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CEOs and intellectual property: How managerial ability affects trademark registrations

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Abstract

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CEOs and intellectual property: How managerial ability affects trademark registrations

by

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ABSTRACT

Arguments based on the upper echelons theory suggest that managerial background characteristics may be decisive in determining organisational outcomes. Based on that general premise, we examine the extent to which managerial ability affects a company's decision to appropriate the value from its intellectual property. Focusing on trademarks as a means of protecting both innovation outcome and corporate reputation, we show that trademark registrations can be partially explained by the heterogeneity in CEO ability levels. More specifically, we find that CEOs with prevailing general skills are positively associated with trademark registrations, and the effect is reinforced by longer company tenure; in turn, recruiting executives from the outside of a company has a significant negative impact on the acquisition of new trademarks. Furthermore, CEOs with degrees in sciences or business studies tend to favour trademark registrations, unlike those who majored in arts or legal studies. Finally, executives who joined their companies or obtained their college degrees during an economic recession are associated with fewer trademark registrations. These results reinforce the discussion on the necessity to account for the managerial ability factor when considering the strategic decision processes.

KEYWORDS: CEO, intellectual property, innovation, corporate reputations, upper echelons theory, managerial ability, trademarks.

JEL CLASSIFICATION: L10, M12, O31, O34.

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1 INTRODUCTION

Much of the modern literature on the strategic decision process relies on the paradigm of bounded rationality which implies that in complex situations, human decision making is constrained by the information on all the alternatives they can obtain through the individual's idiosyncratic search processes, limited cognitive capabilities to asses all the potential outcomes, and time they can devote to making the decision (Conlisk, 1996; Eisenhardt and Zbaracki, 1992; Schwenk, 1995; Simon, 1979). Building upon the bounded rationality tenet, the upper echelons theory maintains that after reaching a certain minimum level of managerial discretion, CEOs wield influence over organisational outcomes, such as strategic choices and performance levels, by applying their personalised interpretations of strategic situations, and the decision-making style is likely to depend on the manager's values and cognitive bases (Carpenter et al., 2004; Finkelstein and Hambrick, 1990; Hambrick, 2007; Hambrick and Finkelstein, 1987; Hambrick and Mason, 1984; Hambrick et al., 2005). Existing studies on upper echelons tend to empirically confirm the contention that CEO characteristics are important in explaining variations in corporate strategy and call for further integrating this perspective in models of the strategic decision process (Chaganti and Sambharya, 1987; Kor, 2003; Norburn and Birley, 1988; Reed and Reed, 1989; Souder et al., 2012; Thomas et al., 1991).

Adopting the upper echelons approach, the purpose of this research is to examine the extent to which CEOs' personal characteristics make a difference in formulating a strategic decision to appropriate returns on intellectual property. We are particularly interested in a company's decision to register a trademark – either due to a product or marketing innovation or for protecting the company's reputation – as a function of its top manager's abilities. The original idea stems from the business literature where several authors have called for a new breed of executives whose understanding of the strategic value of intellectual property rights helps their companies secure competitive advantages and, hence, achieve market leadership (Reitzig, 2004; Reitzig, 2007; Rivette and Kline, 2000). Similarly, recent research in management have demonstrated a positive association between CEO-related issues and various elements of the innovation process at large, such as R&D expenditure (Barker and Mueller, 2002) and patenting (Wu et al., 2005; Kor, 2006; Custódio et al., 2015). Nevertheless, there is a surprising lack of systematic empirical evidence for the CEO's involvement in the downstream phase of the product development process when in a competitive environment, an organisation attempts to protect its product innovation and brand identity in the marketplace – the gap we seek to address.

We draw upon previous research (e.g., Holcomb et al., 2009) to conceptualise CEO characteristics in the form of managerial ability, which is a combination of knowledge, skills, and experience acquired by a top manager over the lifetime. Our main argument is that more able executives are better at recognising the importance of intellectual property protection for an organisation's strategic orientation and, therefore, tend to use this instrument more extensively than their less able rivals. The empirical model we propose includes various measures of the outlined components of managerial ability, such a CEO's general managerial skills, company-specific background, formal education, and labour

market experience. To proxy a company's involvement in the intellectual property protection process, we use a flow of trademark registrations. The choice of trademarks is stipulated by a number of reasons, among which the tightest association with top managers, in the sense that "[i]mportant trademark decisions other than strictly legal interpretations usually rest with top management" (Cohen, 1986:61), and the relevance to a wide range of organisations in different industries are the most appealing. So, if used properly, trademarks may not only last forever, but also confer a number of strategic advantages, such as a higher profit margin or consumer brand loyalty.

The paper's main contribution is to inform the long-standing choice determinism debate (Bourgeois, 1984; Hitt and Tyler, 1991; Hrebiniak and Joyce, 1985) by showing that strategic outcomes of an organisation are likely to be constrained by its manager's personal characteristics. Particularly, we provide new empirical evidence on the role managerial ability plays in a company's decision to register a trademark even after controlling for relevant industry- and firm-specific factors. Next, we also contribute to the literature on intellectual property rights by drawing attention to CEO heterogeneity as a factor that can be powerful in explaining the variations in trademark deposits (Greenhalgh and Rogers, 2007; Hall et al., 2014; Helmers and Rogers, 2010). Finally, we marginally add to the emerging literature on the use of trademarks as an indicator of innovation (e.g., Mendonça et al., 2004) by suggesting a novel classification of trademarks based on the "intent to use" basis (at application).

2 THEORETICAL FRAMEWORK

Conceptualising managerial ability

Managerial ability, as defined by Holcomb et al. (2009:460), is "the knowledge, skills, and experience, which is often tacit, residing with and utilized by managers". It rests on the underlying premise that more able managers possess such expertise that makes them better at "converting firms' resources into rent-generating capabilities" (Kor, 2003:707). The CEO forms the core of managerial ability: from the upper echelons perspective, he is the most powerful actor in organisations whose values and cognitive bases determine organisational outcomes (Hambrick and Mason, 1984). Despite the observation that under competitive assignment more talented managers tend to be matched to larger companies (so-called "positive sorting"; Gabaix and Landier, 2008; Rosen, 1982; Terviö, 2008), it has been widely accepted that CEO demographic factors still play a crucial role in explaining the heterogeneity in firm behaviour and economic performance (Bertrand and Schoar, 2003; Chang et al., 2010; Kaplan et al., 2012).

The conceptualisation of managerial ability at large involves considering its general and specialised components (Harris and Helfat, 1997; Murphy and Zábojník, 2004). Recognising that individuals differ in the amount of knowledge they acquire over a lifetime, either through formal training or personal experience, it seems a plausible conjecture that general skills would be equally useful in many organisations and lead to a similar increase in marginal product in all of them, whereas specialised skills would be applicable only in the organisation where they were mainly developed with no corresponding

effect on the productivity of an individual deploying these skills in other firms (Becker, 1962; Dragoni et al., 2011; Holcomb et al., 2009). A hierarchy-based view of the management function leads to further dividing its specialised constituent into industry- and firm-specific skills (Castanias and Helfat, 1991). In effect, this approach enables us to better capture different gradations of managerial ability, accounting for situations in which CEOs have less general but still fairly broad expertise that applies well to a particular industry. In a diversified firm, however, managerial ability may consist of a combination of specialised skills that, in turn, can form a variation of general skills (Rajagopalan and Prescott, 1990).

Alternatively, it may require that managerial ability reflects personal rather than organisational and environmental aspects (Castanias and Helfat, 1991). Then its classification can be developed by theorising around the question "What do good managers do?" (Katz, 1955). From this perspective, more able executives rely on three basic skills – technical, human, and conceptual. More specifically, technical skills involve an in-depth understanding of a specific activity, including methods, processes, procedures, or techniques it demands. The ability of a top manager to work as an effective team member and, at the same time, to build and maintain cooperative effort within the managing team constitutes human skills. Finally, conceptual skills enable the CEO to understand how the company operates as a whole, so that his actions become subject to maximising the company's welfare in a given situation. Even though they are obviously interrelated, "the relative importance of the three skills varies with the level of administrative responsibility [..., meaning that at] the top level of an organization, conceptual skill becomes the most important skill of all for successful administration" (Katz, 1955:34-38).

The strategic management literature suggests two major sources for drawing managerial ability – domain expertise and resource expertise (Holcomb et al., 2009). Domain expertise entails "a thorough understanding of the business environment", including the firm's position in the industry, its product and market specialisation, and organisational process (Spreitzer et al., 1997:7). The breadth of domain expertise is determined by the amount of knowledge that the executive gains from formal education programmes and at the worksite (also known as "learning-by-doing"; Hatch and Dyer, 2004; Holcomb et al., 2009; Levitt and March, 1988). This type of knowledge enhances top managers' cognitive flexibility, making them more capable in handling potential challenges and, thus, resolving a possible conflict between the company's strategic goals and the industrial environment, especially when information asymmetry is significant (Custódio and Metzger, 2013; Furr et al., 2012; Miller and Friesen, 2006). For instance, the CEO's domain expertise helps strengthen his bargaining position when acquiring other market assets because industry-related knowledge is particularly advantageous in estimating the assets' true value; so, experienced executives tend to "pay a smaller premium and engage in lower-value acquisitions on average" (Custódio and Metzger, 2013:34). Overall, domain knowledge is likely to be positively associated with successful leadership (Levy, 2014), but under certain conditions, may set boundaries on the top manager's vision which reduce his perception of the business environment compared with outsiders (Furr et al., 2012).

