CEO Incentives and Product Development Innovation: Insights from Trademarks

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We introduce trademarks as a new measure of innovation output, and examine the relation between CEO incentives and trademarks in a broad set of industries. Our new dataset contains over 112,038 USPTO trademark registrations by S&P 1500 firms from 1993 to 2011. As compared with patents, trademarks measure innovation over a wider range of industries and focus on the *development* portion of innovation that culminates more immediately as new products and services for sale. We find that firms with high levels of new product trademarks on average have more volatile stock returns, sales, and earnings after relevant controls, consistent with new trademarks being an indicator of risky product development innovation. We find that the fraction of CEO pay in the form of stock options, and the convexity of CEO incentives, are strongly positively associated with future trademarks. Finally, we document a positive relation between changes in stock option compensation around the implementation of SFAS 123(R) and subsequent changes in trademark creation, suggesting that stock option compensation is an important driver of product development innovation.

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1. Introduction

Academic researchers in many fields recognize the importance of innovation for economic growth and have studied innovation extensively (see, for example in the economics and management related fields, Mansfield 1965; Scherer 1965; Pakes 1985; Hall 1996; Giliches 1998; and Hall and Rosenberg 2010). There is much evidence that innovation is a key driver of firm value, and is nurtured by significant corporate resources and managerial leadership. It is therefore important to study how firms can motivate chief executive officers (CEOs) to undertake innovation projects.

In this study, we investigate whether and how the structure of CEO incentives affects the amount of innovation by the firm. This topic is not new. Our primary contribution is in introducing a novel dataset of trademarks as a new measure of innovative output, allowing us to address the determinants of innovative outcomes that were neglected in previous literature using more traditional measures of innovation. Using this new measure of innovation, we test whether the form of CEO compensation affects the amount of new trademarks obtained by the firms. We consider two dimensions of the form of CEO compensation structure, the fraction of CEO compensation which is in the form of stock options and the convexity of the CEO's compensation incentives with respect to firm value.

Previous research has shown that CEOs play a critical role in the pursuit and success of R&D expenditures and patentable innovations (e.g., Dechow and Sloan 1991; Barker and Mueller 2002; Galasso and Simcoe 2011; Hirshleifer, Low and Teoh 2012; Bereskin and Hsu 2013; Custodio, Ferreira and Matos 2014). Innovative activity is inherently risky and requires intense effort. The traditional assumption in principal-agent models of managerial behavior is that CEOs are averse to effort and risk. This implies that incentives are required to motivate

CEOs to undertake risky innovation. Theory suggests that the structure of CEO incentives can increase CEOs' willingness to engage in risky innovative activities, while past empirical research has verified that this is the case for *R&D* and *patent-related* innovative activities.[1] More generally, previous empirical research on innovation in economics use either an input measure such as Research and Development expenses (R&D), or output measures based on patents or patent citations.

However, the Organization of Economic Cooperation and Development (OECD) defines innovation more broadly as follows:

> "An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations." *(OECD 2005, p. 46)*

We therefore contend that R&D, patents, and patent citations are incomplete measures of innovative activity, and that to understand innovation fully, trademark activity must also be considered as a measure of innovative output.

Although in theory R&D expenditures should capture the majority of research and development inputs, there are practical limitations to the R&D expense from companies' financial statements. One limitation of R&D as a measure of innovative input is that accounting rules impose restrictions on the types of expenditures that are reported as R&D (Appendix B). In particular, expenses used for "incremental" improvements of products or product lines are not included, even if those result in new products for sale. The definition of "incremental" is subjective, and many companies interpret it conservatively. In addition, marketing-related expenses are not included, even when those expenses result in marketing innovations. However,

[1] See Smith and Stulz 1985; Hirshleifer and Suh 1992; Datta, Iskandar-Datta and Raman 2001; Rajgopal and Shevlin 2002; Coles, Daniel and Naveen 2006; Xue 2007; Francis, Hasan and Sharma 2011; Manso 2011; Currim, Lim and Kim 2013; and Baranchuk, Kieschnick and Moussawi 2014.

even expenses that we would consider development expenses under the accounting standards are often excluded in practice. Over half of the firms in our sample do not report R&D expenditures, implicitly suggesting that they conduct no product or service development. American Express, for example, does not report separate R&D expenditures. However over our sample period, they innovated in terms of the services they provide to vendors, the products that they offer to consumers, and even the technologies that they utilize for payment services (consider, for example, the "Blue Cash" card, "Amex Sync" services to vendors, the "Plentipoints" loyalty program, and "ExpressPay" which allows a credit card to be waved in front of a reader instead of having it's magnetic strip scanned). Thus, while R&D is informative, particularly for specific industries, it is incomplete in many cases, both due to R&D accounting policies, and due to companies' R&D accounting practices.

With regard to output, patent laws restrict granting of patents only to innovations that satisfy the patentability criteria,[2] which in practical application results in patents being granted primarily for inventions of new technology or discoveries of fundamental science. This omits a broad array of other types of innovative activity. In particular, if we consider firms that generate patents: Patents for new technology and discoveries of fundamental science do not lead to commercial products and services directly, but instead are "commercialized" through further development. Generating new products and services from new technology requires creatively conceptualizing and designing new products, i.e., further innovation. Furthermore, these firms expend resources on incremental improvements to existing products and services, which often have no associated new patents. While these may be more incremental innovations, they are still

[2] See the USPTO's Manual of Patent Examining Procedure available at http://www.uspto.gov/web/offices/pac/mpep/mpep-2100.html. The patentability criteria generally are that the invention must be of certain subject matter determined as patentable, novel or at least new in some aspect, non-obvious (U.S. patent law) or involve an inventive step (European patent law), and useful (U.S. patent law) or susceptible of industrial application (European patent law).

product and service innovations. In addition, there are large numbers of firms that do not produce patents. (Many of these firms also do not report separate R&D expenditures.) Yet these firms produce new products and services. For this subset of firms, trademarks shed unique light on the innovative output they produce.

Another aspect of trademarks makes them unique in capturing innovation: New marketing campaigns often lead to trademarks for slogans, logos, and jingles. Even after viable new products and services are produced, firms can only monetize investments in these innovations when the products and services are purchased by customers. This requires marketing the new products and services. Creative activities pursued to develop new marketing campaigns or redesign and improve existing campaigns are therefore innovative activities, though certainly different from the technology discovery that has been the primary focus of past research on innovation. We refer to trademarked logos and slogans as marketing trademarks to distinguish them from product trademarks (see Section 2 and Appendix A for details and examples).

Trademark information is available from the United States Patent and Trademark Office (USPTO). However the information is not in a form that is directly usable by researchers. Thus, we build the dataset of firm level U.S. trademarks ourselves.[3] Currently, our dataset contains 112,038 U.S. trademarks for all firms in the S&P 1500 from fiscal years 1993 through 2011. The details of the procedure for gathering, cleaning, and matching trademark information to Compustat firms are in Faurel, Li, Shanthikumar and Teoh (2014).

Faurel et al. (2014) provide early evidence that new trademarks are associated with increases in future sales. However innovation outcomes are risky. Firms that innovate more, therefore, are expected to have higher risks. Understanding this riskiness is important for our study as the dimensions of CEO incentives that motivate a CEO towards more risky effort are

[3] Several studies examine firm level European trademarks using the dataset of von Graevenitz (2007).

different than those that motivate less risky effort. In this study, we find that trademarks are positively related to firm risk as measured by stock price volatility, sales volatility, and earnings volatility. When we separate product-related trademarks from marketing-related trademarks, we find that the positive relation between the number of trademarks and risk is stronger for product trademarks. This is consistent with the intuition that innovative activities that are closer to the end of the innovation production cycle, such as marketing, are less risky than those earlier in the innovation development cycle, such as the generation of new products and services.

To induce a CEO to expend high effort and tolerate high risk, agency theory suggests that the compensation schedule should have a long-term incentive component that is increasing in shareholder value and is convex, so that expected compensation is increasing with the riskiness of shareholder value. In other words, the compensation function should contain stock option compensation. Thus, our main test hypothesis asks whether trademarks are positively associated with the fraction of total compensation that is in the form of stock options, and with vega, which is a measure of the sensitivity of the CEO's expected wealth to stock volatility.

Consistent with these theoretical predictions, we find that the fraction of CEO compensation in the form of stock options and the degree of convexity of CEO incentives both predict the number of new product trademarks the firm subsequently creates, after controlling for CEO total compensation, firm sales, R&D intensity, marketing efforts, and investment opportunities.

Since compensation is endogenous, our associational evidence is consistent with both firms with risky innovation opportunities selecting convex compensation schemes, and convex compensation causing managers to engage in greater innovative risk-taking. This endogeneity is not very disturbing, however. In particular, the reason firms with risky innovation opportunities

would offer convex compensation schemes is that the board believes that such schemes do indeed induce managers to change their behavior. In other words, the first possibility makes sense only if the second possibility is also believed to be operating.

Nevertheless, to address potential endogeneity of the compensation structure, we consider an instance in our sample period that likely represents an exogenous shock to the use of option compensation without a corresponding change in the benefits of trademark innovation. A new accounting rule, SFAS 123(R), required firms to expense stock option compensation beginning in 2005. This reduced many firms' use of option compensation for an exogenous reason that is unrelated to trademark innovation. Therefore, we examine changes in trademark creation following changes in stock option compensation resulting from the implementation of SFAS 123(R). We find a significantly positive relation between changes in stock option compensation around SFAS 123(R) and changes in trademark creation. This evidence is consistent with option compensation having a positive causal effect on trademark innovation.

Our study contributes to a large body of research on the determinants of innovation and the effects of stock-based compensation in accounting, economics, finance and management fields.[4] In addition to our specific results regarding CEO compensation and trademark innovation, we notably develop and use a novel measure of innovation output based on new trademarks. We hope that this study encourages future researchers on innovation to include trademarks as measures of innovation output .

[4] On determinants, see for example Rajgopal and Shevlin (2002), Argyres and Silverman (2004) Lerner and Wulf (2007), Aghion, Reenen, and Zingales (2013), Amore, Schneider and Žaldokas (2013), Chang, Hilary, Kang and Zhang (2013), He and Tian (2013), and Baranchuk, Kieschnick, Moussawi (2014). On effects, see for example Mehran, Nogler and Schwartz (1998), Datta, Iskandar-Datta and Raman (2001), Fenn and Liang (2001), Nagar, Nanda and Wysocki (2003), Cheng and Warfield (2005), Erkens (2011), Armstrong, Larcker, Ormazabal and Taylor (2013), Jayaraman and Milbourn (2014), and Wowak, Mannor and Wowak (2014).

The remainder of the paper is structured as follows. Section 2 discusses the related literature and develops hypotheses. Section 3 presents new trademarks as a measure of product and marketing development innovation, describing the data and relating trademarks to firm volatility. Section 4 examines the relation between CEO incentive structure and the creation of new trademarks. Section 5 concludes.

2. Motivation and Hypotheses Development

2.1. Different Types of Innovation

Firms engage in a variety of innovative activities. The OECD definition of innovation given in the introduction, as well as additional reports that the organization has written, emphasize the increasing importance of taking a broad view of innovation, moving beyond the traditional focus on research and development (R&D) expenditures (OECD 2005) to examining different types of innovation by developing new innovation measures (OECD 2010a, 2010b). The OECD defines four types of innovation which firms engage in: product, process, organizational and marketing innovation. Following Faurel, Li, Teoh and Shanthikumar (2014), we use trademark creation as a new measure of innovative output. Trademarks capture both product and marketing innovation in the OECD framework, measuring product development output and new marketing initiatives associated with new and existing products and services. R&D expenditures, patents, and patent citations are often used as measures of innovative activity for United States (US) firms. While these measures effectively capture new technology development, they capture a different type of innovation than trademarks do, and apply primarily to high-technology industries.

