The signaling role of trademarks: Evidence from IPO underpricing

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Abstract

This paper studies the relationship between a firm's pre-IPO trademarks and its IPO underpricing. Using 4,321 US IPOs during the period 1980-2016, we find that firms with a larger number of trademarks prior to the IPO experience significantly less IPO underpricing. We exploit an exogenous shock on trademark protection brought by the 1996 Federal Trademark Dilution Act and average examiner leniency as the instrument to establish the causality. Further evidence suggests trademarks reduce IPO underpricing through signaling firm quality which reduces information asymmetry among IPO participants.

JEL Classification: G14, G24, O30, O34

Keywords: trademark; IPOs underpricing; information asymmetry; signaling

1. Introduction

Together with trade secret, copyright, and patent, trademark is consistently rated as one of the most important intellectual property within a firm (Jankowski, 2012; Hall, Helmers, Rogers, and Sena., 2014). Despite the importance of trademarking as a firm's business activities, most prior academic research focus on a firm's patenting activities (He and Tian, 2018). Relatively less studies examine the role of trademarks in a corporate world. One longstanding puzzle in finance is why we observe initial public offering (IPO) underpricing in worldwide capital markets (Boulton, Smart, and Zutter., 2011). That is, why there is a significant discount between the offering price and first-day closing price. In this paper, we examine whether and how trademarks hold by a firm prior to the IPO have an impact on IPO underpricing in the United States.

A well-known explanation for IPO underpricing dating back to Rock (1986) is based on asymmetric information about the IPO firm's intrinsic value and its fundamental risk. In order to determine the value of an IPO firm, investors rely on firm fundamentals in the prospectus prepared by the new issuer (Bedard et al., 2008; Field and Lowry, 2009). However, because of their large intangible assets, negative cash flows and great technological uncertainty, IPO firms are often characterized by a large information asymmetry between the existing shareholders, who have superior information about the firm's expected future cash flows, and potential investors, who are willing to share the firm's ownership and risk. Correctly pricing the value of an IPO firm for investors is not an easy task. To induce uninformed investors to subscribe stock in companies when they lack full information about the true value of the shares, the issuer compensates these investors in the form of a discount price (Rock, 1986; Chemmanur, 1993). These theories imply that information available about a firm's value prior to an IPO will reduce information asymmetry and thus reduce underpricing.

How does trademarks held by an IPO firm affect its underpricing? On one hand, trademarks, like other intangible assets or intellectual property such as patents and copyrights, are neither directly recognized in a firm's financial statements, nor required by current accounting rules to report separate performance measures. Compared with other types of firm assets (e.g., physical and financial assets), intangible assets are associated with more complex information (Lev, 2000). In term of trademarks specifically, at the first place it is not easy to define and enforce property right on trademarks due to the trademark dilution phenomenon[1] (Heath and Mace, 2019). Trademarks are also rarely traded on active and open markets and their economic value (i.e. the ability to generate future earnings) is difficult to estimate reliably.[2] Insiders or informed investors may have superior information about the potential value of a firm's intangible assets. However, in the setting of information asymmetry, it is difficult for outsiders or uninformed investor to determine the value of a firm that hold a large number of trademarks (Gu and Wang, 2005). High information complexity and value uncertainty of trademarks thus could potentially exacerbate the information asymmetry among various IPO participants including the firms, underwriters, and investors and consequently lead to a higher underpricing.

However, on the other hand, trademarks may also reduce an IPO firm's information asymmetry by signaling firm quality. First, as an output of a firm's late-stage innovation, trademarking activities convey important information on the firm's new product development and marketing strategy (Gao and Hitt, 2012; Faurel et al., 2019; Block et al., 2014). Moreover, by conferring legal protection on the exclusive use on certain brand names, trademarks prevent potential economic loss from competitors' imitation (Heath and Mace, 2019). Further, by enabling the firm to differentiate their products/services from their peers, trademarks could gain the firm more competitive advantage and market power, which allows the firm to charge a price premium

[1] Trademark dilution means that a trademark (or a mark similar enough to confuse customers) can be legally used by an entity other the trademark owner for *non-competing* products or services, i.e., products or serves out of the protected classes of the registered trademark (Mermin, 2000; Morrin, Lee, and Allenby, 2006).
[2] For this argument, see FASA(1974).

and earn higher profits (Besen and Raskind 1991; Landes and Posner 1987). Finally, trademarks may serve as collateral to help firms secure bank loan financing (Chiu et al., 2019). These potential benefits brought by trademarking could help to substantially alleviate uncertainty about firm future prospects. Therefore, assuming that it is costly to register, maintain and renew trademarks[3], a firm's trademark portfolio serves as a credible signal of firm quality to various IPO participants, which consequently reduces the need for underpricing.