Resource expertise refers to the proficiency of the CEO in identifying, adjusting, integrating, and exploiting the firm's resources "to respond to a market opportunity to introduce a new product or service when the demand for it appears" (Sirmon et al., 2007:279). Although more able top managers are more likely to use the best resources at their disposal in the most efficient way (Holcomb et al., 2009), a limited deployment flexibility of the resources, and environmental uncertainty and munificence may reduce the room for manoeuvre (Sirmon et al., 2007; Sirmon, et al., 2008). In particular, the uncertainty argument implies that such expertise becomes pivotal for identifying the future value of a resource (Schmidt and Keil, 2013). That is, knowledge and interpretational skills possessed by CEOs (so-called "managerial mental models"; Foss et al., 2013) influence their expectations about the resource's value and enable them to quantify the risk associated with the realisations of those expectations. Therefore, resource expertise should be regarded as the executive's substantial competitive advantage (Kraaijenbrink et al., 2010) that endows him with essential skills for better identifying "those resources that allow firms to achieve competitive advantage and superior performance" (Foss et al., 2013:208).

3 HYPOTHESSIS DEVELOPMENT

Having strategic value, intangible resources form the basis for sustainable competitive advantages and ultimately contribute towards the company's overall success (see Fernández et al., 2000). The strategic management literature postulates that the CEO is "[t]he only executive who can be responsible for the totality of intangible resources", and his perception of the relative importance of these resources influences their deployment (Hall, 1992:139; Hall 1993).

In this research, we focus on an asset-related component of intangible resources represented by trademarks. The economic justification for protecting intellectual property in general is usually associated with the concept of market failure (Bator, 1958): that is, once developed, knowledge or creative work falls into the public good domain where it can be appropriated relatively easily by other market agents (it is commonly referred to as knowledge exhibiting non-excludable and non-rival characteristics; see Nelson, 1959; Arrow, 1962). By granting intellectual property rights, the state creates a legal, yet temporary monopoly that serves as an ex-ante incentive for the owner and helps him appropriate returns to his ideas (Besen and Raskind, 1991). The owner can form intellectual property portfolios by bundling together instrument with the same or different characteristics (see Hall et al., 2014). In turn, this choice shapes the trajectory in which the firm's intellectual property portfolio and, hence, its competitive position in relation to the rivals develops. However, it has just recently been recognised that in order to be successful in a highly competitive environment, the role of CEOs in intellectual property management should be extended beyond mere legal procedures.

The importance of top management's involvement in dealing with intellectual property rights has been particularly emphasised in the business literature. A work by Rivette and Kline (2000) promotes the idea that intellectual property is a crucial source of the company's added value nowadays, "the DNA of wealth creation", and argues that it becomes an imperative factor for firm survival that has to be recognised by CEOs. Considering some anecdotal evidence (such as Xerox and IBM), the authors

hypothesise that there is a new breed of executives whose understanding of the strategic importance of intellectual property helps their companies achieve market leadership. In consistence with our conceptualisation of managerial ability, this new breed, while possessing general skills such as the recognition of market trends, consumer orientation, and understanding the company's operation, has a keen interest in and strategic vision of intellectual property. Presumably, such a radical shift in top managers' perception of intellectual property rights is a response to "a new ecology of competition in which wars once fought for control of markets are now being waged over the exclusive rights to new ideas, innovations, and inventions" (Rivette and Kline, 2000:62). Overall, Rivette and Kline (2000:63-64; italics in original) devise a key assumption used in our study that "in today's knowledge economy, intellectual property can no longer be considered simply a legal function. It's about business strategy. And that makes it the responsibility of the chief executive officer."

Reitzig (2004) further develops Rivette and Kline's ideas. Similarly, he calls for elevating the role that intellectual property plays in a modern organisation from the functional to corporate level. However, the successful integration of intellectual property in the overall business strategy requires CEOs to take a strategic approach to the issue. According to his framework, intellectual property rights perform a multiple strategic function. They not only affect industry structure and create a market for new ideas but also help obtain incumbency advantages and, under certain circumstances, raise entry barriers. By combining intellectual property rights, the company may achieve vertical and horizontal differentiation, whereas the control over key rights enables it to exercise its power over suppliers in different segments of the value chain. It is also worth noting that along with CEO involvement, appropriate organisational arrangements can make it easier for the company to achieve success in executing its intellectual property strategy. In a subsequent work, Reitzig (2007) presents some empirical evidence for his earlier ideas. He surveyed top managers responsible for intellectual property matters in 34 major companies from eight different industries between 2003 and 2005. The results indicate that despite a difficulty concerning a universal strategy for intellectual property at the business-unit level, there is one strategic success factor that dominates and holds for all studied companies which is "corporate management’s genuine involvement in top-level IP-related projects/discussions" (Reitzig, 2007:41).

At the same time, the reality has somehow been different from the theory. Pointing at the lack of a common framework and functional silos within firm management, Fisher and Oberholzer-Gee (2013:157) argue that organisations "miss opportunities to create and exploit the value of intellectual property". To support their claim, the authors refer to the results of a recently conducted survey which show that only about 50 percent of executives "understand the value and importance of IP and are actively involved in strategic planning related to IP". Recognising the strategic value of intellectual property, they argue that the related decision making should involve a broader range of specialists, with executives taking the lead. Furthermore, "[c]ompanies that design products first and then search for ways of protecting them face a far narrower set of options than" is actually available (Fisher and Oberholzer-Gee, 2013:175). Even when legally acquired, the use of intellectual property rights should not be restricted to stereotypical patterns (such as suppressing competition). Particularly, the authors propose a

two-sided model which, on one hand, helps incumbents extract value from intellectual property and, on the other hand, advises novices on a strategic course of actions.

So, we can conclude that the world of CEOs is heterogeneous in many respects, and managerial ability is a dimension which seems to be crucial for determining the company's success in the competitive environment. Thus,

> **Main Hypothesis**. Since a CEO's ability to deal with intellectual property strategically can contribute towards the company's success, we expect it to be significant in explaining the variations in trademark registrations even after controlling for industry- and firm-specific effects.

Several studies in strategic management have demonstrated that if considered under the angle of the wider innovation process, CEO characteristics are significant in determining a company's R&D spending and inventive activities. Barker and Mueller (2002:782) examined 172 firms between 1989 and 1990 and found that "R&D spending is greater at firms where CEOs are younger, have greater wealth invested in firm stock and significant career experience in marketing and/or engineering/R&D". In line with the idea of CEO risk-aversion and self-interest (see Miller, 1991), their results suggest negative association between R&D investment and CEO tenure. Finally, they found no empirical evidence to support a relationship between formal education and R&D expenditure, apart from CEOs with science-related degrees who tend to be facilitating company research. Further, Kor (2006) studied U.S. technology-based entrepreneurial firms during 1990-1995 and found that R&D expenditure was negatively and nonlinearly related to company tenure. She points out that "managers who are relatively new to the firm and thus want to be affiliated with new product successes push for an intense R&D strategy to increase the likelihood and speedy development of innovative products" (Kor, 2006:1093). As for outcomes of the R&D process, Wu et al. (2005) showed that the relationship between CEO tenure and company inventive activities, measured as the total number of patents a firm successfully filed, represents an inverted U-shaped curve. That is, the CEO life cycle hypothesis that the CEO tenure can be considered as a set of stages, including adaptation, learning, experimentation, and inertial perspectives, was largely supported. Finally, Custódio et al. (2015) show that CEOs with extensive general skills are associated with more patent registrations. Their line of argument maintains that being inherently risky, inventive activities may be restrained by generally risk-averse CEOs; however, this effect can be substantially lower for CEOs with prevailing general skills as their expertise can be equally demanded by other companies even if the outcome of the innovation project is negative.

To sum up, more able managers possess such domain expertise that helps them better understand and respond to challenges of the environment in which their companies operate. Resource expertise, in turn, enables CEOs to respond to the demand for new goods and services. As a result, they are likely to be proactive and acquire legal protection for new products before their actual introduction in the marketplace. However, for certain categories of executives, a potential riskiness of the innovation process may impede them from pursuing innovation-related activities which also results in a lower number of intellectual property rights being registered. At the same time, more able CEOs, while in office, may be

willing to secure the company's competitive advantages and returns from already existing products by acquiring intellectual property rights. This decision may not imply significant costs, but potential benefits of this action may be in the form of greater shareholder value as brands are perceived to be valuable assets. Furthermore, given that until recently intellectual property issues had been largely viewed as a responsibility of legal departments, CEOs with a degree in legal studies may take a positive stance towards intellectual property protection; however, this factor may also have a negative impact – knowing that legal recognition imposes certain responsibilities on the right's holder, these CEOs may attempt to avoid the firm's involvement in protecting its reputation on the federal level and stay within the common law boarders. Presumably, CEOs with a degree in business may be in a better position to recognise the strategic value of intellectual property, given that the curriculum touched upon intellectual property issues. Thus,

Hypothesis 1. Trademark registrations can be viewed as either a manifestation of the innovation process (product or marketing innovations) or the company's attempt to secure its reputation. As a result, different sets of CEO skills are important when either of the goals is pursued.

Hypothesis 2 (a). For innovation-related trademarks, CEOs with extensive general abilities are positively associated with trademark registrations.

Hypothesis 2 (b). For innovation-related trademarks, CEO tenure is negatively associated with trademark registrations.

Hypothesis 2 (c). For innovation-related trademarks, CEOs with science-related degrees, legal, or business degrees are positively associated with trademark registrations.

Hypothesis 3 (a). For reputation-based trademarks, CEOs with extensive company-specific abilities are positively associated with trademark registrations.

Hypothesis 3 (b). For reputation-based trademarks, CEO tenure is positively associated with trademark registrations.

Hypothesis 3 (c). For reputation-based trademarks, CEOs with a business degree are positively associated with trademark registrations.

Hypothesis 4. CEOs with the experience of tight labour market tend to be risk averse and, as a result, are associated with fewer innovation-related trademarks.

4 METHODS

Sample and data collection procedure

We test the hypotheses by examining a longitudinal sample of 263 U.S. publicly-traded companies for the period 1992-2012. The sample was constructed by matching the Standard & Poor's ExecuComp dataset to the Standard & Poor's Compustat North America dataset. In the merged sample, we chose only the companies with the coverage for the entire period of interest and for which we were

able to identify CEOs at any year. All monetary indicators were additionally adjusted to constant 2009 U.S. dollars using the GDP deflator available from the U.S. Bureau of Economic Analysis. CEO demographic characteristics were then manually added by examining such sources as Marquis Who's Who directories; the Bloomberg database; companies' SEC filings, press releases, and official web-sites; and CEOs' LinkedIn profiles, university yearbooks, and obituaries.