The United States Patent and Trademark Office (USPTO) defines a trademark as:

> "A trademark is a brand name. A trademark or service mark includes any word, name, symbol, device, or any combination, used or intended to be used to identify and distinguish the goods/services of one seller or provider from those of others, and to indicate the source of the goods/services. […] The term "trademark" is often used to refer to both trademarks and service marks."[5]

A firm files for a new trademark when they have a new product or service, or a new name, logo, etc., for an existing product or service. Examples of trademarks include, among many others, "Microsoft Office," "Microsoft Office XP" and "Windows Phone" (registered by Microsoft Corp.), "Escort" and "Mustang" (registered by Ford Motor Co.), all versions of Hot Wheels and Barbie toys, including all Hot Wheels and Barbie logos (registered by Mattel Inc.), etc. Thus, a new trademark is likely to capture product or marketing innovation. For example, Apple filed a trademark for "ipad mini" because it viewed the mini as a distinct product from the already popular ipad, and wanted to advertise the ipad mini under a unique name. Similarly, Coke filed a trademark for "Coke Zero" to differentiate it from their main "Coke" product and protect the new product's name. Thus, trademarks measure product and marketing innovation. If we consider the phase of innovation, trademarks measure *development innovation*, the type of innovation which leads to marketed products and services, just as patents capture research innovation. While many firms engage in both types of innovation, some engage only, or primarily, in development innovation. All innovation requires some development component to result in products and services for sale. Thus, trademarks capture *product and marketing development innovation*. Finally, as described in Section 3, we further separate trademarks into the portions associated with product development and marketing by identifying trademarks associated with logos and slogans (marketing), and the remaining portion, associated with

[5] www.uspto.gov/trademarks/ (last accessed in March 2014). Consistent with the USPTO's definition, we use the term "trademark" to refer to trademarks and service marks.

product development innovation.[6,7] Appendix A provides a few examples to help clarify the distinctions between *research*, *product development*, and *marketing development* innovation.

Several studies survey firms on innovation and relate new trademarks to survey-based measures of innovation, as well as commonly-used innovation measures such as R&D spending and patent filings. Mendonca, Pereira and Godinho (2004) examine 724 Portuguese firms and report significant correlations between trademarks and the size of marketing and R&D budgets, the existence of a separate marketing department, and, within sectors, the number of patents. Jensen and Webster (2009) examine 1,400 Australian firms and find that trademark applications are significantly correlated with R&D spending, patent applications, and survey-based measures of overall innovation, product innovation, and marketing innovation. Millot (2012) examines approximately 20,000 French firms and finds that trademarks are significantly related to product innovation, and more weakly related to marketing innovation, controlling for several other firm characteristics. Finally, Flikkeman, de Man and Wolters (2010) study a set of 660 trademarks filed in the Netherlands, Belgium and Luxemburg. When asked about types of innovative activities underlying the trademarks, 58 percent of respondents reported a link to innovation, with product and service innovations being the top two categories. Overall, these prior studies suggest that new trademarks are an effective measure of product and service innovation, and to a

[6] Throughout the paper, we use the term "product development innovation" to refer to innovation in the goods and services sold by firms. These can be new product or service offerings, or updates, modifications or improvements of existing products and services. We differentiate product development innovation from research innovation, which pertains more to fundamental research, which may or may not ultimately lead to future sales of new products or services. The two concepts overlap for the subset of new products or services in the market which use relatively new technology to warrant both trademarks and patents.

[7] The USPTO places an additional requirement prior to registration of a trademark: the applicant must demonstrate that they have "used the mark in commerce in connection with all the goods/services listed" in the trademark application (USPTO 2012). (A trademark application may be filed under the "use in commerce" basis, if the trademark has already been used in commerce, or the "intent to use" basis, if the trademark has not been used in commerce yet. For an application filed under the "intent to use" basis, a "statement of use" must be submitted prior to the registration to confirm the use in commerce of the trademark.) This requirement makes it highly unlikely that firms file extraneous trademarks in case of future use or to block competitors from using them, the way they can register domain names. The USPTO's requirements are designed to ensure that any registered trademark is tied to actual products or services.

lesser extent the associated marketing innovation. They also suggest that trademarks are a useful innovation measure for a wide range of industries, including lower technology and service industries in which patent-producing technological innovation is less relevant.

Our main question is whether certain structures of CEO incentives motivate managers to innovate. The way in which we motivate managers, however, depends on how risky the activity we want them to engage in is, as we discuss in Section 2.2 below. While prior research has shown a link between self-reported innovative activities and trademarks, there is very little work which uses new trademarks as a measure of innovation, particularly for US companies.[8] Thus, we begin our analysis by examining the relation between new trademarks and firm risk. If new trademarks capture product and marketing innovation, they should be related to firm risk. Innovation, by its nature of being something new, is inherently risky. Because new products incorporate both fundamentally new items to sell and new marketing/advertising initiatives, we expect product innovation to be more risky than marketing innovation alone (e.g., a new slogan to promote an established product). We empirically identify new product and marketing trademarks, as described in Section 3, allowing us to examine them separately. Thus, our first set of hypotheses, stated in alternative form, is:

H1a: Product development innovation, as measured by new product trademarks, is associated with firm risk.

H1b: Marketing development innovation, as measured by new marketing trademarks, is associated with firm risk, but to a lesser degree than new product trademarks.

[8] Gonzalez-Pedraz and Mayordomo (2013) use trademarks as a measure of the marketing and advertising of product innovation for US commercial banks. They find a relation between trademark creation and stock returns as well as between the banks' trademark portfolios and their values as measured by market-to-book ratios. However, they do not examine industries outside of commercial banking. Krasnikov, Mishra and Orozco (2009) interpret the set of trademarks which have been previously registered and have not expired as a measure of a firm's brand assets, and partition these trademarks into "brand-identification" and "brand-association" groups, based on whether they help build brand awareness or associations, respectively. They find that brand-association trademarks are positively related with measures of financial performance, such as return on assets. However, they do not examine trademark creation.

2.2. Motivating Product Development Innovation

Assuming product trademarks capture risky product development innovation, our main research question is whether certain incentive structures motivate managers to engage in this type of innovative behavior. Basic agency theory suggests that owners should tie managers' wealth to firm value in order to reduce agency conflicts (Jensen and Meckling 1976). This is often done through equity-based pay. However, because managers are risk averse, the resulting (under-diversified) sensitivity of managers' wealth to firm value incentivizes managers to reduce firm risk (e.g., Smith and Stulz 1985). Theory suggests that using instruments such as stock options, that include convex payoffs with respect to firm value, can help to offset the incentive to reduce risk. For example, Smith and Stulz (1985) show that, in their model, increasing the convexity of managers' wealth with respect to firm value increases the managers' willingness to make risky investments and decreases hedging. Hirshleifer and Suh (1992) conclude that stock option compensation should be higher when there are more risky desirable growth opportunities due to the convexity that they induce. Stock option compensation can increase innovation incentives for other reasons as well. Manso (2011) focuses on the question of how to structure incentives to motivate innovation. He shows that the optimal incentive structure is tolerant of short-term failure and rewards long-term success. He argues that this can be implemented in part using executive compensation, and specifically long-term compensation plans such as stock options with long vesting periods. Given the evidence in Cadman, Rusticus and Sunder (2013) that stock option grants to CEOs have mean and median vesting periods of 36 months, and the evidence in Gopalan, Milbourn, Song and Thakor (2013) that vesting periods cluster around three to four years, our measure of stock option compensation using stock option grants likely captures the type of compensation for long-term success that Manso (2011) describes. Thus, due

to both the convexity of payoffs with respect to firm value and the long-term nature of stock-option compensation in practice, stock option compensation should increase managers' incentives to pursue innovation.

Empirical evidence is largely supportive of these theories. Francis, Hasan and Sharma (2011) find that patent innovation is increasing in stock option compensation. Datta, Iskandar-Datta and Raman (2001) find that executives with higher proportions of their pay in the form of stock options make riskier acquisitions by choosing targets with more growth options and by conducting acquisitions which increase the acquiring firm's standard deviation of stock returns. Lerner and Wulf (2007) focus on compensation for the head of R&D and show that long-term incentives, in the form of stock option compensation or restricted stock, increases the number, originality, and citations of patents. Currim, Lim and Kim (2012) show that increases in stock and stock option compensation, relative to cash bonuses, increase R&D and advertising spending. Finally, Baranchuk, Kieschnick and Moussawi (2014) find that the proportion of CEO compensation in the form of incentive compensation, made up largely of option compensation, is positively associated with post-IPO patent production at newly public firms.

Both theory and empirical evidence suggest that stock option compensation, because of its convex payoffs and longer-term vesting structure, can increase innovation. However, we can measure the convexity of managers' incentives more directly. Guay (1999) constructs an empirical measure for the theoretical construct of incentive convexity based on the sensitivity of CEO option holdings to stock price volatility, which captures the convexity of the relation between CEO wealth and stock price. He shows that stock return volatility is increasing in this measure of incentive convexity. Using the same measure, Rajgopal and Shevlin (2002) show that the convexity of incentives increases the risky oil and gas exploration activities of oil and gas

firms and, while Coles, Daniel and Naveen (2006) show that incentive convexity increases managers' implementation of several risky policies, including high R&D spending. Xue (2007) finds evidence that incentive convexity increases internal development of new technology, as measured by a firm's R&D spending, for high-tech firms.

In line with these prior studies and based on their findings, we examine both the proportion of CEO pay which is in the form of stock options, and the convexity of managers' incentives, measured using the incentive convexity of managers' option portfolio. Theory suggests that stock option compensation and incentive convexity increase incentives to pursue risky innovation. Empirical studies provide evidence consistent with this relation for specific industries and types of innovation. We predict that each of these will motivate the CEO to engage in *product development innovation*, as captured by trademark creation, which applies to a wide range of products and industries. Our second set of hypotheses, stated in alternative form, is:

H2a: The portion of CEO compensation in the form of stock options is positively associated with product development innovation, as measured by product trademark creation.

H2b: The convexity of the relation between CEO wealth and stock price is positively associated with product development innovation, as measured by product trademark creation.

In our main tests, we examine the relation between the structure of CEO incentives and subsequent trademark creation. To more directly address causation, we examine changes in trademark creation following an exogenous shock to option compensation driven by a change in accounting rules from the implementation of SFAS 123(R). We discuss this test in more detail in Section 4.

3. Trademark Creation as a Measure of Development Innovation

3.1. Sample Selection and Trademark Data Description

We obtain data from the USPTO, the Compustat Execucomp database, and the Compustat annual database. We restrict our analysis to firms in the Execucomp database (i.e., S&P 1500 firms) with strictly positive total assets and strictly positive sales. The sample covers fiscal years starting in 1993 due to data availability in Execucomp and ending in 2011 due to trademark data availability on the USPTO website.