Given there exists competing arguments suggesting two opposite conclusions regarding how trademarks affect firm IPO underpricing, we test this question empirically. We obtain data on U.S. trademarks from the United State Patent and Trademark office (USPTO) Case files dataset and information on IPO from Thomson-Reuters Securities Data Company (SDC) new issues database from 1980-2016. In our baseline results, we find that a firm's pre-IPO trademarks negatively predict its subsequent IPO underpricing, after controlling for a variety of firm and deal characteristics. The results are robust using various proxies for a firm's trademarking activities, including the quantity, quality, strategy and type of trademarking. It supports the argument that a firm's trademarks reduce its overall information asymmetry and thus reduce IPO underpricing.

We recognize that our baseline findings may suffer endogeneity risks. For example, high quality firms may own more trademarks and experience less underpricing. To establish the causality, we then employ various econometric techniques to address the endogeneity issues. First, following Heath and Mace (2019) and Chiu et al. (2019), we take advantage of the 1996 Federal Trademark Dilution Act as an arguably exogenous shock that increase trademark

[3] This assumption is reasonable since there are direct and indirect costs related to the application and maintenance of trademarks. For example, according to the USPTO, the application fee for each class that a trademark covers is between $200-$400. Considering that a typical trademark covers more than one class, the total fee for each trademark application could be several thousand dollars. There are other indirect costs associated with trademarks, such as the opposing cost and litigation cost. According to Gaddis, Garboczi, Stewartson, and Reid (2015), the median cost to oppose a trademark application is $80,000, while the litigation cost to protect infringement can be as high as two million dollars depending on the issue size, according to the 2013 Ameirican Intellecual Property Law Association Report of the Economic Survey. Consistent with assumption that trademarks are costly to obtain, in our sample, only about 13.1% firms have at least one trademark prior to the IPO.

protection. We find that after the enhanced legal protection on trademark the effect of trademark on underpricing becomes stronger. Second, we adopt an instrumental variable approach. Following Chemmanur et al. (2018), we use trademark examiner leniency as an instrument for an IPO firm's stock of granted trademarks. The negative association between trademarks and IPO underpricing remains in our two-state-least-square (2SLS) analysis. These tests imply a causal interpretation on the negative association between pre-IPO trademarks and IPO underpricing.

Further, we investigate the economic mechanism through which trademark reduces underpricing. We argue trademarks reduce IPO underpricing by signaling firm quality and reduce information asymmetry. We conduct several tests to support this proposed economic channel. First, if indeed trademarks impact IPO underpricing through the signaling role, we should observe the effect of the trademark on underpricing is stronger for firms with higher information asymmetry. Our subsample analysis confirms this prediction. Second, we find that the effect of trademark on underpricing is stronger for firms in more competitive industries. This may be because trademarks signal potential gain arising from a firm's competitive advantage by differentiating its products/services from competitors. Finally, we examine whether a firm's pre-IPO trademarks are able to predict other outcome variables related to the IPO. Collectively, we find firms held more trademarks are less likely to withdraw the IPO, delist after the IPO and have better post-IPO long-run operating performance. The results further confirm the signaling role of trademarks since firms with more trademarks do achieve greater success in the long run. Overall, these tests show supportive evidence that trademarks reduce underpricing by mitigating information problems and signaling firm quality.

Our paper contributes to the literature in several dimensions. First, we contribute to the studies that analyses how intellectual property (Such as patents and trademarks) affect firm outcomes, in particular valuations around IPO. Perhaps because data on trademarks is only