A separate procedure was developed to obtain information on trademark registrations. We derived trademark data from the USPTO Trademark Case Files dataset (Graham et al., 2013). To ensure data consistency, we had to exclude trademarks with missing owners, non-U.S. owners (based on both the owner's address and nationality), owners who were individuals, and different owners at application and registration. Trademarks with a missing class or type were also removed. Since there was no unique identifier based on which the trademark data could be linked to the firm-level data, we employed the combination of company name and application year[3] as the key field – a commonly used approach in research on intellectual property rights (see Thoma et al., 2010). However, we first had to eliminate the heterogeneity of company names caused by inconsistent abbreviations, variations of names, spelling mistakes, and typographical errors. We applied the methodology proposed by Magerman et al. (2006) and further developed by Magerman et al. (2011) that includes, inter alia, character and punctuation cleaning, legal form indication treatment, common company word removal, and spelling variation harmonisation. For compatibility reasons, we applied the same methodology to company names in the Compustat dataset. As the company name heterogeneity could not be ruled out completely at this stage, we decided to use a mixed method consisting of the edit distance and the token algorithms (Raffo and Lhuillery, 2009) to link the datasets. Finally, a manual check was performed for companies with less than 20 assigned trademarks: we applied approximate search to the entire trademark dataset by using key elements of a company's name to look for trademarks unidentified at previous stages. Although the overall approach enabled us to reduce false positives to some minimal level, there is still a chance for having false negatives caused by, for instance, a company's name change or non-captured name variations.

So, our final sample contains 5,523 firm-year observations on 854 CEOs in 263 U.S. publicly traded companies from 40 industries[4] over the period 1992-2012. For these companies, we were able to identify 34,475 trademarks registered in 41,395 classes, which is roughly 1% of the entire population in the trademark dataset.

Dependent variable

To evaluate the effect of managerial characteristics on the decision to register an intellectual property right, we employed trademarks registered with the United States Patent and Trademark Office

[3] It should be stressed that in this research, we use application year because it enables us to better trace the CEO-trademark link. So, it would be correct to say that we examine trademark applications that were eventually registered. However, we shall further refer to them as trademark registrations, for the sake of simplicity.

[4] In this study, we use the Fama-French industrial classification (see Fama and French, 1997).

(USPTO).[5] The use of federally protected trademarks possesses certain merits and limitations of its own: on the one hand, the USPTO trademark statistics are a valuable source of fairly accurate and very detailed information, extending over several decades, about different aspects of the Federal trademark registration process; on the other hand, in countries following a common law system (and the United States is among them), trademark rights are generally acquired through being the first to use a trademark in commerce (so-called "technical trademarks"; see Cohen, 1986), and federal registration, albeit being beneficial in many respects, is not mandatory for enjoying legal protection. Therefore, this measure may suffer from selection bias and, hence, underestimate the actual effect. At the same time, we believe that this criticism mainly applies to small and medium sized firms, whereas large companies with diverse product portfolios may find it strategically challenging to rely on common law exclusively and, in turn, prefer to obtain federal protection.[6]

Although trademark protection does not act as an incentive for innovation and creativity (Besen and Raskind, 1991), several authors have recently suggested that trademark registrations can be instrumental in studying innovation and industrial dynamics (Mendonça et al., 2004; Stoneman, 2010): in particular, they point out that trademarks may transmit to consumers a signal about an unobservable innovation process. Resting on this premise, we adopt a classification of trademark registrations which, in our opinion, enables us to disentangle innovation-related trademarks from trademarks that reflect other firm-level processes. Similar to other intellectual property assets, each trademark has its own lifecycle which is predetermined not only by law and legal procedures but also by a company's branding strategy. It does not necessarily start with the application for or registration of trademark right: under a common law system, some companies may choose to use technical trademarks for a certain period of time and obtain federal protection at a later stage of trademark lifecycle. The opposite can also be true – a firm may wish to apply for the formal registration of a trademark some time before its actual use in commerce. In the United States, the Trademark Law Revision Act of 1988 expanded the grounds on which trademark registrations were permitted: it introduced a provision that a trademark is eligible for federal protection either if it is used in commerce or if the registrant can demonstrate a bona fide intent to use it in commerce.[7] So, we argue that trademarks registered on the "intent to use" basis (at application) are likely to be associated with an unobservable innovation process, whereas other legal bases for filing do not allow us to establish this link with a comparable degree of certainty. One may argue, however, that trademark registrations granted on the "intent to use" basis (at application) may also contain information on newly created firms aspired to protect their brand identity. Sharing this criticism in general, it seems to be less applicable to the companies in our sample due to their long-standing presence in the marketplace.

[5] It is worth noting that we use a trademark's class as a unit of measurement to account for the fact that "[a]n owner can achieve the same protection for a mark through multiple single class registrations or one multiple class registration" (Graham et al., 2013:59).

[6] Form an economic point of view, for large companies the opportunity cost of applying for trademark registration is likely to be much lower than its expected value (Mendonça et al., 2004).

[7] According to USPTO (2014:19), "having a business plan, creating sample products, or performing other initial business activities may reflect a bona fide intent to use the mark".

Independent variables

General skills. In this research, we used the CEO's general ability index (GAI) proposed by Custódio et al. (2013) which they developed by analysing the lifetime work experience of executives in publicly traded companies. Particularly, they considered such criteria as the number of positions (X1), number of firms (X2), and number of industries (X3) where a CEO worked during his career, as well as the CEO experience (X4) and conglomerate experience (X5) dummies.[8] To combine these factors in a single index, they extracted common components by using principal component analysis. With each component being positively correlated with the general ability index, the final equation takes the following form:

$$\mathrm{GAI}_{i,t} = 0.268\,\mathrm{X1}_{i,t} + 0.312\,\mathrm{X2}_{i,t} + 0.309\,\mathrm{X3}_{i,t} + 0.218\,\mathrm{X4}_{i,t} + 0.153\,\mathrm{X5}_{i,t}. \quad (1)$$

The resulting index was then standardised to have zero mean and a standard deviation of one. We, in turn, linked these data to our sample by using EXECID – a unique identifier for each person in the ExecuComp database. We were unable to identify 234 CEOs because the original index was calculated for the period 1993-2007 only and, therefore, did not account for earlier or later CEO appointments. For those CEOs who had still been in office outside of this timeframe, we decided to extrapolate existing index values on preceding or subsequent years, assuming that these values did not deviate significantly from the already observed levels. This approach enabled us to improve the time coverage and to reduce the number of omitted observations to 688 firm-year observations.

Next, we control for a CEO's training level by tracking his degrees' history. First, we group the data on the level of education attained: we distinguish between CEOs who obtained a bachelor's degree from those who did not. For CEOs with a bachelor's degree, we further control for the total number of university degrees they were subsequently awarded. Next, we adopt the classification proposed by Barker and Mueller (2002) to derive the highest degree a CEO attained: it is based on a four-point scale where 0 = no college degree; 1 = undergraduate degree; 2 = master's degree, MBA, or JD; and 3= PhD degree. Further, we account for the specialisation a CEO was trained in: initially, we created five major groups, including arts, engineering, medicine, sciences, and social sciences; we then removed controls for engineering and medicine, and divided degrees in social sciences by business and legal degrees to avoid multicollinearity. Finally, we control for a university type – private, public, or foreign, and belonging to the Ivy League or the Association of American Universities – in order to account for selectivity.

CEO company-specific experience. To capture the company-related component of managerial ability, we calculated company tenure and CEO tenure. We also identified whether a CEO was hired from the outside of a company or promoted internally by introducing the external hire dummy: we consider the hire to be external if the difference between the year a manager joined the company and the year he

[8] For calculating the index, Custódio et al. (2013) examined a sample of CEOs they obtained by manually matching the executives in the ExecuComp database who were identified as CEOs in a specific year with profiles in the BoardEx database.

became a CEO is less than or equal to 1. Additionally, we control for short tenure, the age at which a manager was appointed as a CEO, a CEO's age, and gender (1 = male; 0 = female).

CEO labour market experience. We used the NBER's data on the U.S. business cycle expansions and contractions to distinguish between CEOs who were hired or obtained their university degrees during a recession period. We introduced four dummy variables: an undergraduate degree obtained during a recession, the highest degree obtained during a recession, a manager joined the company during a recession, and a manager was appointed as a CEO during a recession.

Control variables

In order to control for firm-specific effects, we use a standard set of proxies (see Custódio et al., 2013; Krasnikov et al., 2009). Firm size is measured as the logarithm of the total number of employees (Compustat mnemonic EMP). Establishment date refers to the year a company considers as its inception year. Capital intensity is calculated as the ratio of property, plants, and equipment to the number of employees (PPENT/EMP). Due to the fact that firm-level data on advertising and R&D expenditure are sparsely populated, we employ a more inclusive measure that accounts for selling, general, and administrative expenses scaled by total assets (XSGA/AT). Finally, we control for a firm's prior performance by including Tobin's Q, ROA, and leverage.

We also use proxies to control for industry-specific (or environmental, which are related to dynamism and heterogeneity; see Miller et al., 1982; Krasnikov et al., 2009) effects, including industry demand growth and industry demand instability. The former is measured as the average 5-year sales growth for each industry, while the latter is calculated as the standard deviation of 5-year sales growth for each industry. Industry R&D intensity is the average ratio of firms' R&D expenditure to total assets. Industry advertising intensity is the average ratio of firms' advertising expenditure to total sales. Market concentration is measured by using the Herfindahl-Hirschman index. Industry dummies are also introduced to account for specific effects for the service sector.