We obtain trademark data from the USPTO's website.[9] Each trademark application goes through four steps: filing, examination by the USPTO, publication for opposition, and registration. After an application is filed, the USPTO examines the filing and determines whether the trademark is registrable. If the registration is refused or pending with additional requirements, the USPTO issues a letter of "office action" to which the applicant must respond. If the registration request is accepted without additional requirements, or if additional requirements are met in the applicant's response, the trademark is published online in the Official Gazette, which corresponds to the third step. The public may raise objections to the registration of the trademark within 30 days. If no opposition is received, the USPTO proceeds with the registration. For applications filed under the "use in commerce" basis (i.e., the trademark has been used in commerce at the time of the filing), the USPTO directly approves the registration. For applications filed under the "intent to use" basis (i.e., the trademark has not been used in commerce yet at the time of the filing), the registration is not complete until the receipt

[9] The USPTO provides data on 6.7 million trademark applications filed with, or registrations issued by, the USPTO between January 1870 and September 2012 through the website http://www.uspto.gov/products/index.jsp.

of a "statement of use" or other equivalent forms.[10] The average length of time between the filing date and the registration date is approximately 15 months.

To compile a comprehensive sample of new trademarks, we first download from the USPTO's website all trademark applications filed between January 1, 1992 and September 8, 2012, with at least one US corporation in the list of owners of each trademark. This yields 2,653,464 trademark applications. We then select new trademarks owned by US corporations, with no change in ownership from the filing date until the registration date (or throughout the trademark's history if no registration date is provided). This reduces the sample to 1,606,170 new trademarks. Next, we restrict our sample to trademarks that are registered, which decreases the sample to 1,316,985 new trademarks. Finally, using company names and locations, we manually merge the trademark data with the Execucomp data. Restricting to Execucomp firms and requiring trademark registration dates to be within fiscal years 1993-2011, reduces the sample to 112,038 unique new trademarks registered by 2,371 distinct firms.[11]

To distinguish between product development innovation and marketing development innovation, we classify each trademark as either a new product trademark or a new marketing trademark. Trademarks registered for innovations in logos (i.e., drawings), slogans (identified as trademarks with at least four words), or sounds capture marketing development innovation and are classified as new marketing trademarks. Conversely, trademarks registered for innovations in product names, service names, brand names, etc., identified as trademarks with three words or less, capture product development innovation and are classified as new product trademarks. In

[10] Detailed information regarding the filing and registration process of trademarks is available at http://www.uspto.gov/trademarks/basics/BasicFacts.pdf.

[11] We exclude 186 firms from the Trademark Execucomp Sample because they each have only one registered trademark throughout the period January 1, 1992 to September 8, 2012. The single trademark generally corresponds to the firm name, which is not an indication of product or marketing innovation. These firms remain in our Full Execucomp Sample.

our final sample of 112,038 unique new trademarks, 77,394 are classified as new product trademarks and 34,644 are classified as new marketing trademarks, registered by 2,278 and 2,119 distinct firms, respectively.

Table 1 presents the distribution of new registered trademarks in our sample by year (Panel A), by industry (Panel B), and across firm-years (Panels C and D). The distributions reported in Panels A and B are generally in line with the findings reported in studies describing the entire population of trademarks (e.g., Graham, Hancock, Marco and Myers 2013; Myers 2013). As shown in Panel A, the number of new trademarks increases in the first three years of our sample period (1993-1995), after which it fluctuates over a narrow range, encompassing between five to seven percent of our sample every year. Columns 5 and 6 present the number of firms in the sample in each year, which peaks in year 4 and then generally declines. Thus the average number of new trademarks per firm-year is generally increasing over the sample period. We include year fixed effects in our main tests to adjust for this time trend. Next, as presented in Panel B, the new trademarks span all 48 industry groups, which is evidence that trademarks are created in any type of industry, contrary to patents for example. While the distribution of new trademarks across the 48 industries is not even, there is little evidence of industry clustering. The most represented industry in the new product trademark samples is Recreational Products (including Mattel Inc. and Hasbro Inc.), which only represents 9.7 percent of the sample. The most represented industry in the new marketing trademark sample is Retail (including Wal-Mart Stores Inc. and Target Corp.), which only represents 7.5 percent of the sample. The next most represented industries in both samples are Consumer Goods, Business Services, Telecommunications, Pharmaceutical Products, and Banking. Moreover, our evidence shows a

substantial representation of service industries.[12] Panels C and D show that trademark firms register an average of 5.3 and 3.5 new product and new marketing trademarks per year, respectively. This varies across industries, with, for example, 3.5 new product trademarks per firm-year in the Business Services industry and 56.2 in the Recreational Products industry.

Lastly, Table 1, Panel E, reports selected descriptive statistics for the new product trademark firm-year observations (14,614 firm-year observations from 2,278 distinct firms) and the full sample of Execucomp firm-year observations (42,879 firm-year observations from 3,275 distinct firms), with comparisons and results of *t*-tests (Wilcoxon rank-sum tests) of mean (median) differences for each variable.[13] The results show that firms with new product trademarks are larger than the average firm in Execucomp with greater total assets and greater market value of equity. They also have greater investment opportunities, as captured by higher Tobin's Q, and report higher advertising expense as a percentage of sales. Moreover, the CEOs of new product trademark firms receive higher compensation, including higher salary, bonus and total compensation. The CEOs of new trademark firms also have greater portions of their total compensation in the form of stock options, with a mean (median) of 30 (27) percent of total compensation for new trademark firms versus 28 (22) percent for the average Execucomp firm. Finally, the CEOs of new trademark firms have greater risk-taking incentives in the form of higher convexity of incentives (i.e., *Vega*), as well as greater pay-performance sensitivity (i.e., *Delta*). While the new trademark firms differ from the average Execucomp firm in many dimensions, the magnitudes of the differences are economically small. For example, the average Tobin's Q for trademark firms is approximately 6 percent higher than for the average

[12] These descriptive statistics are generally consistent with Myers (2013), which describes USPTO trademark data for 1985 through 2011.
[13] The Execucomp firm-year observations include the new product trademark firm-year observations.

Execucomp firm. The primary difference between firms with and without trademarks appears to be firm size, captured by assets, sales and market value of equity. However, not all large firms have trademarks. There are many large firms without trademarks. For instance, 50.3 percent of our sample Execucomp firms have an average market capitalization over one billion dollars. Of these largest firms, 24.8 percent have no trademarks during our sample period. Still, in our regressions, we include control variables to control for firm size.

3.2. Trademark Creation and Firm Volatility

To provide insights on whether development innovation, as measured by new trademarks, is a risky activity, we examine the relation between trademark creation and firm volatility. We conjecture that, if new trademarks measure risky development innovation, they should be associated with more volatile firm performance. To test this hypothesis, H1a and H1b, we estimate the following models for firm *i* in year *t*:

$$\begin{aligned} RetVol_{i,t+1} = \alpha &+ \beta_1 Log(NbTrademarks)_{i,t} + \beta_2 Log(NbMktgTrademarks)_{i,t} \\ &+ \beta_3 RetVol_{i,t} + \beta_4 FirmAge_{i,t} + \beta_5 FirmSize_{i,t} + \sum \chi_j Year_j + \varepsilon_{i,t+1} \end{aligned} \quad (1a)$$

$$\begin{aligned} ChangeSalesVol_{i,[t+1;t+3]} = \alpha &+ \beta_1 Log(NbTrademarks)_{i,t} + \beta_2 Log(NbMktgTrademarks)_{i,t} \\ &+ \beta_3 ChangeSalesVol_{i,[t-2;t]} + \beta_4 FirmAge_{i,t} + \beta_5 FirmSize_{i,t} \\ &+ \sum \chi_j Year_j + \varepsilon_{i,[t+1;t+3]} \end{aligned} \quad (1b)$$

where the variables are defined as follows:

RetVol	Annualized stock return volatility, measured as the annualized standard deviation of daily stock returns over the year.
ChangeSalesVol	Sales volatility, measured as the standard deviation of seasonal sales changes estimated over the three years.
Log(NbTrademarks)	Natural logarithm of one plus the number of new product trademarks registered during the year.[14]

[14] We replicate our results using the number of trademarks filed (rather than registered) during the year. The results are qualitatively similar. However, little cost or requirement is involved when filing a trademark, whereas the

Log(NbMktgTrademarks) Natural logarithm of one plus the number of new marketing trademarks registered during the year.

FirmAge Natural logarithm of one plus the number of months since the firm first appeared on CRSP.

FirmSize Natural logarithm of market value of equity.

We also estimate Equation (1b) after substituting *ChangeSalesVol* with *ChangeEarnVol*, defined as the standard deviation of seasonal earnings changes over the same period. In all models, we include firm characteristics, age and size, and expect each to be negatively associated with firm volatility. The results are displayed in Table 3. Panel A presents results for the relation between subsequent-year stock return volatility and the total number of new product and/or marketing trademarks produced by a firm. As presented in Model I, and as predicted, we find a significant positive relation (p-value < 0.01) between new product trademarks and future stock return volatility, controlling for current stock return volatility. The coefficients on the control variables have the predicted signs. Return volatility is persistent, and older and larger firms are less volatile. In Model II, we also find a significant positive relation (p-value < 0.01) between new marketing trademarks and future stock return volatility, with similar magnitudes and significance. However, the number of new product and new marketing trademarks are highly positively correlated, with a correlation of 0.60. When a company sells a new product or service, they will often initiate a new marketing campaign as well. When we include both in the regression, in Model III, we find a significantly positive relation between new product trademarks and future stock return volatility, but an insignificant relation for new marketing trademarks. This suggests that the positive coefficient on *Log(NbMktgTrademarks)* in Model II is driven more strongly by the portion of new marketing trademarks related to new products than

trademark registration process has strict requirements. Therefore, trademark registration is a cleaner indication that: i) a new product/service has been created and ii) the new product/service is being used in commerce.

the portion of new marketing trademarks related to previously established products. Panel B presents results for the volatility of sales and earnings, respectively, measured over three years following the year of the new trademarks. Results are similar. The total number of new product and new marketing trademarks, individually, are each significantly related to subsequent sales and earnings volatility. However, when included together, new product trademarks are positively related to future volatility while new marketing trademarks are not. It is important to note that in all of these regressions, firm volatility in the year of the new trademark is included as a control variable. Therefore, these results are not driven by more volatile firms producing a larger number of trademarks. They provide evidence of a relation between trademark creation and future volatility.

Overall, the results in Table 3 support H1a and H1b and indicate that trademarks are a measure of risky innovation. Consistent with H1b, marketing development innovation by itself is not as risky as new product development innovation. Given the high correlation between the two, and the riskiness of product development innovation, we focus on new product trademarks in the subsequent analyses.

4. CEO Incentives and Trademark Creation

4.1. CEO Incentive Structure and Trademark Creation

Our primary research question is whether the structure of CEO incentives, specifically the use of option-based pay and the convexity of incentives, motivates executives towards more product development innovation, as measured by the creation of new trademarks. In this section, we first explore the general relation between the structure of CEO incentives and future trademark creation. Second, and mainly to address endogeneity concerns, we conduct a changes

analysis focusing on stock option compensation, using SFAS 123(R) as an event which drove an exogenous change in stock option compensation.