publicly available recently (Graham et al., 2013), most earlier studies focus on the role of patents. For example, Heeley, Matusik and Jain (2007) find that patents negatively affect IPO underpricing only when the link between patenting and inventive value is transparent. Cao, Jiang, and Ritter (2015) focus on the venture capital (VC) backed IPOs and show that a firm's pre-IPO patents are able to positively predict its long-run performance after the IPO. Different from patents which mainly capture a firm's early stage of technology innovation, trademarks represent the output of later stage of innovation and are more associated with a firm's future product development and marketing strategies (Gao and Hitt, 2012; Faurel et al., 2019; Block et al., 2014). Therefore, a trademark may better signal the intention and ability of a firm to commercialize its technology innovation and provide more reliable signal on a firm's expected future cash flows generated from innovation. Consistent with this argument, Chemmanur et al. (2018) examine the role of trademarks in entrepreneurial finance. Using VC backed IPOs, they find that trademarks are associated a larger amount of VC investment, higher IPO and secondary market valuations and better post-IPO performance. Our paper differs from theirs by focusing on IPO underpricing and using the full sample of IPO firms. Given the high-cost of IPO underpricing[4] and potential selection-bias of VC investment choice, it is important to investigate whether firms can use trademarks to mitigate the information asymmetry when they go public using the full sample of IPO firms.

Second, we contribute to the substantial literature on IPO underpricing. Prior studies have documented many determinants of IPO underpricing, including VC backing (e.g., Barry et al 1990; Megginson and Weiss, 1991; Brav and Gompers, 2003; Bradley and Jordan, 2002), underwriter reputation (e.g., Carter, Dark and Singh, 1998; Carter and Manaster, 1990; Loughran and Ritter, 2004), firm size and age (e.g., Ibbotson, Sindelar, and Ritter, 1988; Megginson and Weiss, 1991; Mikkelson, Partch, and Shah, 1997; Ritter, 1991), patent and

[4] According to Loughran and Ritter (2004), the average money left on table in the U.S. market is $17.5 million between 1980 and 2003.

R&D (e.g., Heeley et al, 2007 Guo, Lev, and Shi, 2006), market condition (e.g., Ritter, 1984), prior market return (e.g., Beard et al, 2002; Loughran and Ritter, 2002; Logue, 1973), secondary shares (e.g., Barry, 1989; Habib and Ljungqvist, 2001; Ljungqvist and Wilhelm, 2003). We add to the literature by considering an important class of intellectual property, trademarks, as another key factor in determining IPO underpricing.

Lastly, our study adds to the literature on quality signal theories. There are many studies examining the quality signal role of the third-party affiliations and founder characteristics (e.g., Baum and Oliver, 1991; Megginson and Weiss, 1991; Rao, 1994; Podolny, 1994; Stuart et al., 1999; Gulati and Higgins, 2003; Eisenhardt and Schoonhoven 1990; Burton, Sorensen, and Beckman, 2002). Our findings show that firms' intellectual asset (i.e. trademark) also acts as a credible quality signal in reducing IPO underpricing.

The remainder of the paper proceeds as follows. Institutional background and hypothesis development are given in Section two. Section three describes the sample construction. Section four presents the empirical analysis results. We conclude this paper in Section 5.

2. Institutional background and hypothesis development

2.1 Basics on trademarks

According to the USPTO, a trademark is defined as "any word, name, symbol, device, or any combination, used to or intended to be used to identify and distinguish the goods/services of on seller or provider from those of others". An easier way to understand the definition offered by USPTO is that "a trademark is a brand name". For example, Microsoft Corp registered "Microsoft Corp", "Microsoft Office XP" and "Windows Phone". When a firm intends to introduce new products or services into the market using a new brand name that is distinct from its existing ones, it will file a trademark application to the USPTO. The registrant is required to assure that trademark is not confusingly similar to other registered trademarks, otherwise may lead to a denial of the registration. The registrant also needs to specify the coverage of the

trademark in the classification system and provide evidence that the trademark has been indeed commercially used in goods-and-services classes specified in the application document. The use-in-commerce requirement is important since it ensures that registered trademarks reflect products and services that firms were verified to produce and sell (Graham et al., 2013). The main statute of modern trademark law, the 1946 Lanham Act, only provides legal protection for trademarks/brand names in their registered class from infringement by other entities.

Trademarking is reported as the most widely used form of intellectual property (IP) protection as it can be applied to any product or service (Hall et al., 2014). According to Business R&D and Innovation Survey conducted by the Census Bureau and National Science Foundation in 2015, a higher fraction of firms rank trademarks as a very important form of IP protection[5]. Despite the importance of trademarks, however, existing finance literature mainly focus on firms' patenting activities, especially on how internal and external factors shape a firm's quantity and quality of patents (See He and Tian, 2018). This is perhaps because of the limited access to the comprehensive trademark data (Graham et al., 2013).