Model estimation

Given that our dependent variable – trademark registrations – takes on a limited range of nonnegative integer values, it seems natural to assume that it follows the Poisson distribution (see Hausman et al., 1984). However, more detailed analysis shows that the trademark data display substantial overdispersion (that is, the conditional variance is much greater than the conditional mean), and the statistical inference with Poisson methods may therefore yield erroneous or overly optimistic results (Cox, 1983; Dean and Lawless, 1989; Paul and Plackett, 1978; Quenouille, 1949). So, we come to the decision that the data are fitted well by the negative binomial distribution which is essentially a generalised version of the Poisson distribution with a stochastic component that handles the problem of overdispersion (Greene, 2003; Greene, 2008; Hausman et al., 1984).

The estimated model can be specified in the following basic form:

$$\mathrm{E}\left[\mathrm{Y}_{\mathrm{i,t}}|\mathrm{X}_{\mathrm{j,t-1}}, \mathrm{M}_{\mathrm{i,t-1}}, \mathrm{N}_{\mathrm{h,t-1}}\right] = \mathrm{e}^{(\alpha + \beta \mathrm{X}_{\mathrm{j,t-1}} + \gamma \mathrm{M}_{\mathrm{i,t-1}} + \theta \mathrm{N}_{\mathrm{h,t-1}} + \lambda_{\mathrm{t}})}, \quad (2)$$

where $E[Y_{i,t} | X_{j,t-1}, M_{i,t-1}, N_{h,t-1}]$ is the conditional expectation of the number of trademark registrations for firm i in period t, $X_{j,t-1}$ is a vector of CEO-related variables for CEO j in period t-1, $M_{i,t-1}$ is a vector of firm controls for firm i in period t-1, $N_{h,t-1}$ is a vector of industry controls for industry h in period t-1, and λ_t is a vector of time-period effects. All independent variables are lagged one period to avoid simultaneity bias. Effectively, this model considers β as an indicator of whether companies run by more able CEOs are expected to generate a higher number of trademark registrations than their rivals led by less able executives.

Due to the panel nature of our data, we also have to determine whether a fixed or random effects specification is preferred. Although the random effects model allows for more degrees of freedom, it may suffer from the inconsistency caused by assuming the individual effects to be uncorrelated with the other regressors (Greene, 2003). By contrast, the fixed effects model exploits within-group variation over time to estimate the regression coefficients, which excludes omitted variable bias. A widely used approach to decide on which specification is more appropriate is to use a test developed by Hausman (1978). Its results suggest that the fixed effects model should be employed because the null hypothesis of the orthogonality of the random effects and the regressors must be rejected. Following this justification, we report the results based on a fixed effects specification. However, it is worth noting that several authors (Allison and Waterman, 2002; Guimarães, 2008) have expressed their concerns about the validity of a fixed effects negative binomial model, as proposed by Hausman et al. (1984). More specifically, they argue that "the conditional maximum likelihood estimator of the negative binomial with fixed effects does not necessarily remove the individual fixed effects in count panel data" (Guimarães, 2008:66). In order to address this criticism as well as to reinforce the robustness of our results, we tested an additional specification with an unconditional fixed-effects estimator (Allison and Waterman, 2002). Evidently, the results were relatively stable for the independent variables of interest across different specifications; moreover, after comparing the fixed and random effects negative binomial models, the coefficients were substantially similar.

5 RESULTS

Table 1 provides the descriptive statistics and correlation matrix of the variables used in assessing the link between managerial ability and trademark registrations.

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= Table 1 about here =
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In our sample, the average company register 7 trademarks per year, and large companies tend to be more trademark active. We also observe the positive association of trademark registrations with advertising and R&D expenditure which can be interpreted as evidence of trademarks being both a valuable means for communicating with customers and an indicator of innovation activity. The absolute majority of executives in our sample are male, they have an average CEO tenure of 8 years and an average company tenure of 22 years. On average, around 20% of their compensation is received in the

form of options. Almost all CEOs have a bachelor's degree, and a significant proportion of them also studied for a master's degree. The most popular major is business studies, while an MBA degree was awarded to 36% of all top managers in our sample. Roughly 50% of the executives obtained their degrees from private universities. Finally, about one of three CEOs previously experienced tough labour market condition, either after their graduation or during their career pathway.

Table 2 presents the results of negative binomial regressions of trademark registrations on the CEO general ability index and firm-specific skills. It confirms our main hypothesis that managerial ability is significant in explaining trademark registrations, and that its effect is slightly different for reputation-based and innovation-related trademarks (Hypothesis 1). CEOs hired from the outside of a company are negatively and significantly associated with trademark registrations. CEO tenure is positively associated with all kinds of trademarks (it is contrary to Hypothesis 2(b) and supports Hypothesis 3(b)) but significant only for reputation-based trademarks; company tenure is positively and significantly associated with all trademark types (it supports Hypothesis 3(a)). CEOs with a higher general ability index are positively and significantly associated with trademark registrations (it supports Hypothesis 2(a)), and the effect is larger for reputation-based trademarks. Finally, CEO compensation that includes a sizable proportion of options is positively associated with trademark registrations, albeit only marginally significant, and the effect on innovation-based trademarks is generally larger.

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= Table 2 about here =

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Table 3 reports the results regarding CEO education. The results suggest that the effect of the highest degree in arts on trademark registrations is negative and significant, and the highest degree in legal studies has a negative, but statistically insignificant, association with trademark registrations (it partially contradicts Hypothesis 2(c)). The highest degree in sciences is negatively associated with the overall count of trademark registrations, but has a positive association for innovation-related and reputation-based trademarks individually (it partially supports Hypothesis 2(c)). At the same time, the highest degree in business, although being positively associated with trademark registrations, is only statistically significant for overall trademark counts and for reputation-based trademarks (it supports Hypothesis 2(c) partially and Hypothesis 3(c) fully). The highest degree from a private university is positively and significantly associated with trademark registrations. Finally, the number of degrees a CEO obtained is only positively associated with innovation-related trademarks, but the effect is statistically insignificant.

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= Table 3 about here =

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Table 4 presents the results of the test of the hypothesis regarding a CEO's labour market experience. The association between trademark registrations and the labour market effect, as measured by

an undergraduate degree obtained in a recession year, is negative and statistically significant across all trademark groups. However, for overall trademark counts and innovation-based trademarks, the labour market effect as measured by becoming a CEO in a recession has a positive and statistically significant association. For reputation-based trademarks, this effect negative, but statistically insignificant. Overall, Hypothesis 4 is partially supported.

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= Table 4 about here =

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6 DISCUSSION

The results of our study provide strong support for the main hypothesis that managerial ability is important in determining an organisation's intellectual property rights trajectory even when controlled for industry- and firm-fixed effects. Particularly, we have demonstrated that in spite of various reason to apply for a trademark – to appropriate returns from the innovation activity or to secure the company's reputation, CEO characteristics are important for making this decision.

More specifically, CEOs' general skills are positively associated with trademark registrations, confirming an already observed effect for patents: that is, "CEOs who gain more human capital through their lifetime work experience promote more innovation in the organizations that they run" (Custódio et al., 2015). At the same time, trademarks as a means of product differentiation requires "a broader knowledge base and the ability to explore and evaluate a range of competitive behaviors" (Rajagopalan and Prescott, 1996:201).

Our results also demonstrate that unlike previous studies which associate shorter company tenures with product-market innovation and diversification strategies, company tenure is positively associated with the number of trademark registrations. A plausible explanation lies in its effect on a CEO's cognitive orientation and knowledge base, meaning that a high degree of organisation-specific knowledge, acquired during a longer tenure with the company, turns out to be valuable for a better understanding of strategic opportunities conveyed by trademarks. Similarly, CEO tenure has a positive association with trademark registrations, but the factor is only significant for reputation-related trademarks. We speculate that more able CEOs, while in office, are willing to secure the company's competitive advantages and returns from already existing products by acquiring intellectual property rights – this decision may be beneficial for shareholders as brands are perceived to be valuable assets. Recognising trademarks as a signal of product or marketing innovation (Mendonça et al., 2004), we can also conclude that longer-tenured CEOs are more reluctant to changes and prefer not to bear risks pertained to innovation activities, but when a product is at its commercialisation stage, the rent-seeking effect outweighs.

Further, the argument against business education in general as breeding risk-averse managers (Barker and Mueller, 2002) fails to find empirical support since CEOs with the highest degree in a

business discipline are associated with higher trademark registrations (total counts and reputation-based trademarks). At the same time, there is a negative association between executives with the highest degree in law and trademark registrations (albeit not statistically significant) due to a seeming lack of emphasis on innovation and the awareness of possible legal consequences intellectual property rights may imply. A degree from a private university has a significantly positive impact on trademark registrations, confirming the selective nature of these institutions.

Finally, negative experience of the tight labour market is mainly relevant to the moment when a CEO obtained his undergraduate or highest degree – a part of the wider effect of economic conditions on labour market outcomes (Oyer, 2008; Kahn, 2010; Schoar and Zuo, 2011). Interestingly, managers who are appointed to a CEO job during an economic recession are positively associated with innovation-related trademarks and do not demonstrate signs of risk aversion in this respect as one might have expected it – the effect that shall be further studied.

7 CONCLUSION

This study argues that managerial ability should be taken into account when explaining the heterogeneity in a company's strategic behaviour. We have demonstrated that more able executives are better at perceiving the strategic value of intellectual property and, hence, tend to register trademarks more often than their less able rivals. The results lend further support to the upper echelons theory and contribute to the ongoing debate on the strategic view of intellectual property in general and the necessity to involve CEOs in the process of intellectual property management in particular.

