ***	-0.08 ***	0.07 ***	0.14 ***	0.20 ***	0.34 ***	0.05 ***	1					
1 (Eastern Germany)	0.01	-0.01	-0.01	0.01	-0.09 **	-0.08 **	0.03 **	-0.03 **	-0.05 ***	-0.05 ***	-0.08 ***	0.01	-0.17 ***	1				
1 (R&D-intensive industries)	0.04 *	0.11 ***	0.00	-0.15 ***	0.19 **	0.20 ***	-0.11 ***	0.13 ***	0.22 ***	0.29 ***	0.39 ***	0.09 ***	0.18 ***	-0.03	1			
1 (other manufacturing industries)	-0.08 ***	-0.09 ***	0.07 ***	0.07 ***	-0.02	-0.03	0.04 **	0.05 ***	-0.04 **	-0.06 ***	-0.05 ***	-0.03	-0.01	0.00	-0.39 ***	1		
1 (Knowledge-intensive services)	0.04 ***	0.06 ***	-0.05 ***	-0.03 **	-0.04 ***	-0.04 **	-0.04 **	-0.14 ***	-0.10 ***	-0.01	-0.13 ***	-0.05 ***	-0.16 ***	-0.01	-0.30 ***	-0.42 ***	1	
1 (other services)	0.01	-0.08 ***	-0.03 **	0.11 ***	-0.13 ***	-0.14 *	0.11 ***	-0.05 ***	-0.07 **	-0.22 ***	-0.20 ***	0.00	0.00	0.05	-0.25 ***	-0.35 ***	-0.27 ***	1