Trademarks differ from patents to a great extent. A trademark typically protects brand names or logos used on goods and services, while a patent protects a technological invention. Compared with patents that are typically obtained in the earlier states of the innovation process, trademarks, indicating potential introduction of new product/services, are generated at the end of the innovation process. Moreover, patents are not feasible in protect the IP in some sectors, such as service, consumer and retail industries.

2.2 Recent literature on trademarks

There are a growing body of studies examine the impact of trademark on firm outcomes since Graham et al. (2013). For example, Block et al. (2014) find that the number and breadth of trademark application have U-shaped relationships with the financial valuations of start-ups

[5] 15% of surveyed firms rate trademarks as very important, while 11% of firms rate patents as very important. See: https://ncses.nsf.gov/pubs/nsf18313/#&

by Venture Capitalists. Hsu, Li, Liu, and Wu (2017) find that companies with similar trademarks are more likely to be merged and these deals are associated with higher combined announcement returns. Regarding trademarks as a proxy for new product development, Faurel et al. (2019) show that trademark creation increases with the value of stock option in CEO compensation. Hsu, Li, Teoh, and Tseng (2018) show that firms with more trademarks experience significantly higher future profitability, larger analyst forecast errors, and higher future abnormal stock returns. One paper that closely related to ours is Chemmanur et al. (2018). They examine how trademarks held by VC backed firms affect VC investments in them, their probability of successful exit, IPO and secondary market valuations, institutional investor IPO participation, post-IPO operating performance, and post-IPO information asymmetry. This paper differs from theirs by looking at IPO underpricing and by looking at all the U.S. IPO firms.

Because of the endogenous nature of a firm' trademarking activities, several studies use the 1996 Federal Trademark Dilution Act as an exogenous shock and study how enhanced trademark protection affects firm outcomes. For example, Heath and Mace (2019) show that stronger trademark protection increases firms' operating profits but has negative effects on firm innovation and product quality. Chiu et al. (2019) find evidence that U.S. public firm use trademarks as collateral to secure bank loan financing and strengthened trademark protection decreases a firm's cost of bank loan.

2.3 Trademarks and IPO underpricing

Prior literature has documented substantial evidence that on average initial public offerings are underpriced around the world (Boulton, Smart, and Zutter, 2011). When the offer price is below the price at the close of the first day of trading, the offering is said to be underpriced and the firm has "left money on the table (Ritter, 1998). Although several explanations for the underpricing phenomenon have been proposed in the literature (Certo et al., 2001), no one could

dominate the others, which creates the "underpricing puzzle" in finance research. One of the most popular argument is based on information asymmetry theories (Rock, 1986). Outsiders and uninformed investors do not possess the full information about the true value of the issuing firm. To induce them to buy the shares, firms and underwriters underprice the offering price as a compensation.

We assume there exist great information asymmetry among various IPO participants and the firm seeks sources to signal its quality. Several studies examine how a firm's intangible assets or intellectual property affect information asymmetry in the context of IPO valuation, focusing on firms' patenting activities (Cao, Jiang, and Ritter, 2015; Heeley et al., 2007). Trademarks, together with patents, represent an important class of a firm's intangible assets or intellectual property. Although a trademark protects a firm's brands and logos, it is sometimes difficult to define and enforce the property rights of trademark (Heath and Mace, 2019). One notable example is the trademark dilution phenomenon, which makes the infringement activities hard to be sued. Moreover, compared to tangible (financial and physical) assets, the immediate values of trademarks are typically not reflected in a firm's financial statement and there is great uncertainty regarding whether and how much they will contribute to future profit (Lev, 2000). Most intangible assets are not traded on active and transparent market. Outside investors are thus not able to rely on market prices in estimating the future earning power of the firm. Because of these unique characteristics of trademarks, firms with high trademarking intensity are associated with high information complexity. For example, Gu and Wang (2005) show that firms with more intangible assets are associated with higher analyst forecast error and dispersion, and Hsu, Li, Teoh, and Tseng (2018) confirm this finding using data on trademarks. The presence of a large number of trademarks may thus increase the information asymmetry and lead to a higher underpricing.