To provide evidence on the effect of incentive structures on firm innovation, we examine the relation between stock option compensation, incentive convexity, and pay-performance sensitivity, and future product trademark creation, as a measure of product development innovation. Given that stock option compensation and incentive convexity each increase incentives to pursue risky innovation, we predict that each is associated with more trademark creation in the future. To test this prediction, we first focus on testing H1a and focusing first on option compensation, we estimate the following model for firm *i* in year *t*:

$$\begin{aligned} Log(NbTrademarks)_{i,t} = {} & \alpha + \beta_1 OptionComp_{i,t-1} + \beta_2 Log(TotalComp)_{i,t-1} + \beta_3 Log(Sales)_{i,t-1} \\ & + \beta_4 R\&D_{i,t-1} + \beta_5 Adv_{i,t-1} + \beta_6 TobinQ_{i,t-1} + \sum \chi_j Year_j \\ & + \sum \delta_k Industry_k + \varepsilon_{i,t} \end{aligned} \quad (2)$$

where the variables are defined as follows:

Log(NbTrademarks)	Natural logarithm of one plus the number of new product trademarks registered during the year.
OptionComp	CEO's annual stock option compensation, measured as the value of new stock options granted as a percentage of total compensation.
Log(TotalComp)	Natural logarithm of the CEO's annual total compensation, measured as the sum of salary, bonus, other annual compensation, value of restricted stock granted, value of new stock options granted during the year, long-term incentive payouts, and all other compensation.
Log(Sales)	Natural logarithm of total sales.
R&D	Ratio of R&D expense divided by total sales.
Adv	Ratio of advertising expense divided by total sales.
TobinQ	Ratio of the market value of total assets to the book value of total assets.

Our variable of interest in testing H2a is *OptionComp*, the proportion of CEO compensation in

the form of stock options. To test H2b, we estimate Equation (2) after substituting *OptionComp* with *Vega,* the CEO's sensitivity to stock return volatility, measured as the dollar change in the CEO's option portfolio for a 0.01 change in annualized standard deviation of stock returns. Following H2a and H2b, we predict a positive and significant coefficient on *OptionComp* and on *Vega*. Finally, solely for comparison purposes, we estimate Equation (2) after substituting *OptionComp* with *Delta,* the CEO's sensitivity to stock price, measured as the dollar change in the CEO's stock and option portfolio for a one-percent change in stock price, and we do not predict a significant coefficient on *Delta.* We include independent variables to control for factors that potentially impact future product development innovation. These control variables capture CEO total compensation (*Log(TotalComp)*), firm sales (*Log(Sales)*), R&D intensity (*R&D*), advertising intensity (*Adv*) which serves as a proxy for marketing efforts, and investment opportunities or growth (*TobinQ*).

Table 4 presents the results. Model I presents the results for a benchmark model excluding the structure of CEO compensation. As expected, we find that CEO total compensation (*Log(TotalComp))* is not related to future trademark creation, while all other independent variables, *Log(Sales)*, *R&D*, *Adv*, and *TobinQ*, are significantly positively related to future trademark creation. Larger firms, firms that spend proportionally more on R&D or on advertising, and firms with more growth opportunities tend to produce larger numbers of new trademarks.

Model II presents the results including CEO stock option compensation, *OptionComp*, testing H2a. As predicted, we find a significantly positive relation between *OptionComp* in year *t*-1 and trademark registration in year *t*, controlling for year and industry fixed effects (*p*-value < 0.01). Recall that *OptionComp* is the fraction of total compensation in the form of

option-based pay. Thus, increasing option-based pay from the first to the third quintile, roughly by 50 percentage points, results in an increase in *Log(NbTrademarks)* of 0.054. For a company producing one trademark a year, this is an 11% increase in trademark production, controlling for R&D spending, advertising, and sales. While this may not sound like a dramatic change, it is a significant change, particularly in comparison to the effects of other factors. For example, increasing from the first to third quartile for *OptionComp* has 2.7 times the effect of increasing from the first to third quartile of advertising expenditures, over two hundred times the impact of increasing R&D from the first to third quartile, and twelve percent of the effect of increasing sales from the first to third quartiles – which amounts to growing sales by over a factor of eight. Thus, when considering controllable factors that are associated with increased trademark creation, *OptionComp* is significant.

Model III presents the results including *Vega*, testing H2b. Similarly, we find a significantly positive relation between *Vega*, the convexity of the relation between CEO wealth and stock price, in year *t*-1 and trademark registration in year *t* (*p*-value < 0.01). The magnitude of the effect is roughly half that of *OptionComp* in Model II. The magnitude of the coefficient estimate suggests that, holding all else equal, moving from the first to third quartile of *Vega* has 40% of the effect of moving from the first to third quartile of *OptionComp*. Also as expected, we find that CEO pay-performance sensitivity (*Delta* in Model IV) is not related to future trademark creation, with a small and statistically insignificant coefficient estimate.[15]

Overall, the findings in Table 4 support H2a and H2b. They suggest that when firms pay their CEOs a greater percentage of their compensation in the form of stock options, or when

[15] These results are robust to several alternative specifications. In particular, the results for model III (IV) is similar if we substitute *Log(Vega)* (*Log(Delta)*) for *Vega* (*Delta*), or if we scale *Vega* (*Delta*) by CEO wealth. Results for all four models are also robust if we measure development innovation using the number of new product and marketing trademarks, instead of specifically the number of product trademarks.

firms provide risk incentives in the form of higher convexity of incentives, the firm creates more product development innovation, as measured by product trademarks in the following year, controlling for other firm factors that may drive trademark creation. Furthermore, boards of directors interested in motivating CEOs to engage in product development innovation are likely to have a stronger impact if they structure CEO pay to be based more on stock options or with stronger risk incentives, rather than simply increasing total compensation.

4.2. Changes in CEO Incentives Structure and Trademark Creation around SFAS 123(R)

Given the persistence in many firm characteristics, our results presented in Table 4 could be due to endogenous factors driving both CEO compensation structure and trademark creation. To address any endogeneity concerns, we use the change in the accounting of stock option compensation, introduced by the adoption of SFAS 123(R) in 2005, as an exogenous shock to the use of option-based pay. Prior to SFAS 123(R), firms provided pro forma footnote disclosures of the fair value of stock option grants during the period, but only recognized the "intrinsic value" of these granted options as an expense on their income statement. Because the strike price of stock options is typically set at the current stock price on the grant date, the intrinsic value is typically zero. For fiscal years beginning after June 15, 2005, firms are mandated by SFAS 123(R) to recognize the fair value of stock option grants as compensation expense. Consequently, the financial reporting cost of using stock options increased considerably with the implementation of SFAS 123(R). Prior research documents a noticeable decrease in the use of stock option compensation after the adoption of SFAS 123(R) (Brown and Lee 2010; Hayes, Lemmon and Qiu 2012; Skantz 2012).

To exploit, in our setting, this exogenous shock in the use of option-based compensation, we follow the basic approach of Hayes, Lemmon and Qiu (2012) and compute three-year

averages of our main variables, both pre- and post-SFAS 123(R).[16] Our sample consists of 1,558 distinct firms with non-missing data for our main variables included in Equation (3) below. Out of these 1,558 firms, 1,055 (i.e., 68 percent) experienced a decrease in *OptionComp* after the adoption of SFAS 123(R) compared to before, whereas 383 (25 percent) had an increase. Table 5, Panel A, provides univariate statistics of variables pre- and post-SFAS 123(R). In line with findings from prior research, we document that *OptionComp* decreases considerably following the adoption of SFAS 123(R). Indeed, the mean (median) *OptionComp* in our sample firms decreases from 33 (31) percent of total compensation to 20 (17) percent. These decreases are statistically significant. Moreover, in the subsample of firms with a decrease in *OptionComp*, the mean (median) *OptionComp* decreases from 42 (40) percent of total compensation to 17 (14) percent.[17]

To provide evidence on the effect of changes in stock option compensation introduced by SFAS 123(R) on changes in new product trademark creation, we estimate the following model for firm *i*:

$$\begin{aligned}\Delta Log(NbTrademarks)_i = \alpha + \beta_1 \Delta OptionComp_i + \beta_2\, \Delta Log(TotalComp)_i \\ + \beta_3 \Delta Log(Sales)_i + \beta_4 \Delta R\&D_i + \beta_5\, \Delta Adv_i + \beta_6\, \Delta TobinQ_i + \varepsilon_i\end{aligned} \quad (3)$$

where the sign Δ represents the difference, for each variable, between i) the three-year average in

[16] Hayes, Lemmon and Qiu (2012) define the pre-123(R) period as the 3-year interval of 2002-2004 and the post-123(R) period as the 4-year interval of 2005-2008 to include any firms which respond to 123(R) before the required change in accounting. To reduce noise we exclude the transition year, 2005, and define our post-123(R) period as 2006-2008.

[17] We focus our analysis on changes in *OptionComp* since we expect SFAS 123(R) to most directly affect the use of option compensation. While SFAS 123(R) may also indirectly reduce the convexity of CEO incentives through the reduction in new option compensation; this effect is likely to be smaller, since the overall convexity of incentives is affected by the entire stock of CEO security holdings, and not just new grants, and will be affected more strongly by factors other than SFAS 123(R). Consistent with this, we find a much smaller reduction in *Vega* than in *OptionComp*. While average (median) *OptionComp* decreases by 40 (46) percent, average (median) *Vega* decreases by only 23 (12) percent. Similarly, while 68 (25) percent of firms decrease (increase) option compensation around SFAS 123(R), 55 (44) percent decrease (increase) *Vega*.

the post-SFAS 123(R) period and ii) the three-year average in the post-SFAS 123(R) period.[18] All variables are defined as in Equation (2). If CEO stock option compensation drives product development innovation, measured by new product trademarks, then we should find that firms which change (e.g., decrease) their option-based pay around SFAS 123(R) also experience a change (e.g., decrease) in trademark creation. In other words, we should find a positive relation between the change in stock option compensation and the change in trademark creation for firms affected by SFAS 123(R). Table 5, Panel B, presents the results. Model I includes all firm observations. The coefficient on *ΔOptionComp* is significantly positive, with $p = 0.07$. The magnitude of the coefficient, 0.1180, is similar to the magnitude of the coefficient on *OptionComp* in Table 4, 0.1110, suggesting that the association between lagged option compensation and trademark production documented in Table 4 is largely due to the effect of option compensation on product development innovation. Because we expect the exogenous shock of SFAS 123(R) to decrease the use of option compensation, firms which experience a decrease are most likely to have been affected by the exogenous shock. Firms which experience an increase in option compensation over the same time period are most likely being affected by other factors. Thus, to better isolate the impact of the exogenous shock, Model II (Model III) includes only the subsample of firm observations with decreases (increases) in *OptionComp* after the adoption of SFAS 123(R). Across both models, we find that changes in stock option compensation are significantly positively associated with subsequent changes in trademark creation. Overall, these findings confirm that stock option compensation is a significant driver of product development innovation, as measured by new product trademarks.

It is interesting to note that these results also suggest a previously undocumented real

[18] For the dependent variable, *Log(NbTrademarks)*, the pre(post)-SFAS 123(R) period corresponds to fiscal years 2003-2005 (2007-2009), whereas for all other variables, the pre(post)-SFAS 123(R) period corresponds to fiscal years 2002-2004 (2006-2008).

effect to the implementation of SFAS 123(R). In addition to somewhat directly impacting the use of option compensation, the accounting standard indirectly impacts product development innovation. The magnitudes of the effects we document suggest the following: Given that average *OptionComp* drops from 33 to 20 percent of total compensation, we would expect a 3.4 percent decrease in trademark production after 123(R) for an average firm. This amounts to 45 fewer new product trademarks per year after 123(R) than before 123(R), across the sample of 1,558 firms included in our analysis. This decrease in product development innovation is a potential cost to the entire economy. Alternatively, this might be a more optimal level of innovation, if pre-123(R) levels included inefficient investments.