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APPENDIX

Table 1. Sample Statistics and Correlations [a]

Variables	Obs.	Mean	Median	s.d.	Min	Max	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38
1. Trademark registrations	5,523	7.495	1.000	17.034	0.000	318.000	1	**0.304**	**-0.066**	**-0.092**	**0.256**	**0.213**	**0.159**	**-0.082**	0.012	**-0.094**	**0.206**	**0.218**	**0.168**	**0.108**	-0.016	**-0.081**	0.006	**0.042**	**0.249**	**0.107**	-0.014	**-0.079**	**0.095**	0.037	0.000	**0.108**	**-0.055**	0.014	**0.105**	**-0.108**	**0.131**	0.002	**-0.111**	**0.075**	0.003	-0.021	0.032	-0.011
2. Company size[b]	5,523	9.258	9.290	1.566	1.099	13.094	**0.310**	1	**-0.210**	**-0.147**	**0.126**	**0.124**	**0.093**	-0.001	**-0.047**	**-0.165**	**0.089**	**0.113**	**0.155**	**0.241**	-0.039	**-0.141**	**-0.056**	**0.150**	**0.546**	**0.106**	0.016	**-0.055**	**0.042**	0.029	-0.038	**0.072**	-0.009	0.009	**0.068**	**-0.059**	**0.042**	**-0.058**	**-0.075**	**0.055**	0.031	0.008	**0.051**	-0.010
3. Establishment date	5,523	1,919	1,917	42	1,784	1,989	**-0.094**	**-0.268**	1	**-0.207**	**0.199**	**0.257**	**0.201**	**-0.247**	0.038	**-0.075**	**0.083**	**0.154**	**0.154**	**-0.141**	0.033	**0.209**	0.018	**-0.081**	**-0.220**	-0.021	**-0.119**	**-0.094**	**-0.054**	**0.050**	**-0.043**	**-0.182**	-0.025	0.019	**-0.044**	**-0.077**	**-0.083**	**0.056**	-0.031	**-0.138**	-0.038	**-0.090**	0.020	0.003
4. Capital intensity[b]	5,523	4.116	4.040	2.380	-13.816	9.199	-0.013	**-0.111**	**-0.070**	1	**-0.413**	**-0.149**	**-0.127**	**0.334**	0.030	**0.154**	**-0.122**	**-0.136**	**-0.225**	**0.126**	-0.015	**-0.125**	0.004	-0.022	0.035	**-0.043**	**0.088**	0.011	**0.097**	**-0.079**	0.007	-0.008	-0.013	0.027	**-0.098**	**0.120**	**-0.052**	0.025	**0.121**	0.000	0.031	**0.061**	-0.005	-0.028
5. Selling, general, and administrative expenses[b]	5,523	-4.137	-1.930	4.767	-13.816	0.159	**0.135**	**0.084**	**0.152**	**-0.070**	1	**0.504**	**0.439**	**-0.288**	**-0.106**	**-0.250**	**0.261**	**0.422**	**0.375**	**-0.051**	-0.026	0.011	0.006	-0.010	-0.039	**0.080**	**-0.132**	0.000	0.002	**-0.053**	**-0.081**	-0.010	0.024	0.038	**0.061**	**-0.225**	0.021	**-0.073**	**-0.221**	**0.094**	0.002	**-0.126**	-0.006	**-0.043**
6. Tobin's Q	5,523	1.873	1.490	1.264	0.404	16.138	**0.151**	-0.012	**0.239**	-0.019	**0.237**	1	**0.730**	**-0.335**	**0.075**	**-0.219**	**0.307**	**0.370**	**0.280**	**-0.059**	0.030	-0.021	-0.012	0.034	**0.128**	**0.161**	**-0.102**	-0.004	**0.042**	**-0.087**	**-0.053**	-0.007	0.035	**0.090**	**-0.041**	**-0.150**	0.022	0.014	**-0.120**	-0.034	**0.056**	-0.024	**0.113**	-0.029
7. ROA	5,523	0.050	0.050	0.097	-3.247	0.953	**0.099**	**0.160**	**0.046**	0.030	**0.186**	**0.316**	1	**-0.316**	**0.057**	**-0.208**	**0.159**	**0.256**	**0.219**	**-0.068**	0.025	0.020	-0.001	**0.065**	**0.091**	0.024	**-0.098**	-0.022	0.012	**-0.051**	-0.010	-0.031	0.001	**0.045**	-0.030	**-0.085**	-0.011	**-0.043**	**-0.078**	-0.029	-0.003	**-0.061**	**0.087**	-0.031
8. Leverage	5,523	0.233	0.220	0.167	0.000	1.455	-0.030	**0.062**	**-0.133**	**-0.068**	**-0.258**	**-0.258**	**-0.123**	1	**-0.113**	0.016	**-0.204**	**-0.178**	**-0.107**	**0.087**	**-0.063**	**-0.134**	0.009	**-0.103**	0.039	**-0.046**	**0.137**	**0.149**	0.023	**-0.110**	**0.044**	**0.083**	0.032	**-0.048**	-0.035	**0.209**	**0.067**	-0.012	**0.119**	**0.044**	**-0.041**	**0.096**	**-0.041**	0.004
9. Industry demand growth	5,523	1.044	1.040	0.049	0.836	1.435	-0.019	**-0.040**	**0.066**	-0.001	**-0.118**	**0.127**	**0.038**	**-0.073**	1	**0.078**	**0.110**	0.018	**-0.208**	0.004	**0.050**	-0.016	**0.067**	-0.023	0.017	**0.191**	-0.002	**-0.045**	**0.067**	-0.016	0.034	0.034	**-0.051**	**0.079**	**-0.067**	0.014	0.001	**0.045**	0.023	**-0.052**	0.019	0.019	0.014	-0.024
10. Industry demand instability	5,523	0.084	0.070	0.055	0.006	0.510	**-0.095**	**-0.128**	**-0.040**	**0.084**	**-0.185**	**-0.162**	**-0.090**	0.013	**0.287**	1	-0.040	**-0.212**	**-0.082**	**0.068**	**-0.044**	0.009	**0.053**	-0.032	0.013	0.019	**0.082**	**-0.067**	0.026	-0.036	0.033	**-0.057**	**-0.065**	-0.017	-0.003	-0.024	-0.027	-0.024	0.013	**0.057**	-0.001	-0.014	-0.019	0.033
11. Industry R&D intensity	5,523	-3.224	-2.910	1.673	-8.680	-0.525	**0.110**	0.025	**0.079**	**-0.147**	**0.362**	**0.203**	0.023	**-0.184**	**0.135**	0.028	1	**0.422**	**0.221**	0.024	**0.061**	**-0.043**	-0.001	0.005	**0.160**	**0.162**	0.016	**-0.074**	0.039	-0.007	**-0.046**	**0.138**	-0.004	**0.047**	**0.071**	**-0.176**	**0.154**	**0.057**	**-0.151**	**0.067**	-0.001	-0.037	0.037	-0.020
12. Industry advertising intensity	5,523	-3.485	-3.490	1.103	-7.790	-0.544	**0.190**	**0.053**	**0.161**	**-0.090**	**0.384**	**0.281**	**0.067**	**-0.151**	**0.090**	**-0.177**	**0.442**	1	**0.306**	-0.006	-0.009	-0.020	-0.015	0.030	0.038	**0.203**	**-0.114**	-0.018	-0.006	**0.046**	**-0.075**	**0.081**	**0.059**	**0.042**	**0.043**	**-0.192**	**0.067**	**0.040**	**-0.158**	-0.024	0.023	**-0.105**	0.036	-0.028
13. Industry HH index	5,523	0.062	0.050	0.081	0.008	0.785	**0.087**	**0.097**	**0.090**	-0.030	**0.103**	0.018	-0.005	0.017	**-0.078**	**-0.043**	**0.097**	**0.041**	1	0.036	**-0.096**	0.018	-0.017	-0.011	**0.091**	**-0.041**	**0.047**	-0.010	0.008	-0.011	**-0.042**	**0.043**	**-0.048**	0.032	**0.044**	**-0.049**	**0.073**	0.026	-0.027	**0.092**	-0.013	0.040	0.037	**0.056**
14. General Ability Index	4,835	0.027	-0.160	0.932	-1.504	5.434	**0.097**	**0.270**	**-0.135**	0.019	**-0.094**	**-0.057**	-0.027	**0.079**	0.020	**0.078**	0.020	-0.027	**0.082**	1	**-0.062**	**-0.072**	**0.207**	**-0.195**	**0.274**	0.003	**0.221**	**-0.056**	**0.066**	-0.020	**-0.046**	**0.110**	**-0.146**	-0.022	**0.056**	**0.063**	**0.070**	**0.044**	**0.124**	**0.088**	**-0.048**	**0.057**	**-0.069**	0.030
15. CEO gender (1 - male, 0 - female)	5,523	0.987	1.000	0.113	0.000	1.000	-0.023	**-0.053**	**0.036**	-0.025	-0.017	0.029	0.016	**-0.065**	**0.043**	**-0.042**	**0.057**	0.010	-0.011	**-0.084**	1	**0.074**	-0.028	**0.098**	**-0.042**	**0.053**	-0.022	**-0.110**	-0.014	-0.002	0.016	**-0.047**	**-0.139**	0.015	-0.005	0.020	0.036	0.027	0.036	-0.012	**-0.056**	-0.006	**0.074**	0.000
16. CEO tenure	5,523	8.224	5.970	7.651	0.080	49.033	**-0.068**	**-0.111**	**0.250**	**-0.041**	0.010	**0.048**	0.035	**-0.127**	**0.051**	0.004	-0.019	0.029	0.011	**-0.086**	**0.066**	1	**-0.053**	**0.374**	**-0.146**	**-0.135**	**-0.048**	**0.062**	**-0.050**	**-0.047**	0.023	0.020	0.038	-0.039	-0.039	0.007	**0.065**	**0.045**	0.034	-0.038	**-0.041**	0.031	**0.085**	**0.183**
17. External hire	5,523	0.161	0.000	0.368	0.000	1.000	-0.032	**-0.093**	**0.069**	**-0.054**	0.010	-0.026	-0.034	-0.012	0.030	0.028	0.015	0.008	-0.022	**0.196**	-0.016	-0.020	1	**-0.513**	**0.059**	-0.001	0.029	**-0.054**	0.031	-0.022	**-0.054**	-0.009	-0.006	0.020	0.038	**-0.055**	-0.013	-0.036	**-0.044**	**0.051**	**0.082**	**-0.043**	**-0.150**	**-0.070**
18. Company tenure	5,523	21.625	22.020	11.828	0.080	58.038	**0.059**	**0.181**	**-0.109**	**0.059**	0.002	0.021	**0.081**	**-0.086**	0.013	**-0.036**	-0.005	**0.036**	-0.028	**-0.185**	**0.080**	**0.382**	**-0.505**	1	-0.018	0.005	**-0.105**	**0.062**	-0.038	**-0.072**	**0.096**	-0.037	**0.060**	0.000	**-0.074**	0.008	-0.015	**0.051**	-0.040	**-0.104**	-0.018	-0.035	**0.204**	**0.078**
19. Total compensation[b]	5,523	8.141	8.210	1.356	-13.816	13.505	**0.160**	**0.405**	**-0.227**	**-0.035**	-0.022	**0.039**	**0.070**	**0.091**	0.022	0.032	**0.099**	0.018	0.034	**0.200**	**-0.045**	**-0.143**	0.015	-0.016	1	**0.208**	**0.131**	-0.030	**0.080**	**-0.049**	**0.058**	**0.129**	-0.010	0.035	0.005	**0.055**	**0.111**	-0.011	0.027	**0.100**	**0.042**	**0.064**	-0.011	**-0.081**