However, trademarks may also reduce a firm's information asymmetry by signaling firm

quality. Different from patents which mainly capture a firm's early stage of technological innovation, trademarks typically represent output at the end of a firm's innovation progress. A firm's trademarking activities contain reliable information on its new product development, product quality and marketing strategy in the near future (Gao and Hitt, 2012; Faurel et al., 2019). Moreover, when searching in the product market and making purchase decisions, consumers rely on brand names or trademarks, especially in circumstances where search costs and information asymmetry are high (Gao and Hitt 2012; Graham et al., 2013). Persistent promotion of trademarks helps reduce consumers' search cost, maintain brand awareness and engender loyalty and trust among consumers (Crass, Czarnitzki, and Toole 2016). Further, trademarks assist firms to achieve a competitive advantage by differentiating their products/services from their peers (e.g., Besen and Raskind 1991; Landes and Posner 1987). By conferring legal protection on the exclusive use on the trademark to the owner, trademarks allow the firm to prevent economic loss from competitors' imitation behavior, e.g., using similar marks, images or symbols that can cause customer confusion and erode their market share (Heath and Mace 2019). The consequent market power built upon specific brand names/trademarks enables the firm to charge a price premium and earn higher profits. Finally, trademarks may serve as collateral and help firm secure bank loan financing (Chiu et al., 2019). These potential benefits brought by trademarking may alleviate information uncertainty on firm future performance and help signal firm quality in the IPO process. From this perspective, trademarks reduce information asymmetry and are expected to reduce IPO underpricing.

Given there are arguments that are both in favor or against IPO underpricing, we propose the main (null) hypothesis underlying in this paper:

Hypothesis 1: Ceteris paribus, a firm's Pre-IPO trademarks does not affect IPO underpricing.

3. Data and Sample

3.1 Data on trademarks

To construct our sample, we start with all the IPO firms from the Thomson-Reuters Securities Data Company (*SDC*) New Issues database during 1980 to 2016. The sample period is chosen because there are too many missing observations on the financial data of IPO firms before 1980 in *Compustat*. Following prior literature (Jain and Kini, 1994; Loughran and Ritter, 2004; Megginson and Weiss, 1991; Heeley et al., 2007), we remove financial firms (SIC 6000-6999), IPOs with proceeds under $1.5 million and with offer price under $5 per share or missing. We also exclude IPOs that correspond to unites offers, spin-offs, limited partnership, leverage buyout (LBO). We finally delete observations with incomplete financial information. The details about our sample filtering process are presented in Appendix Table A1.

We download the trademark data from the United States Patent and Trademark Office (USPTO) Trademark Case Files Dataset.[6] This dataset contains detailed information on 9.1 million trademark applications and registrations between January 1870 and February 2018. It maintains information on trademark contents, ownership, classification, date of filing, registration, renewal or abandoned, the name of examining attorneys who examine the trademark applications, and so on.[7] Following prior literature, we focus on trademark applications that are successfully registered to ensure that all trademarks we consider are in actual use by the trademark assignees. As mentioned in Bereskin, Hsu, Na, and Rotenberg. (2018), the major challenge for our use of the USPTO trademark database is to match trademarks assignees to U.S. public firms. This is also necessary for our study since we need to link trademark data to IPO firms. We implement the matching process similar to Heath and Mace (2019): First, we generate a list of names of IPO firms from SDC or *CRSP*. Similar to the

[6] The data can be downloaded in the following website: https://www.uspto.gov/learning-and-resources/electronic-data-products/trademark-case-files-dataset-0.

[7] Graham et al. (2013) provides a practical description of the USPTO Trademark Case Files Dataset and associated institutional details to facilitate future research using the data.

patent application, a firm may register a trademark under the name of its subsidiaries[8]. We thus supplement all the subsidiaries within a corporate family, which are collected from the LexisNexis Corporate Affiliation Database.[9] Next, for each name of a trademark owner in the trademark dataset, we search in the company names of both parent and subsidiaries and try to find the closest one using a fuzzy matching algorithm (Levenshtein Algorithm). Finally, we double-check and manually verify each match to ensure our matching quality using firms' location information. In sum, we are able to successfully match 4,070 registered trademark records to 568 unique U.S. public firms between 1870 and 2017.[10][11] We use the stock of a firm's filed (successfully registered and still valid)[12] trademarks at the time of its IPO date as proxies for the Pre-IPO trademarking intensity.[13]

We obtain first-day trading information for the IPO firms from the Center for Research in Security Prices (*CRSP*) and financial fundamentals such as firm assets, sales, and R&D expenditures in the last financial statement prior to the IPO from *Compustat*. Information on firm founding date and underwriter quality are from Jay Ritter's website (Field and Karpoff, 2002; Loughran and Ritter, 2004). To mitigate the influence of outliers, all continuous variables are winsorized at the 1*st* and 99*th* percentiles and financial variables are adjusted to the dollar value in 2010 using CPI data from he IMF International Financial Statistics. Detailed definitions of the variables in this paper are given in Appendix Table A2.