4.3. CEO Incentives and Trademark Creation for Subsamples of Firms with and without Patents

Prior research has examined the relation between patent innovation and CEO incentives (Francis, Hasan, and Sharma, 2011; Baranchuk, Kieschnick, and Moussawi, 2014). However the type of innovation we examine is distinct, focusing on *product development* innovation rather than *research* innovation. Given the novelty of the trademark data, it is important to verify that our results are not driven by the subset of firms with patents. First, we examine the correlation between patent and trademark production. Not surprisingly, given the fundamental differences in the type of research they capture, the correlation is low. The correlation between the number of new trademarks and number of new patents across firm-years in our sample is significantly positive, but only 0.16. There are also many cases in which firms produce only one or the other. Fifty-five percent of the firm-years with new trademarks do not include a new patent, while 43% of the firm-years with a new patent do not include a new trademark.

The variation in patent and trademark production allows us to estimate Equation (2) separately for the subsamples of firm-years with and without patents. Table 6 reports the results. The coefficients on *OptionComp*, in Model I, and *Vega*, in Model II, remain positive and statistically significant for the subsample of firm-years with no patents. However the results are statistically insignificant for the sub-sample with patents. It may be the case that these firms focus their innovation on producing additional technological and scientific innovation – the more risky type of innovation. Consistent with this, in untabulated analyses we find that the number of patents is significantly increasing in *OptionComp* and *Vega*, if we use *Log(NbPatents)* as our dependent variable instead of *Log(NbTrademarks)*, for the subsample of firms with patents.

5. Conclusion

We examine the structure of CEO incentives as a determinant of product development innovation. We introduce a new measure of development innovation: trademark creation. We document that product development innovation, as measured by new product trademarks, is associated with the volatility of firms' sales, earnings, and stock returns, suggesting that product development innovation is in fact a risky activity. Using this new measure of product development innovation, we find that the structure of CEO incentives, specifically the use of stock option compensation and the convexity of incentives, provides incentives to engage in product development innovation. We exploit SFAS 123(R) as an exogenous shock to the use of stock options and document a significantly positive relation between changes in CEO stock option compensation around SFAS 123(R) and subsequent changes in trademark creation. These findings provide evidence that the structure of CEO incentives affects product development innovation activities.

Our study provides valuable insights to help better understand innovation and the incentives to engage in innovative activities. We collect and compile a comprehensive sample of new trademarks, as a new measure of product and marketing development innovation. Little is known about what contributes to firms' success in product and marketing development innovation, given the focus of prior research on research-oriented innovation in technology-intensive firms. Our study fills the gap by shedding light on how firms, including those in non-technology-intensive industries, can motivate product development innovation through the design of executive compensation contracts. Given the broad presence of non-technology-intensive firms and industries in the economy, the potential importance of product development innovation to firm performance, and the substantial differences between research innovation and development innovation, our study provides key contributions.

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Appendix A
Trademarks as a Measure of Product and Marketing Development Innovation

Patents have traditionally been used as a measure of innovation in firms. We make a distinction between *research innovation* and *development innovation.* To illustrate this distinction, consider the following two examples.

First, consider Apple Inc.'s iPhone, launched in 2007. On the one hand, the iPhone was technologically innovative. Prior to 2007, Apple had only 17 patents related to cell phones. By 2012, it had nearly 1,300, almost all filed after the 2007 launch of the initial iPhone (Gaze and Roderick 2012). While some patents may never be related to eventual products, these patents were turned into a product for sale, in the form of the iPhone. The trademark process resulted in a single trademark for the iPhone itself, with additional trademarks over time for variations in the logo, and for related products or marketing phrases, like "Made for iPod, iPad, iPhone" and "Works with iPhone." We were able to find a total of just 15 active trademarks registered by Apple Inc. for the iPhone. Thus the iPhone encompasses both *research innovation* and *development innovation*, with patents serving as a reasonable proxy for the extent of *research innovation* involved in the product, and trademarks capturing the fact that these translated, through *development innovation,* into a product for sale.

Second, consider General Mills' Yoplait Pro-Force Greek Yogurt. While this new product was innovative for the company and market – tailoring the relatively new high-protein Greek yogurt product to children and teenagers who have traditionally favored the sweeter traditional yogurts – it was not technologically innovative. Based on our search, General Mills and Yoplait did not file any new patents related specifically to the production of Greek yogurt or high-protein yogurt around the launch of Yoplait's new product. Most likely, they relied on their existing production methods. However the company registered two trademarks, for "Yoplait Pro-

Force" and for "Pro-Force," to protect their new product line. The company has also taken on substantial risk in launching this new product. Because of its novelty, they do not know if it will be accepted by its target customers. The company will have to divert certain limited resources, such as the limited shelf space they are allotted by grocery stores, away from more established products. Overall, the company is engaging in a type of risky innovation, which is distinct from the type of *research innovation* which Apple engaged in. One analyst focused on Yoplait's "innovation," in an analysis of this new product:

> "Through its strategy of innovating new and established brands, the company wants to cater to the increasing global demands for packaged food. Some of these innovations, mainly in yogurt, …" *(Zacks Equity Research 2013).*

We label this type of innovation, which results in a new product available to the market, but which may or may not exploit new technologies from *research innovation*, as *development innovation.*

The second distinction that we make is between *product development innovation* and *marketing development innovation*. While many trademarks represent product names, usually indicating new products, many marketing-related trademarks are related to new marketing campaigns for existing products. For example, the following three images were registered by Coca-Cola Company in 1976, 1992, and 2005 respectively.

1976:	

1992:	
2005:	

While these trademarks represent innovations to the firm's marketing of the Fanta product, they do not represent new product development innovation.[19]Marketing functions are often separated from product development in organizations, and factors that contribute to the pursuit and success of these separate innovations likely also differ. Consequently, for our analyses, separating new trademarks resulting from product development innovation and new trademarks from marketing innovation is appropriate.

We classify all images (21 percent of our sample trademarks) as marketing-related. While companies often trademark logos such as the Fanta logos above, they often also include a "Word mark" for the product name. In the case of Fanta, Coca-Cola Co. has a trademark for the word "Fanta," which was originally registered in 1955 and which is still active, in addition to the changing image marks displayed above. Similarly, we classify "sound marks," such as the MGM

[19] While we were unable to find definitive sources, a reading of dozens of news articles related to Fanta suggests that the 1992 and 2005 logo changes were not associated with any significant changes in the taste, color, or general packaging (e.g., cans, bottles) of the Fanta product. The 1992 logo change corresponded with a significant overseas marketing push of Fanta, particularly in the former Soviet Union and Eastern Bloc countries. The 2005 logo change corresponded to a reintroduction of the Fanta product in the U.S. market in the early 2000's, with a large associated marketing push. We were unable to find significant information regarding the 1976 logo change.

roaring of the lion at the beginning of movies and the THX sound at movies, as marketing-related (0.02 percent of our sample trademarks). The final category, "word marks," tends to include both product names and slogans used for marketing. Below we provide examples to illustrate this distinction. The following is a table with a few examples of each for well-known companies:

Company	Example Product Trademarks	Example Marketing Trademarks (e.g., Slogans)
McDonald's Corp.	Big Mac; Big N' Tasty; McDouble	I'm Lovin' It; What We're Made Of
Coca-Cola Co.	Fanta; Sprite; Cherry Coke	The Coca-Cola Side of Life; Coca-Cola Refresh Your Flow
Citigroup Inc.	Citi Retail Services; Citi Treasury Diagnostics; C-Trackss	Citibank Deals About Town; Endless Points. Endless Potential.; Every Step of the Way

In order to categorize word marks as either product or marketing trademarks, we examined 500 randomly chosen trademarks, and hand-coded them as product, marketing, or unclear, trademarks based upon searches for the given words or phrases. As might be expected, longer phrases are more likely to be marketing-focused, while shorter phrases are more likely to represent product names. In particular, we found that for trademarks of four words, slightly more than 50 percent were related to marketing. The percentage was even higher for longer phrases. For trademarks of three words, the percentage was only 23 percent by the most conservative measure (including all "unclear" trademarks as marketing-related), and less than 7 percent (2.5 percent for two-word (one-word) trademarks. Thus, we use the number of words in the word mark to separate marketing- from product-focused word-based trademarks. While this partition is not error-proof, it provides a reasonable rule for categorizing the large number of trademarks in our sample (112,038 unique trademarks), while minimizing errors. In the examples provided above, only the "I'm Lovin' It" trademark from McDonalds would be misclassified.

Appendix B

FASB Accounting Standards Codification 730-15-4 indicates that R&D expense excludes the following transactions and activities:

a. Accounting for the costs of research and development activities conducted for others under a contractual arrangement, which is a part of accounting for contracts in general. Indirect costs, including indirect costs that are specifically reimbursable under the terms of a contract, are also excluded from the scope of this Topic.

b. Activities that are unique to entities in the extractive industries, such as prospecting, acquisition of mineral rights, exploration, drilling, mining, and related mineral development.

c. The acquisition, development, or improvement of a process by an entity for use in its selling or administrative activities. A process may be intended to achieve cost reductions as opposed to revenue generation. However, (e) specifically excludes market research or market testing activities from research and development activities. Those activities were excluded because they relate to the selling function of an entity. Thus, while in the broadest sense of the word, a process may be used in all of an entity's activities, the acquisition, development, or improvement of a process by an entity for use in its selling or administrative activities shall be excluded from the definition of research and development activities. To the extent, therefore, that the acquisition, development, or improvement of a process by an entity for use in its selling or administrative activities includes costs for computer software, those costs are not research and development costs. Examples of the excluded costs of software are those incurred for development by an airline of a computerized reservation system or for development of a general management information system. See SubTopic 350-40 for guidance related to costs of computer software developed or obtained for internal use and SubTopic 985-20 for computer software intended to be sold, leased or marketed.

d. Routine or periodic alterations to existing products, production lines, manufacturing processes, and other ongoing operations even though those alterations may represent improvements.

e. Market research or market testing activities.

f. Research and development assets acquired in a business combination or an **acquisition by a not-for-profit entity.** If tangible and intangible assets acquired in that manner are used in research and development activities, they are recognized and measured at fair value in accordance with SubTopic 805-20, regardless of whether they have an alternative future use. After recognition, tangible assets acquired in a business combination or an acquisition by a not-for-profit entity that are used in research and development activities are accounted for in accordance with their nature. After recognition, intangible assets acquired in a business combination or an acquisition by a not-for-profit entity that are used in research and development activities are accounted for in accordance with Topic 350.