20. Option compensation	5,523	0.199	0.000	0.256	0.000	1.000	**0.047**	**0.099**	0.012	**-0.044**	**0.062**	**0.182**	0.021	**-0.060**	**0.215**	0.012	**0.194**	**0.204**	-0.005	0.008	**0.052**	**-0.048**	0.009	0.013	**0.238**	1	0.025	-0.004	-0.003	**-0.065**	**0.054**	**0.085**	-0.037	0.018	-0.020	-0.023	**0.055**	**0.043**	**-0.050**	0.011	0.039	0.030	**0.049**	**-0.057**
21. Number of degrees	5,486	1.656	2.000	0.717	0.000	4.000	-0.027	0.016	**-0.084**	-0.001	**-0.146**	**-0.067**	-0.030	**0.131**	-0.002	**0.077**	0.005	**-0.096**	**0.123**	**0.227**	-0.015	**-0.042**	**0.055**	**-0.138**	**0.140**	0.018	1	-0.002	**0.124**	**-0.081**	**0.110**	**0.146**	**-0.215**	0.000	**0.228**	**0.196**	**0.268**	**0.304**	**0.301**	**0.588**	0.009	**0.424**	-0.040	**0.045**
22. UG degree in Arts	4,906	0.108	0.000	0.311	0.000	1.000	0.001	-0.030	**-0.080**	0.010	**-0.040**	**-0.039**	-0.012	**0.127**	**-0.041**	**-0.064**	**-0.064**	-0.018	-0.007	**-0.057**	**-0.090**	**0.050**	**-0.062**	**0.068**	0.002	-0.003	-0.006	1	**-0.106**	**-0.302**	**-0.048**	**0.179**	**0.639**	**-0.056**	**-0.165**	**0.107**	**0.118**	**-0.061**	**0.133**	**-0.043**	0.027	0.021	-0.019	0.002
23. UG degree in Sciences	4,906	0.071	0.000	0.257	0.000	1.000	**0.121**	**0.038**	**-0.039**	**0.068**	**-0.042**	**0.049**	0.013	0.010	**0.068**	**0.042**	0.026	-0.003	0.021	**0.090**	-0.006	-0.035	0.035	**-0.046**	**0.067**	0.000	**0.129**	**-0.096**	1	**-0.242**	-0.039	0.037	**-0.070**	**0.577**	**-0.121**	-0.011	0.032	**0.223**	-0.006	0.000	0.018	**0.082**	-0.024	**-0.040**
24. UG degree in Business	4,906	0.412	0.000	0.492	0.000	1.000	-0.009	0.016	0.026	**-0.046**	-0.009	-0.033	**-0.039**	**-0.070**	0.009	0.010	0.001	**0.045**	**-0.089**	-0.016	0.008	**-0.052**	-0.023	**-0.060**	-0.008	**-0.042**	**-0.079**	**-0.292**	**-0.232**	1	**-0.111**	**-0.043**	**-0.199**	**-0.163**	**0.519**	**-0.062**	-0.032	**-0.138**	0.004	**0.068**	**0.051**	**-0.047**	-0.014	0.016
25. UG degree in Law	4,906	0.016	0.000	0.126	0.000	1.000	-0.030	-0.024	-0.030	0.020	**-0.056**	-0.015	0.006	0.025	0.027	0.029	**-0.040**	**-0.069**	-0.029	**-0.049**	0.016	**0.083**	**-0.045**	**0.080**	**0.046**	**0.047**	**0.100**	**-0.045**	-0.035	**-0.107**	1	**0.063**	-0.032	-0.029	**-0.117**	**0.334**	**0.052**	-0.030	**-0.041**	**-0.059**	-0.016	-0.024	-0.035	0.032
26. UG degree from private university	5,486	0.464	0.000	0.499	0.000	1.000	**0.083**	**0.075**	**-0.155**	**-0.043**	-0.014	-0.033	-0.029	**0.066**	**0.041**	-0.026	**0.112**	**0.068**	0.025	**0.093**	**-0.042**	0.024	**-0.038**	-0.031	**0.123**	**0.063**	**0.150**	**0.157**	0.034	**-0.042**	**0.050**	1	**0.125**	**0.067**	**0.055**	**0.084**	**0.621**	0.018	**0.057**	**0.103**	**0.043**	**0.110**	-0.011	-0.018
27. Highest degree in Arts	5,204	0.049	0.000	0.216	0.000	1.000	-0.013	0.015	-0.019	0.009	-0.001	-0.007	-0.015	0.017	**-0.045**	**-0.063**	-0.010	**0.051**	**-0.048**	**-0.132**	**-0.119**	0.024	-0.015	**0.064**	0.006	-0.022	**-0.188**	**0.644**	**-0.065**	**-0.193**	-0.030	**0.090**	1	**-0.052**	**-0.272**	**-0.065**	**0.067**	**-0.055**	**-0.075**	**-0.185**	**0.095**	**-0.126**	0.037	-0.038
28. Highest degree in Sciences	4,945	0.041	0.000	0.199	0.000	1.000	**0.070**	-0.009	0.026	0.034	0.025	**0.077**	0.016	**-0.041**	**0.062**	-0.008	0.023	**0.040**	0.006	-0.018	0.008	-0.025	0.012	-0.006	0.021	0.020	0.030	**-0.053**	**0.556**	**-0.155**	-0.027	**0.059**	**-0.048**	1	**-0.264**	**-0.065**	0.005	**0.333**	**-0.067**	**-0.142**	**0.042**	-0.014	**-0.050**	-0.030
29. Highest degree in Business	4,945	0.599	1.000	0.490	0.000	1.000	**0.041**	**0.066**	**-0.041**	**-0.068**	**0.092**	**-0.042**	-0.022	-0.007	**-0.059**	0.013	**0.085**	**0.064**	-0.022	**0.044**	0.002	**-0.054**	**0.056**	**-0.079**	0.018	-0.008	**0.193**	**-0.169**	**-0.114**	**0.513**	**-0.110**	**0.043**	**-0.259**	**-0.254**	1	**-0.368**	**0.154**	**-0.212**	**-0.206**	**0.572**	-0.023	**0.072**	0.020	0.006
30. Highest degree in Law	4,945	0.098	0.000	0.297	0.000	1.000	**-0.080**	**-0.088**	**-0.047**	**0.061**	**-0.206**	**-0.103**	-0.033	**0.157**	**0.045**	0.022	**-0.150**	**-0.179**	-0.001	**0.049**	0.023	0.034	**-0.065**	0.013	**0.047**	**-0.038**	**0.183**	**0.101**	-0.003	**-0.063**	**0.317**	**0.114**	**-0.069**	**-0.069**	**-0.403**	1	**0.126**	**-0.060**	**0.693**	**-0.208**	**-0.070**	**0.190**	**-0.072**	0.039
31. Highest degree from private university	5,224	0.536	1.000	0.499	0.000	1.000	**0.100**	**0.040**	**-0.082**	**-0.091**	-0.018	-0.016	-0.030	**0.076**	0.018	-0.005	**0.127**	**0.069**	**0.050**	**0.086**	**0.037**	**0.063**	-0.014	**-0.041**	**0.099**	0.030	**0.249**	**0.093**	**0.044**	-0.026	**0.046**	**0.597**	**0.039**	0.001	**0.141**	**0.113**	1	0.021	**0.113**	**0.223**	0.017	**0.162**	-0.036	0.003
32. PhD degree	5,486	0.046	0.000	0.209	0.000	1.000	0.003	-0.023	**0.042**	**-0.107**	**-0.094**	**0.047**	-0.014	**0.036**	0.029	-0.018	**0.050**	0.029	**0.070**	**0.050**	0.025	**0.066**	-0.028	0.021	-0.005	0.033	**0.338**	**-0.060**	**0.222**	**-0.133**	-0.029	0.020	**-0.051**	**0.341**	**-0.199**	**-0.061**	0.024	1	**-0.070**	**-0.145**	**0.064**	**0.120**	-0.002	-0.031
33. JD degree	5,486	0.096	0.000	0.295	0.000	1.000	**-0.068**	**-0.087**	-0.010	**0.041**	**-0.210**	**-0.067**	-0.032	**0.113**	**0.050**	**0.047**	**-0.133**	**-0.144**	0.004	**0.106**	0.026	0.034	**-0.046**	-0.033	**0.042**	**-0.035**	**0.306**	**0.131**	0.009	-0.003	-0.027	**0.092**	**-0.076**	**-0.070**	**-0.257**	**0.738**	**0.100**	**-0.071**	1	**-0.074**	**-0.048**	**0.237**	**-0.045**	0.040
34. MBA degree	5,486	0.362	0.000	0.481	0.000	1.000	0.032	**0.052**	**-0.110**	0.017	**0.081**	-0.028	-0.005	**0.045**	**-0.061**	**0.043**	**0.051**	0.002	**0.039**	**0.096**	-0.011	**-0.053**	**0.094**	**-0.134**	**0.070**	0.017	**0.539**	**-0.047**	-0.003	**0.067**	**-0.052**	**0.104**	**-0.179**	**-0.127**	**0.577**	**-0.234**	**0.207**	**-0.125**	**-0.120**	1	-0.034	**0.250**	0.027	**0.048**
35. UG degree obtained in recession year	5,486	0.368	0.000	0.482	0.000	1.000	0.002	0.001	**-0.048**	**0.038**	0.015	0.003	-0.012	**-0.045**	-0.003	-0.020	**-0.039**	0.020	-0.013	-0.017	-0.030	**-0.052**	**0.079**	**-0.016**	**0.038**	0.028	0.017	0.015	0.026	**0.049**	-0.014	0.004	**0.077**	**0.045**	**-0.037**	**-0.040**	-0.004	**0.068**	-0.015	-0.032	1	**0**	0.027	**-0.076**
36. Highest degree obtained in recession year	5,486	0.207	0.000	0.405	0.000	1.000	-0.033	**-0.045**	**-0.047**	**0.036**	**-0.116**	-0.013	**-0.036**	**0.079**	**0.041**	0.033	**-0.043**	**-0.093**	**0.113**	**0.070**	-0.009	0.016	-0.018	**-0.042**	**0.055**	**0.040**	**0.372**	0.027	**0.087**	**-0.045**	-0.014	**0.114**	**-0.120**	-0.019	**0.057**	**0.201**	**0.138**	**0.084**	**0.255**	**0.253**	**-0.067**	1	**0.053**	0.038
37. Joined company in recession year	5,523	0.315	0.000	0.465	0.000	1.000	**0.042**	**0.054**	0.005	**-0.068**	0.012	**0.063**	**0.062**	0.001	0.020	-0.015	0.011	0.029	0.025	**-0.091**	**0.071**	**0.046**	**-0.100**	**0.174**	-0.011	0.018	-0.026	-0.028	-0.016	-0.017	-0.027	0.006	0.010	**-0.056**	0.032	**-0.042**	-0.028	-0.025	-0.022	**0.046**	**0.045**	**0.064**	1	**0.245**
38. Became CEO in recession year	5,523	0.238	0.000	0.426	0.000	1.000	-0.011	0.030	-0.009	**-0.035**	-0.023	-0.032	-0.020	0.006	**-0.079**	**0.045**	**-0.045**	**-0.072**	**0.067**	0.003	-0.004	**0.111**	-0.031	**0.054**	**-0.041**	**-0.112**	0.011	-0.013	**-0.040**	0.008	0.015	**-0.052**	-0.032	**-0.044**	0.025	-0.011	-0.024	**-0.036**	-0.018	**0.051**	**-0.036**	0.000	**0.244**	1