Table 1
Distribution of New Product and Marketing Trademarks and Firm-Year Observations

Panel A: Distribution of New Product and Marketing Trademarks and Firm-Year Observations by Fiscal Year

Year	New Product Trademarks		New Marketing Trademarks		Execucomp Firm-Year Observations	
	N	%	N	%	N	%
1993	1,855	2.40	890	2.57	2,229	5.20
1994	2,432	3.14	1,014	2.93	2,330	5.43
1995	3,105	4.01	1,464	4.22	2,514	5.86
1996	3,859	4.99	1,587	4.58	2,582	6.02
1997	4,320	5.58	1,902	5.49	2,553	5.95
1998	3,725	4.81	1,646	4.75	2,543	5.93
1999	3,479	4.50	1,570	4.53	2,480	5.78
2000	3,807	4.92	1,859	5.37	2,386	5.56
2001	4,040	5.22	1,693	4.89	2,321	5.41
2002	5,157	6.66	2,157	6.23	2,321	5.41
2003	4,918	6.35	2,068	5.97	2,315	5.40
2004	4,434	5.73	1,824	5.26	2,287	5.33
2005	4,237	5.47	1,920	5.54	2,227	5.19
2006	4,966	6.42	2,102	6.07	2,152	5.02
2007	5,150	6.65	2,230	6.44	2,055	4.79
2008	5,386	6.96	2,534	7.31	1,977	4.61
2009	4,630	5.98	2,352	6.79	1,936	4.52
2010	3,943	5.10	1,945	5.61	1,878	4.38
2011	3,951	5.11	1,887	5.45	1,805	4.21
All Years	**77,394**	**100.00**	**34,644**	**100.00**	**42,891**	**100.00**

Table 1 (cont'd)

Panel B: Distribution of New Product and Marketing Trademarks and Firm-Years by Industry

Industry Code and Description	New Product Trademarks		New Marketing Trademarks		Execucomp Firm-Years	
	N	%	N	%	N	%
1: Agriculture	225	0.29	119	0.34	139	0.32
2: Food Products	2,361	3.05	1,608	4.64	771	1.80
3: Candy, Soda	49	0.06	24	0.07	96	0.22
4: Alcoholic Beverages	1,343	1.74	1,268	3.66	135	0.31
5: Tobacco Products	49	0.06	204	0.59	71	0.17
6: Recreational Products	7,473	9.66	1,114	3.22	220	0.51
7: Entertainment	835	1.08	620	1.79	497	1.16
8: Printing, Publishing	1,650	2.13	1,024	2.96	407	0.95
9: Consumer Goods	5,286	6.83	1,691	4.88	713	1.66
10: Apparel	1,312	1.69	808	2.33	629	1.47
11: Healthcare	393	0.51	316	0.91	838	1.95
12: Medical Equipment	2,531	3.27	505	1.46	1,049	2.45
13: Pharma. Products	3,589	4.64	2,145	6.19	1,533	3.57
14: Chemicals	2,840	3.67	700	2.02	1,021	2.38
15: Rubber, Plastic Products	364	0.47	83	0.24	208	0.48
16: Textiles	594	0.77	153	0.44	236	0.55
17: Construction Materials	660	0.85	253	0.73	739	1.72
18: Construction	394	0.51	307	0.89	527	1.23
19: Steel Works, Etc.	727	0.94	279	0.81	811	1.89
20: Fabricated Products	59	0.08	24	0.07	116	0.27
21: Machinery	2,878	3.72	986	2.85	1,490	3.47
22: Electrical Equipment	1,216	1.57	321	0.93	541	1.26
23: Miscellaneous	948	1.22	254	0.73	231	0.54
24: Automobiles, Trucks	2,425	3.13	1,133	3.27	723	1.69
25: Aircraft	430	0.56	150	0.43	191	0.45
26: Ship., Railroad Equip.	123	0.16	43	0.12	67	0.16
27: Defense	544	0.70	268	0.77	93	0.22
28: Precious Metals	1	0.00	6	0.02	138	0.32
29: Nonmetallic Mining	75	0.10	21	0.06	146	0.34
30: Coal	8	0.01	8	0.02	84	0.20
31: Petroleum, Natural Gas	1,081	1.40	593	1.71	1,603	3.74
32: Utilities	777	1.00	841	2.43	2,309	5.38
33: Telecommunications	3,990	5.16	2,305	6.65	1,006	2.35
34: Personal Services	241	0.31	258	0.74	420	0.98
35: Business Services	5,080	6.56	2,069	5.97	4,310	10.05
36: Computers	2,711	3.50	800	2.31	1,613	3.76
37: Electronic Equipment	2,826	3.65	935	2.70	2,569	5.99
38: Measure, Control Equip.	1,094	1.41	191	0.55	826	1.93
39: Business Supplies	1,932	2.50	750	2.16	671	1.56
40: Shipping Containers	141	0.18	55	0.16	185	0.43
41: Transportation	812	1.05	564	1.63	1,087	2.53
42: Wholesale	1,532	1.98	747	2.16	1,402	3.27
43: Retail	5,205	6.73	2,609	7.53	2,730	6.37
44: Restaurant, Hotel, Motel	1,364	1.76	1,090	3.15	787	1.83
45: Banking	3,265	4.22	1,954	5.64	2,655	6.19
46: Insurance	2,453	3.17	1,552	4.48	1,922	4.48
47: Real Estate	2	0.00	6	0.02	68	0.16
48: Trading	1,506	1.95	890	2.57	2,268	5.29
All Industries	**77,394**	**100.00**	**34,644**	**100.00**	**42,891**	**100.00**

Table 1 (cont'd)

Panel C: Distribution of New Product Trademarks across Firm-Years

	No. of Firm-Years	Min	Q1	Mean	Median	Q3	P99	Max	Std Dev
Execucomp Sample	42,891	0	0	1.8	0	1	24	705	8.7
With Product Trademarks	14,614	1	1	5.3	2	5	41	705	14.2
By Industry:									
6: Rec. Products	133	1	3	56.2	12	36	538	705	111.1
9: Consumer Goods	476	1	2	11.1	5	11.5	125	180	19.9
33: Telecom.	372	1	2	10.7	4	9.5	127	216	21.2
35: Business Svcs	1,470	1	1	3.5	2	4	28	56	5.2
43: Retail	1,027	1	1	5.1	2	5	37	65	7.3

Panel D: Distribution of New Marketing Trademarks across Firm-Years

	No. of Firm-Years	Min	Q1	Mean	Median	Q3	P99	Max	Std Dev
Execucomp Sample	42,891	0	0	0.8	0	0	13	112	3.2
With Marketing Trademarks	10,035	1	1	3.5	2	3	28	112	6.0
By Industry:									
13: Pharma. Products	437	1	1	4.9	2	4	34	112	9.8
33: Telecom.	311	1	1	7.4	3	7	60	111	12.9
35: Business Svcs	884	1	1	2.3	1	2	18	56	3.9
43: Retail	810	1	1	3.2	2	3	22	52	4.2
45: Banking	663	1	1	2.9	2	3	18	29	3.4

Panel E: New Product Trademark Firm-Years versus Execucomp Firm-Years

	New Product Trademark Firm-Years N=14,614		Execucomp Firm-Years N=42,879		Trademark vs. Execucomp *p*-value of Difference	
Variable	Mean	Median	Mean	Median	Mean	Median
TotalAssets (in $M)	13,244.8	1,654.2	7,333.0	1,080.7	<0.01	<0.01
Sales (in $M)	6,140.5	1,478.6	3,436.7	812.4	<0.01	<0.01
MarketValueEquity ($M)	8,761.1	1,740.4	4,605.0	996.4	<0.01	<0.01
TobinQ	2.0623	1.5647	1.9398	1.4465	<0.01	<0.01
R&D (in % of *Sales*)	0.0485	0.0045	0.0476	0.0000	0.39	<0.01
Adv (in % of *Sales*)	0.0141	0.0000	0.0099	0.0000	<0.01	<0.01
NbMonths (in months)	285.5	218.0	245.3	178.0	<0.01	<0.01
Salary (in $K)	720.36	680.00	634.27	582.48	<0.01	<0.01
Bonus (in $K)	611.06	200.00	489.07	157.50	<0.01	<0.01
TotalComp (in $K)	5,282.77	3,057.57	4,233.58	2,264.81	<0.01	<0.01
OptionComp (in % of *TotalComp*)	0.30	0.27	0.28	0.22	<0.01	<0.01
Vega (in $K)	160.25	63.10	112.23	39.99	<0.01	<0.01
Delta (in $K)	967.98	265.26	679.61	195.71	<0.01	<0.01

Table 1 (cont'd)

Notes:
Panel A (Panel B) of this table presents the distribution by year (by industry) of the sample of 77,394 new product trademarks and 34,644 new marketing trademarks registered by 2,278 and 2,119 distinct Execucomp firms, respectively, during fiscal years 1993-2011 as well as the full sample of 42,891 Execucomp firm-year observations (3,276 distinct firms). Panel C (Panel D) of this table presents the distribution of new product (marketing) trademarks registered during a year across firms for the Execucomp Sample, the Execucomp Sample with product (marketing) trademarks, and each of the top five industry groups based on total number of new product (marketing) trademarks. Panel E of this table presents selected summary statistics for the new product trademark firm-year observations (14,614 firm-year observations from 2,278 distinct firms) and the Execucomp firm-year observations (42,891 firm-year observations from 3,276 distinct firms), which include the new product trademark firm-year observations. Panel E also presents comparisons and results of *t*-tests (Wilcoxon rank-sum tests) of mean (median) differences for each variable. The sample covers fiscal years 1993-2011. *TotalAssets* is total assets, in $M. *Sales* is total sales, in $M. *MarketValueEquity* is market value of common equity, in $M. *TobinQ* is the ratio of the market value of total assets to the book value of total assets. *R&D* is research and development expense divided by total sales (set as zero when R&D expense is missing in Compustat). *Adv* is advertising expense divided by total sales (set as zero when advertising expense is missing in Compustat). *NbMonths* is the number of months since the firm first appeared on CRSP. *Salary* is the CEO's annual base salary, in $K. *Bonus* is the CEO's annual bonus, in $K. *TotalComp* is the CEO's annual total compensation, in $K, measured as the sum of salary, bonus, other annual compensation, value of restricted stock granted, value of new stock options granted during the year, long-term incentive payouts, and all other compensation. *OptionComp* is the CEO's annual stock option compensation, defined as the value of new stock options granted as a percentage of total compensation. *Vega* is the CEO's sensitivity to stock return volatility, measured as the dollar change in the CEO's option portfolio for a 0.01 change in standard deviation of stock returns. *Delta* is the CEO's pay-performance sensitivity, measured as the dollar change in the CEO's wealth for a one-percent change in stock price. To mitigate the influence of outliers, all variables except *NbMonths* are winsorized at the 1st and 99th percentiles.

Table 2
Descriptive Statistics and Correlation Coefficients

Panel A: Descriptive Statistics

Variable	Q1	Mean	Median	Q3	Std Dev
Log(NbTrademarks)	0.0000	0.4758	0.0000	0.6931	0.7983
Log(NbMktgTrademarks)	0.0000	0.2786	0.0000	0.0000	0.5890
RetVol	0.2856	0.4589	0.3977	0.5649	0.2500
ChangeSalesVol	0.0132	0.0592	0.0279	0.0541	1.6022
ChangeEarnVol	0.0045	0.0582	0.0108	0.0269	3.5610
OptionComp	0.0000	0.2769	0.2205	0.4773	0.2799
Vega	11.5557	118.6891	39.9897	117.5611	252.8997
Delta	71.6801	1,019.6559	195.7120	543.5267	8,736.0544
Log(TotalComp)	6.9796	7.7510	7.7275	8.5248	1.1767
Log(Sales)	5.5742	6.7044	6.7000	7.8831	1.8305
R&D	0.0000	0.1543	0.0000	0.0304	4.6072
Adv	0.0000	0.0108	0.0000	0.0072	0.0415
TobinQ	1.1040	1.9994	1.4464	2.1644	2.2608
Age	4.4427	5.0358	5.1874	5.8464	1.1252
Size	5.8661	6.9718	6.9042	8.0702	1.7537

Table 2 (cont'd)

Panel B: Pearson (Spearman) Correlation Coefficients in the Lower Left (Upper Right) Diagonal

	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
A: Log(NbTrademarks)	--	0.582	-0.068	-0.015	-0.002	0.095	0.237	0.179	0.217	0.283	0.172	0.160	0.102	0.164	0.263
B:Log(NbMktgTrademarks)	0.677	--	-0.094	-0.054	-0.059	0.064	0.211	0.174	0.218	0.286	0.025	0.167	0.045	0.148	0.262
C: RetVol	-0.089	-0.098	--	0.423	0.499	0.114	-0.164	-0.164	-0.148	-0.372	0.253	0.061	0.065	-0.352	-0.431
D: ChangeSalesVol	-0.008	-0.007	0.188	--	0.548	0.093	-0.123	-0.093	-0.126	-0.163	0.214	0.012	0.239	-0.174	-0.310
E: ChangeEarnVol	-0.006	-0.005	0.306	0.998	--	0.114	-0.046	-0.145	-0.061	-0.258	0.394	0.040	0.202	-0.193	-0.284
F: OptionComp	0.084	0.056	0.135	0.006	0.004	--	0.437	0.180	0.374	0.040	0.194	0.009	0.192	-0.094	0.137
G: Vega	0.246	0.249	-0.121	-0.063	-0.045	0.213	--	0.552	0.664	0.482	0.098	0.110	0.123	0.163	0.581
H: Delta	0.058	0.056	-0.023	-0.013	-0.009	0.004	0.138	--	0.481	0.372	0.017	0.107	0.356	0.001	0.590
I: Log(TotalComp)	0.227	0.220	-0.120	-0.009	-0.007	0.364	0.465	0.024	--	0.602	0.009	0.085	0.060	0.180	0.652
J: Log(Sales)	0.336	0.325	-0.361	-0.028	-0.028	0.002	0.400	0.106	0.554	--	-0.217	0.049	-0.174	0.453	0.769
K: R&D	-0.012	-0.010	0.049	0.001	0.002	0.014	-0.012	-0.003	-0.026	-0.117	--	0.035	0.371	-0.058	-0.052
L: Adv	0.103	0.120	0.062	-0.001	-0.002	0.028	0.088	0.029	0.042	-0.031	0.003	--	0.100	-0.029	0.045
M: TobinQ	0.025	0.008	0.138	0.007	0.006	0.152	0.064	0.108	-0.003	-0.200	0.051	0.125	--	-0.190	0.178
N: Age	0.188	0.160	-0.294	-0.141	-0.110	-0.131	0.137	0.004	0.149	0.422	-0.012	-0.049	-0.184	--	0.332
O: Size	0.325	0.316	-0.421	-0.021	-0.017	0.135	0.487	0.159	0.584	0.760	-0.034	0.022	0.090	0.299	--

Notes:

This table presents selected descriptive statistics (Panel A) and correlation coefficients (Panel B) of the variables included in Tables 3 through 5 for the Execucomp sample (42,879 firm-year observations from 3,275 distinct firms). The sample covers fiscal years 1993-2011. In Panel B, pearson (spearman) correlation coefficients are provided in the lower (upper right) diagonal. *Log(NbTrademarks)* is the natural logarithm of one plus the number of new product trademarks registered during the year. *Log(NbMktgTrademarks)* is the natural logarithm of one plus the number of new marketing trademarks registered during the year. *RetVol* is the annualized stock return volatility, measured as the annualized standard deviation of daily stock returns over the year. *ChangeSalesVol* (*ChangeEarnVol*) is sales (earnings) volatility, measured as the standard deviation of seasonal sales (earnings) changes estimated over the most recent three years. *OptionComp* is the CEO's annual stock option compensation, measured as the value of new stock options granted as a percentage of total compensation. *Vega* is the CEO's sensitivity to stock return volatility, measured as the dollar change in the CEO's option portfolio for a 0.01 change in annualized standard deviation of stock returns. *Delta* is the CEO's sensitivity to stock price, measured as the dollar change in the CEO's stock and option portfolio for a one-percent change in stock price. *Log(TotalComp)* is the natural logarithm of the CEO's annual total compensation, measured as the sum of salary, bonus, other annual compensation, value of restricted stock granted, value of new stock options granted during the year, long-term incentive payouts, and all other compensation. *Log(Sales)* is the natural logarithm of total sales. *R&D* is the ratio of research and development expense divided by total sales (set as zero when R&D expense is missing in Compustat). *Adv* is the ratio of advertising expense divided by total sales (set as zero when advertising expense is missing in Compustat). *TobinQ* is the ratio of the market value of total assets to the book value of total assets. *Age* is the natural logarithm of one plus the number of months since the firm first appeared on CRSP. *Size* is the natural logarithm of market value of equity. To mitigate the influence of outliers, all variables are winsorized by year and industry at the 1st and 99th percentiles.

Table 3
Relation between New Product and Marketing Trademarks and Firm Volatility

Panel A: Relation between New Product and Marketing Trademarks and Stock Return Volatility

$$RetVol_{i,t+1} = \alpha + \beta_1 Log(NbTrademarks)_{i,t} + \beta_2 Log(NbMktgTrademarks)_{i,t} + \beta_3 RetVol_{i,t} + \beta_4 Age_{i,t} + \beta_5 Size_{i,t} + \sum \chi_j Year_j + \varepsilon_{i,t+1}$$

Variable	Expected Sign	Coefficient *(t-statistic)*		
		Model I	Model II	Model III
$Log(NbTrademarks)_t$	+	**0.0036** ***(3.93)***		**0.0031** ***(2.70)***
$Log(NbMktgTrademarks)_t$	?		**0.0036** ***(2.93)***	0.0009 *(0.60)*
$RetVol_t$	+	**0.7342** ***(135.60)***	**0.7347** ***(135.93)***	**0.7342** ***(135.59)***
Age_t	–	**-0.0093** ***(-11.43)***	**-0.0092** ***(-11.28)***	**-0.0094** ***(-11.44)***
$Size_t$	–	**-0.0126** ***(-19.96)***	**-0.0124** ***(-19.66)***	**-0.0126** ***(-19.78)***
Year Effects			Included	
No. of Observations		39,000	39,000	39,000
Adj. R^2 (%)		68.69	68.68	68.69

Panel B: Relation between New Product and Marketing Trademarks and Sales (Earnings) Volatility

$$ChangeSalesVol_{i,[t+1;t+3]} = \alpha + \beta_1 Log(NbTrademarks)_{i,t} + \beta_2 Log(NbMktgTrademarks)_{i,t} + \beta_3 ChangeSalesVol_{i,[t-2;t]} + \beta_4 Age_{i,t} + \beta_5 Size_{i,t} + \sum \chi_j Year_j + \varepsilon_{i,[t+1;t+3]}$$

Variable	Expected Sign	Coefficient *(t-statistic)*					
		Sales Volatility			Earnings Volatility		
		Model I	Model II	Model III	Model IV	Model V	Model VI
$Log(NbTrademarks)_t$	+	**0.0009** ***(2.76)***		**0.0008** ***(2.03)***	**0.0008** ***(2.74)***		**0.0007** ***(1.94)***
$Log(NbMktgTrademarks)_t$	?		**0.0010** ***(2.18)***	0.0003 *(0.62)*		**0.0009** ***(2.24)***	0.0003 *(0.69)*
$ChangeSalesVol_t$	+	**0.4073** ***(33.67)***	**0.4075** ***(33.71)***	**0.4073** ***(33.67)***			
$ChangeEarnVol_t$	+				**0.4687** ***(32.97)***	**0.4692** ***(33.09)***	**0.4688** ***(32.98)***
Age_t	–	0.0006 *(1.45)*	0.0006 *(1.55)*	0.0006 *(1.45)*	**-0.0018** ***(-5.12)***	**-0.0018** ***(-5.04)***	**-0.0018** ***(-5.12)***
$Size_t$	–	**-0.0041** ***(-15.70)***	**-0.0041** ***(-15.59)***	**-0.0041** ***(-15.57)***	**-0.0030** ***(-12.09)***	**-0.0030** ***(-11.94)***	**-0.0030** ***(-11.99)***
Year Effects			Included			Included	
No. of Observations		36,144	36,144	36,144	36,144	36,144	36,144
Adj. R^2 (%)		28.82	28.81	28.82	28.20	28.18	28.20

Table 3 (cont'd)

Notes:
This table (Panels A and B) presents the results from the regressions presented above and estimated using Huber-White robust standard errors clustered by firm. The sample covers fiscal years 1993-2011. *t*-statistics are in parenthesis below the coefficient estimates. Year effects are included but not reported for brevity. In Panel A, the dependent variable *RetVol* is the annualized stock return volatility, measured as the annualized standard deviation of daily stock returns over the year. In Panel B, Models I through III (Models IV through VI) the dependent variable *ChangeSalesVol* (*ChangeEarnVol*) is sales (earnings) volatility, measured as the standard deviation of seasonal sales (earnings) changes estimated over the three years. *Log(NbTrademarks)* is the natural logarithm of one plus the number of new product trademarks registered during the year. *Log(NbMktgTrademarks)* is the natural logarithm of one plus the number of new marketing trademarks registered during the year. *Age* is the natural logarithm of one plus the number of months since the firm first appeared on CRSP. *Size* is the natural logarithm of market value of equity. To mitigate the influence of outliers, all variables are winsorized by year at the 1^{st} and 99^{th} percentiles.