[a] The pairwise Pearson (the lower left) and Spearman (the upper right) correlation coefficients in bold are significant at the 0.01 level or better.

[b] Logarithm.

Table 2. Results of Negative Binomial Regressions of Trademark Registrations on General and Firm-Specific Skills [a]

Variable	*DV - all trademark registrations*		*DV - intent-to-use trademark registrations*		*DV - non intent-to-use trademark registrations*	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
General ability index $_{i, t-1}$	0.113 ***	0.095 ***	0.083 **	0.068 **	0.110 ***	0.100 ***
	0.023	*0.023*	*0.027*	*0.026*	*0.027*	*0.026*
CEO gender (1 - male, 0 - female) $_{i, t-1}$	0.533 **	0.492 **	0.572 **	0.537 **	0.427 *	0.369 †
	0.182	*0.183*	*0.208*	*0.209*	*0.207*	*0.207*
CEO tenure $_{i, t-1}$	0.003		0.001		0.007 *	
	0.003		*0.003*		*0.003*	
External hire $_{i, t-1}$	- 0.312 ***		- 0.276 ***		- 0.318 ***	
	0.061		*0.068*		*0.073*	
Company tenure $_{i, t-1}$		0.006 ***		0.006 **		0.009 ***
		0.002		*0.002*		*0.002*
Option compensation $_{i, t-1}$	0.152 †	0.161 †	0.147	0.163 †	0.081	0.082
	0.083	*0.083*	*0.094*	*0.094*	*0.100*	*0.100*
Company size $_{i, t-1}$	0.086 ***	0.077 ***	0.072 **	0.065 *	0.193 ***	0.180 ***
	0.023	*0.023*	*0.027*	*0.027*	*0.027*	*0.027*
Establishment date $_{i}$	- 0.001	- 0.001	- 0.001	- 0.001	- 0.002 †	- 0.001
	0.001	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*
Capital intensity $_{i, t-1}$	- 0.031 *	- 0.026 †	- 0.033 *	- 0.031 †	- 0.077 ***	- 0.073 ***
	0.015	*0.014*	*0.016*	*0.016*	*0.020*	*0.020*
Selling, general, and administrative expenses $_{i, t-1}$	0.044 ***	0.045 ***	0.047 ***	0.048 ***	0.047 ***	0.047 ***
	0.007	*0.007*	*0.009*	*0.009*	*0.008*	*0.008*
Tobin's Q $_{i, t-1}$	0.064 ***	0.064 ***	0.063 ***	0.063 ***	0.061 **	0.064 **
	0.016	*0.017*	*0.018*	*0.018*	*0.020*	*0.020*
ROA $_{i, t-1}$	0.629 *	0.588 *	0.214	0.167	1.022 **	0.969 **
	0.292	*0.294*	*0.332*	*0.334*	*0.364*	*0.364*
Leverage $_{i, t-1}$	0.159	0.194	0.129	0.164	0.058	0.091
	0.152	*0.152*	*0.183*	*0.182*	*0.184*	*0.183*
Industry demand growth $_{j, t-1}$	0.843 †	0.812 †	1.202 *	1.191 *	0.139	0.183
	0.471	*0.472*	*0.546*	*0.547*	*0.576*	*0.575*
Industry demand instabilit $_{y j, t-1}$	- 1.071 *	- 1.065 *	- 1.789 ***	- 1.808 ***	- 0.233	- 0.261
	0.431	*0.434*	*0.510*	*0.514*	*0.528*	*0.530*
Industry R&D intensity $_{j, t-1}$	0.063 ***	0.062 ***	0.089 ***	0.086 ***	0.038 †	0.040 †
	0.019	*0.019*	*0.023*	*0.023*	*0.022*	*0.022*
Industry advertising intensity $_{j, t-1}$	0.094 ***	0.089 ***	0.122 ***	0.117 ***	0.090 ***	0.083 **
	0.023	*0.023*	*0.026*	*0.026*	*0.027*	*0.027*
Industry Herfindahl-Hirschman index $_{j, t-1}$	0.988 **	1.040 **	0.804 *	0.871 *	1.029 *	1.027 *
	0.377	*0.374*	*0.382*	*0.380*	*0.435*	*0.432*
Service sector dummy $_{j}$	0.231 **	0.235 **	0.048	0.051	0.224 *	0.225 *
	0.090	*0.090*	*0.106*	*0.105*	*0.104*	*0.104*
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Company fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of groups	257	257	242	242	251	251
Number of observations	4,623	4,623	4,357	4,357	4,532	4,532
Wald χ^2	324.5 ***	305.6 ***	329.8 ***	318.5 ***	283.3 ***	275.0 ***
Log-likelihood	- 9,948.5	- 9,957.2	- 7,530.2	- 7,535.1	- 7,154.1	- 7,158.2

[a] Trademark registrations are measured at time t. Year- and firm-specific effects, and constants are omitted.The standard errors (in italics) are clustered by firm.

† $p < 0.1$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Table 3. Results of Negative Binomial Regressions of Trademark Registrations on General and Firm-Specific Skills, and Education [a]