Table 4
Relation between CEO Incentives and New Product Trademarks

$$Log(NbTrademarks)_{i,t} = \alpha + \beta_1 OptionComp_{i,t-1} + \beta_2 Log(TotalComp)_{i,t-1} + \beta_3 Log(Sales)_{i,t-1} + \beta_4 R\&D_{i,t-1} + \beta_5 Adv_{i,t-1} + \beta_6 TobinQ_{i,t-1} + \sum \chi_j Year_j + \sum \delta_k Industry_k + \varepsilon_{i,t}$$

Variable	Expected Sign	Coefficient *(t-statistic)*			
		Model I	Model II	Model III	Model IV
$OptionComp_{t-1}$	+		**0.1110** ***(3.47)***		
$Vega_{t-1}$				**0.0002** ***(2.69)***	
$Delta_{t-1}$					0.0000 *(0.65)*
$Log(TotalComp)_{t-1}$	?	0.0119 *(1.16)*	-0.0032 *(-0.29)*	0.0029 *(0.29)*	**0.0185** ***(1.90)***
$Log(Sales)_{t-1}$	+	**0.2015** ***(18.12)***	**0.2060** ***(18.65)***	**0.1977** ***(17.83)***	**0.2065** ***(18.20)***
$R\&D_{t-1}$	+	**0.0072** ***(3.98)***	**0.0074** ***(4.07)***	**0.0144** ***(3.52)***	**0.0151** ***(3.54)***
Adv_{t-1}	+	**2.6121** ***(5.58)***	**2.6047** ***(5.58)***	**2.6751** ***(5.61)***	**2.8117** ***(5.86)***
$TobinQ_{t-1}$	+	**0.0205** ***(4.54)***	**0.0199** ***(4.47)***	**0.0314** ***(4.95)***	**0.0344** ***(5.28)***
Year Effects			Included		
Industry Effects			Included		
No. of Observations		32,553	32,553	30,510	29,431
Adj. R^2 (%)		24.41	24.50	25.41	25.15

Notes:
This table presents the results from the regression presented above and estimated using Huber-White robust standard errors clustered by firm. The sample covers fiscal years 1993-2011. *t*-statistics are in parenthesis below the coefficient estimates. Year and industry effects are included but not reported for brevity. The dependent variable *Log(NbTrademarks)* is the natural logarithm of one plus the number of new product trademarks registered during the year. *OptionComp* is the CEO's annual stock option compensation, measured as the value of new stock options granted as a percentage of total compensation. *Vega* is the CEO's sensitivity to stock return volatility, measured as the dollar change in the CEO's option portfolio for a 0.01 change in annualized standard deviation of stock returns. *Delta* is the CEO's sensitivity to stock price, measured as the dollar change in the CEO's stock and option portfolio for a one-percent change in stock price. *Log(TotalComp)* is the natural logarithm of the CEO's annual total compensation, measured as the sum of salary, bonus, other annual compensation, value of restricted stock granted, value of new stock options granted during the year, long-term incentive payouts, and all other compensation. *Log(Sales)* is the natural logarithm of total sales. *R&D* is the ratio of research and development expense divided by total sales (set as zero when R&D expense is missing in Compustat). *Adv* is the ratio of advertising expense divided by total sales (set as zero when advertising expense is missing in Compustat). *TobinQ* is the ratio of the market value of total assets to the book value of total assets. Industry grouping is based on the Fama-French (1997) 48-industry classification. To mitigate the influence of outliers, all variables are winsorized by year and industry at the 1st and 99th percentiles.

Table 5
Changes in CEO Stock Option Compensation
and Changes in New Product Trademarks around SFAS 123(R)

Panel A: Univariate Analysis

	Three-Year Average Pre-SFAS 123(R)		Three-Year Average Post-SFAS 123(R)		Post vs. Pre *p*-value of Difference	
Variable	Mean	Median	Mean	Median	Mean	Median
All (N=1,558)						
Log(NbTrademarks)	0.6093	0.2310	0.6524	0.2310	0.16	0.39
OptionComp	0.3326	0.3114	0.1991	0.1696	<0.01	<0.01
$Log(TotalComp)_t$	7.8899	7.8762	8.0823	8.1267	<0.01	<0.01
Log(Sales)	7.1451	7.0517	7.5355	7.4772	<0.01	<0.01
R&D	0.1361	0.0000	0.0642	0.0000	0.30	0.89
Adv	0.0107	0.0000	0.0113	0.0000	0.54	0.20
TobinQ	1.8770	1.4519	1.7482	1.4161	0.01	<0.01
OptionComp Decrease (N=1,055)						
Log(NbTrademarks)	0.6371	0.2310	0.6830	0.3466	0.23	0.28
OptionComp	0.4156	0.3954	0.1657	0.1402	<0.01	<0.01
$Log(TotalComp)_t$	8.0296	8.0047	8.1035	8.1440	0.10	0.01
Log(Sales)	7.1403	7.0650	7.5346	7.4567	<0.01	<0.01
R&D	0.1839	0.0000	0.0634	0.0000	0.24	0.83
Adv	0.0104	0.0000	0.0111	0.0000	0.57	0.30
TobinQ	1.9170	1.4762	1.7663	1.4476	0.01	<0.01
OptionComp Increase (N=383)						
Log(NbTrademarks)	0.6194	0.2310	0.6737	0.2310	0.38	0.83
OptionComp	0.2082	0.1803	0.3536	0.3409	<0.01	<0.01
$Log(TotalComp)_t$	7.7687	7.7430	8.2575	8.2629	<0.01	<0.01
Log(Sales)	7.2769	7.2131	7.6659	7.6225	<0.01	<0.01
R&D	0.0425	0.0000	0.0823	0.0000	0.34	0.94
Adv	0.0116	0.0000	0.0122	0.0000	0.78	0.48
TobinQ	1.8185	1.4322	1.7375	1.3967	0.31	0.27

Table 5 (cont'd)

Panel B: Regression Analysis

$$\Delta Log(NbTrademarks)_i = \alpha + \beta_1 \Delta OptionComp_i + \beta_2 \Delta Log(TotalComp)_i + \beta_3 \Delta Log(Sales)_i + \beta_4 \Delta R\&D_i + \beta_5 \Delta Adv_i + \beta_6 \Delta TobinQ_i + \varepsilon_i$$

Variable	Expected Sign	Coefficient *(t-statistic)*		
		All	*OptionComp* Decrease	*OptionComp* Increase
		Model I	Model II	Model III
Intercept	?	0.0144 *(0.75)*	**0.0643** ***(1.99)***	**-0.1212** ***(-2.14)***
ΔOptionComp	+	**0.1180** ***(2.00)***	**0.1965** ***(2.10)***	**0.4136** ***(2.06)***
ΔLog(TotalComp)	?	-0.0184 *(-0.98)*	-0.0161 *(-0.72)*	-0.0370 *(-0.78)*
ΔLog(Sales)	+	**0.1204** ***(4.34)***	**0.0797** ***(2.34)***	**0.3287** ***(4.85)***
ΔR&D	+	0.0006 *(0.13)*	0.0015 *(0.29)*	**0.0507** ***(2.89)***
ΔAdv	+	0.2979 *(0.28)*	-0.5691 *(-0.41)*	1.7477 *(1.11)*
ΔTobinQ	+	-0.0057 *(-0.38)*	-0.0045 *(-0.27)*	-0.0182 *(-0.52)*
No. of Observations		1,558	1,055	383
Adj. R^2 (%)		1.28	0.91	6.34

Notes:

This table presents univariate results (Panel A) and regression results (Panel B) of changes in CEO stock option compensation and changes in trademark registration around the adoption of SFAS 123(R). The sample consists of 1,558 distinct firms. For each variable, we calculate i) the three-year average pre-SFAS 123(R) and ii) the three-year average post-SFAS 123(R). For *Log(NbTrademarks)*, the pre(post)-SFAS 123(R) period corresponds to fiscal years 2003-2005 (2007-2009), whereas for all other variables, the pre(post)-SFAS 123(R) period corresponds to fiscal years 2002-2004 (2006-2008). Panel A presents univariate results, with comparisons and results of *t*-tests (Wilcoxon rank-sum tests) of mean (median) differences for each variable. For Panel B, we calculate the difference between ii) and i). *t*-statistics are in parenthesis below the coefficient estimates. Model II (III) includes only firm observations with decreases (increases) in *OptionComp* around the adoption of SFAS 123(R). *Log(NbTrademarks)* is the natural logarithm of one plus the number of product trademarks registered during the year. *OptionComp* is the CEO's annual stock option compensation, measured as the value of new stock options granted as a percentage of total compensation. *Log(TotalComp)* is the natural logarithm of the CEO's annual total compensation, measured as the sum of salary, bonus, other annual compensation, value of restricted stock granted, value of new stock options granted during the year, long-term incentive payouts, and all other compensation. *Log(Sales)* is the natural logarithm of total sales. *R&D* is the ratio of research and development expense divided by total sales (set as zero when R&D expense is missing in Compustat). *Adv* is the ratio of advertising expense divided by total sales (set as zero when advertising expense is missing in Compustat). *TobinQ* is the ratio of the market value of total assets to the book value of total assets. Industry grouping is based on the Fama-French (1997) 48-industry classification. To mitigate the influence of outliers, all variables are winsorized by industry at the 1st and 99th percentiles.

Table 6
Relation between CEO Incetives and New Product Trademarks, for Subsamples with no and with Patents

$$Log(NbTrademarks)_{i,t} = \alpha + \beta_1 OptionComp_{i,t-1} + \beta_2 Log(TotalComp)_{i,t-1} + \beta_3 Log(Sales)_{i,t-1} + \beta_4 R\&D_{i,t-1} + \beta_5 Adv_{i,t-1} + \beta_6 TobinQ_{i,t-1} + \sum \chi_j Year_j + \sum \delta_k Industry_k + \varepsilon_{i,t}$$

Variable	Expected Sign	Coefficient *(t-statistic)*			
		Subsample with no Patents		Subsample with Patents	
		Model I	Model II	Model III	Model IV
$OptionComp_{t-1}$	+	**0.0990**		0.0511	
		(3.22)		*(0.88)*	
$Vega_{t-1}$			**0.0002**		0.0000
			(1.97)		*(0.39)*
$Log(TotalComp)_{t-1}$	?	-0.0159	-0.0097	0.0059	0.0114
		(-1.51)	*(-0.90)*	*(0.31)*	*(0.70)*
$Log(Sales)_{t-1}$	+	**0.1423**	**0.1365**	**0.2468**	**0.2444**
		(12.40)	***(11.41)***	***(14.17)***	***(14.19)***
$R\&D_{t-1}$	+	**0.0039**	**0.0077**	**0.0268**	**0.0264**
		(3.63)	***(2.83)***	***(4.58)***	***(4.62)***
Adv_{t-1}	+	**2.3254**	**2.3910**	**2.3001**	**2.4844**
		(4.75)	***(4.54)***	***(3.20)***	***(3.33)***
$TobinQ_{t-1}$	+	**0.0145**	**0.0252**	**0.0128**	**0.0217**
		(3.51)	***(3.71)***	***(2.20)***	***(2.82)***
Year Effects		Included		Included	
Industry Effects		Included		Included	
No. of Observations		18,536	17,159	10,480	10,049
Adj. R^2 (%)		15.50	16.28	28.79	28.99

Notes:
This table presents the results from the regression presented above and estimated using Huber-White robust standard errors clustered by firm. The sample covers fiscal years 1993-2009 and consists of 39,208 firm-year observations (3,269 distinct firms). *t*-statistics are in parenthesis below the coefficient estimates. Year and industry effects are included but not reported for brevity. Models I and II present the results for a subsample of 27,144 firm-year observations (2,902 distinct firms) with no patent filed by firm *i* in year *t*-1. Models III and IV present the results for a subsample of 12,064 firm-year observations (1,612 distinct firms) with at least one patent filed by firm *i* in year *t*-1. The dependent variable *Log(NbTrademarks)* is the natural logarithm of one plus the number of new product trademarks registered during the year. *OptionComp* is the CEO's annual stock option compensation, measured as the value of new stock options granted as a percentage of total compensation. *Vega* is the CEO's sensitivity to stock return volatility, measured as the dollar change in the CEO's option portfolio for a 0.01 change in annualized standard deviation of stock returns. *Log(TotalComp)* is the natural logarithm of the CEO's annual total compensation, measured as the sum of salary, bonus, other annual compensation, value of restricted stock granted, value of new stock options granted during the year, long-term incentive payouts, and all other compensation. *Log(Sales)* is the natural logarithm of total sales. *R&D* is the ratio of research and development expense divided by total sales (set as zero when R&D expense is missing in Compustat). *Adv* is the ratio of advertising expense divided by total sales (set as zero when advertising expense is missing in Compustat). *TobinQ* is the ratio of the market value of total assets to the book value of total assets. Industry grouping is based on the Fama-French (1997) 48-industry classification. To mitigate the influence of outliers, all variables are winsorized by year and industry at the 1st and 99th percentiles.