Variable	*DV - all trademark registrations*		*DV - intent-to-use trademark registrations*		*DV - non intent-to-use trademark registrations*	
	Model 13	Model 14	Model 15	Model 16	Model 17	Model 18
Number of degrees $_{i, t-1}$	- 0.016	- 0.021	0.037	0.032	- 0.010	- 0.016
	0.035	*0.035*	*0.041*	*0.040*	*0.040*	*0.040*
Highest degree in Arts $_{i, t-1}$	- 0.503 ***	- 0.493 ***	- 0.726 ***	- 0.717 ***	- 0.287 *	- 0.284 †
	0.131	*0.132*	*0.158*	*0.158*	*0.145*	*0.145*
Highest degree in Sciences $_{i, t-1}$	- 0.048	- 0.079	0.110	0.089	0.097	0.067
	0.114	*0.113*	*0.123*	*0.122*	*0.133*	*0.133*
Highest degree in Business $_{i, t-1}$	0.109 †	0.120 †	0.071	0.087	0.174 *	0.175 *
	0.065	*0.064*	*0.075*	*0.074*	*0.077*	*0.076*
Highest degree in Law $_{i, t-1}$	- 0.171 †	- 0.149	- 0.188	- 0.161	- 0.135	- 0.118
	0.101	*0.101*	*0.119*	*0.119*	*0.121*	*0.121*
Highest degree from private university $_{i, t-1}$	0.199 ***	0.206 ***	0.146 *	0.150 *	0.185 **	0.204 ***
	0.051	*0.051*	*0.060*	*0.060*	*0.060*	*0.060*
General ability index $_{i, t-1}$	0.082 ***	0.072 **	0.046 †	0.039	0.080 **	0.078 **
	0.024	*0.024*	*0.028*	*0.028*	*0.028*	*0.027*
CEO gender (1 - male, 0 - female) $_{i, t-1}$	0.383 *	0.306 †	0.415 *	0.352 †	0.322	0.228
	0.182	*0.183*	*0.206*	*0.208*	*0.208*	*0.209*
CEO tenure $_{i, t-1}$	0.007 *		0.005		0.010 **	
	0.003		*0.004*		*0.003*	
External hire $_{i, t-1}$	- 0.364 ***		- 0.322 ***		- 0.370 ***	
	0.062		*0.069*		*0.074*	
Company tenure $_{i, t-1}$		0.011 ***		0.010 ***		0.013 ***
		0.002		*0.002*		*0.002*
Option compensation $_{i, t-1}$	0.050	0.058	0.054	0.065	- 0.001	0.000
	0.085	*0.085*	*0.097*	*0.097*	*0.103*	*0.103*
Company size $_{i, t-1}$	0.075 **	0.059 *	0.086 **	0.071 *	0.170 ***	0.150 ***
	0.024	*0.024*	*0.028*	*0.028*	*0.028*	*0.028*
Establishment date $_{i}$	- 0.001	- 0.001	- 0.001	- 0.001	- 0.002 *	- 0.002
	0.001	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*
Capital intensity $_{i, t-1}$	- 0.037 *	- 0.034 *	- 0.041 *	- 0.040 *	- 0.080 ***	- 0.075 ***
	0.015	*0.014*	*0.017*	*0.016*	*0.021*	*0.020*
Selling, general, and administrative expenses $_{i, t-1}$	0.042 ***	0.044 ***	0.047 ***	0.048 ***	0.047 ***	0.049 ***
	0.007	*0.007*	*0.009*	*0.009*	*0.009*	*0.009*
Tobin's Q $_{i, t-1}$	0.067 ***	0.068 ***	0.065 ***	0.065 ***	0.064 **	0.069 ***
	0.016	*0.017*	*0.018*	*0.018*	*0.021*	*0.021*
ROA $_{i, t-1}$	0.554 †	0.465	0.210	0.115	0.959 **	0.874 *
	0.300	*0.301*	*0.344*	*0.345*	*0.368*	*0.368*
Leverage $_{i, t-1}$	0.050	0.104	- 0.003	0.042	0.008	0.068
	0.159	*0.159*	*0.190*	*0.189*	*0.193*	*0.192*
Industry demand growth $_{j, t-1}$	1.013 *	1.027 *	1.199 *	1.257 *	0.214	0.300
	0.480	*0.481*	*0.560*	*0.560*	*0.593*	*0.592*
Industry demand instabilit $_{y j, t-1}$	- 0.898 *	- 0.916 *	- 1.593 **	- 1.649 **	0.118	0.081
	0.444	*0.447*	*0.527*	*0.530*	*0.550*	*0.552*
Industry R&D intensity $_{j, t-1}$	0.049 *	0.046 *	0.075 ***	0.071 **	0.016	0.017
	0.019	*0.019*	*0.024*	*0.024*	*0.023*	*0.023*
Industry advertising intensity $_{j, t-1}$	0.125 ***	0.116 ***	0.160 ***	0.152 ***	0.115 ***	0.104 ***
	0.024	*0.024*	*0.027*	*0.027*	*0.028*	*0.028*
Industry Herfindahl-Hirschman index $_{j, t-1}$	1.009 **	1.089 **	0.646	0.718 †	1.189 **	1.196 **
	0.390	*0.388*	*0.397*	*0.395*	*0.448*	*0.443*
Service sector dummy $_{j}$	0.162 †	0.169 †	- 0.005	- 0.003	0.154	0.154
	0.094	*0.094*	*0.110*	*0.109*	*0.109*	*0.108*
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Company fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of groups	252	252	236	236	246	246
Number of observations	4,322	4,322	4,057	4,057	4,231	4,231
Wald χ^2	389.8 ***	378.8 ***	382.1 ***	377.5 ***	309.9 ***	307.8 ***
Log-likelihood	- 9,315.2	- 9,321.2	- 7,073.0	- 7,075.6	- 6,690.3	- 6,692.1

[a] Trademark registrations are measured at time t. Year- and firm-specific effects, and constants are omitted.The standard errors (in italics) are clustered by firm.

† $p < 0.1$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Table 4. Results of Negative Binomial Regressions of Trademark Registrations on General and Firm-Specific Skills, and Labour Market Experience [a]

Variable	*DV - all trademark registrations*		*DV - intent-to-use trademark registrations*		*DV - non intent-to-use trademark registrations*	
	Model 25	Model 26	Model 27	Model 28	Model 29	Model 30
UG degree obtained in recession year $_{i, t-1}$	- 0.132 **	- 0.155 ***	- 0.132 **	- 0.153 **	- 0.106 *	- 0.120 *
	0.044	*0.043*	*0.050*	*0.050*	*0.051*	*0.051*
Highest degree obtained in recession year $_{i, t-1}$	- 0.069	- 0.061	- 0.085	- 0.076	- 0.068	- 0.056
	0.054	*0.054*	*0.062*	*0.062*	*0.064*	*0.064*
Joined company in recession year $_{i, t-1}$	- 0.060	- 0.048	- 0.101 †	- 0.086	0.066	0.072
	0.048	*0.048*	*0.055*	*0.055*	*0.055*	*0.055*
Became CEO in recession year $_{i, t-1}$	0.113 †	0.112 †	0.228 ***	0.211 ***	- 0.049	- 0.027
	0.058	*0.058*	*0.066*	*0.065*	*0.069*	*0.068*
General ability index $_{i, t-1}$	0.107 ***	0.090 ***	0.074 **	0.060 *	0.104 ***	0.096 ***
	0.023	*0.023*	*0.027*	*0.027*	*0.027*	*0.026*
CEO gender (1 - male, 0 - female) $_{i, t-1}$	0.485 **	0.434 *	0.514 *	0.468 *	0.392 †	0.338
	0.182	*0.183*	*0.207*	*0.208*	*0.207*	*0.207*
CEO tenure $_{i, t-1}$	0.004		- 0.000		0.008 *	
	0.003		*0.003*		*0.003*	
External hire $_{i, t-1}$	- 0.312 ***		- 0.294 ***		- 0.286 ***	
	0.062		*0.070*		*0.075*	
Company tenure $_{i, t-1}$		0.007 ***		0.006 **		0.008 ***
		0.002		*0.002*		*0.002*
Option compensation $_{i, t-1}$	0.170 *	0.181 *	0.162 †	0.185 †	0.101	0.102
	0.083	*0.083*	*0.095*	*0.095*	*0.100*	*0.101*
Company size $_{i, t-1}$	0.086 ***	0.077 ***	0.080 **	0.072 **	0.191 ***	0.179 ***
	0.023	*0.023*	*0.027*	*0.027*	*0.027*	*0.027*
Establishment date $_{i}$	- 0.001	- 0.001	- 0.001	- 0.001	- 0.002 †	- 0.001
	0.001	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*
Capital intensity $_{i, t-1}$	- 0.034 *	- 0.028 *	- 0.037 *	- 0.034 *	- 0.076 ***	- 0.073 ***
	0.015	*0.014*	*0.017*	*0.016*	*0.020*	*0.020*
Selling, general, and administrative expenses $_{i, t-1}$	0.043 ***	0.044 ***	0.047 ***	0.048 ***	0.046 ***	0.046 ***
	0.007	*0.007*	*0.009*	*0.009*	*0.008*	*0.008*
Tobin's Q $_{i, t-1}$	0.067 ***	0.068 ***	0.063 ***	0.064 ***	0.065 ***	0.068 ***
	0.016	*0.016*	*0.018*	*0.018*	*0.020*	*0.020*
ROA $_{i, t-1}$	0.663 *	0.618 *	0.325	0.271	0.987 **	0.933 *
	0.294	*0.296*	*0.333*	*0.335*	*0.368*	*0.368*
Leverage $_{i, t-1}$	0.174	0.207	0.146	0.189	0.069	0.092
	0.153	*0.153*	*0.184*	*0.183*	*0.185*	*0.184*
Industry demand growth $_{j, t-1}$	0.898 †	0.844 †	1.172 *	1.123 *	0.079	0.116
	0.477	*0.477*	*0.555*	*0.555*	*0.582*	*0.581*
Industry demand instabilit$_{y j, t-1}$	- 1.097 *	- 1.088 *	- 1.756 ***	- 1.777 ***	- 0.229	- 0.248
	0.435	*0.437*	*0.516*	*0.520*	*0.533*	*0.535*
Industry R&D intensity $_{j, t-1}$	0.063 ***	0.061 ***	0.090 ***	0.087 ***	0.035	0.036
	0.019	*0.019*	*0.023*	*0.023*	*0.022*	*0.022*
Industry advertising intensity $_{j, t-1}$	0.096 ***	0.091 ***	0.125 ***	0.119 ***	0.088 ***	0.081 **
	0.023	*0.023*	*0.026*	*0.026*	*0.027*	*0.027*
Industry Herfindahl-Hirschman index $_{j, t-1}$	0.998 **	1.054 **	0.792 *	0.883 *	1.117 *	1.101 *
	0.383	*0.381*	*0.387*	*0.385*	*0.440*	*0.437*
Service sector dummy $_{j}$	0.200 *	0.210 *	0.025	0.037	0.211 *	0.209 *
	0.091	*0.090*	*0.106*	*0.106*	*0.105*	*0.105*
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Company fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of groups	256	256	240	240	250	250
Number of observations	4,593	4,593	4,316	4,316	4,502	4,502
Wald χ^2	347.3 ***	330.4 ***	358.5 ***	347.1 ***	287.5 ***	280.2 ***
Log-likelihood	- 9,877.2	- 9,884.9	- 7,470.7	- 7,475.8	- 7,113.1	- 7,116.8

[a] Trademark registrations are measured at time t. Year- and firm-specific effects, and constants are omitted.The standard errors (in italics) are clustered by firm.

† $p < 0.1$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.