[8] In our sample, about 30% of trademark are registered under subsidiaries.

[9] LexisNexis Corporate Affiliation dataset contains details time series subsidiary information for 18,388 parent firms starts from 1993 to 2017. For the year before 1993, we use the subsidiary information in 1993 to match with the trademark.

[10] The earliest registered trademark we matched to our IPO sample is filed on February 08th ,1886, registered on April 27th, 1886 and renewed on April 27th, 2016. This trademark is owned by General Mills, Inc. and the mark content is "WASHBURN'S GOLD MEDAL".

[11] Our matching result is slight different from Heath and Mace (2019) since they obtain subsidiary information from CapitalIQ database, which only covers current information on subsidiaries.

[12] Similar to patent, trademark protection also starts from filing dates. Filing a trademark application with the USPTO provides a certain amount of protection to the applicant even when the mark is not yet used in commerce (the so-called "intent-to-use" applications) and serves as a constructive notice to all third parties as to the applicant's claimed rights to the mark.

[13] We only consider the valid trademark, that is, we exclude the trademark that filed but expired before IPO date.

3.2 *Sample Description*

Table 1 presents descriptive statistics. Our final sample consists of 4,321 IPO firms from 1980 to 2016, of which 568 (13.1%) firms have at least one granted trademark prior to their initial public offering. The average IPO first-day stock return is 19.2% for the full sample. On average, a firm in our sample has 0.664 trademarks before IPO, the book asset of 181.2 million (in 2010) dollars, the firm age of 15.3 years and the IPO proceeds of 89.5 million (in 2010) dollars. 46.8% of our firms are venture-backed, and 44.0% are underwritten by prestigious underwriters.

[Insert Table 1 about here]

In table 2, we present the descriptive statistics for our sample. As shown in Panel A, the variation in underpricing across industries (Fama and French 12 industries) is quite large. For example, Business Equipment (Computers, Software, and Electronic Equipment) is the most underpriced industry with an average 31.8% first-day stock return, which amounts as much as eight times of the Energy industry (Oil, Gas, and Coal Extraction and Products). However, with an average of 0.664 trademark ownership, the trademarking intensity of Business Equipment industry is quite low. Turn to Panel B, similar to the pattern documented by Loughran and Ritter (2004), underpricing of IPOs during 1980-1994 is quite modest and surges during the internet bubble period (1995 -2000). However, IPO firms during the bubble period seems to hold very few trademarks. In Panel C, we compare the IPO charactersitics between firms with at least one trademark and firms without any trademark. The average IPO underpricing of firms that filed at least one trademark before IPO is 3.7% lower than that of firms that never filed trademarks. Moreover, trademark sample tend to be larger, more mature and raise more money in their IPOs. Taken together, these univariate analyses in general suggest a negative relation between a firm's trademarking activities and its IPO underpricing.

[Insert Table 2 about here]

4. Empirical results

4.1 Baseline Regression Results

We first present the results from our baseline specification. To examine whether corporate pre-IPO trademark affects US firms' IPO underpricing, we run the following OLS regressions:

$$Underpricing_{i,t} = \beta_0 + \beta_1 * Trademark\ dummy_i / Log\ (1+trademark_i) + \gamma * Controls + Industry\ Dummy + Year\ Dummy + \varepsilon_i$$

The dependent variable, *Underpricing*, in this model is the IPO first-day stock return or IPO underpricing. The explanatory variable of our interest is either *Trademark dummy*, equals to one if an IPO firm holds at least one trademark, or *Log*(*1+trademark*), the log of one plus the total number of trademarks an IPO firm holds. Both of the two variables are measured at the time of IPO. If pre-IPO trademarks reduce IPO underpricing, β_1 is expected to be negatively significant. We follow the existing IPO literature[14] to control for a number of known determinants of IPO underpricing (*Controls*), including whether the firm is backed by centure capital (*VC*), underwriter reputation (*Underwriter*), firm age (*Log (1+Age)*), firm size (*Log (Asset)*, share overhang (*Share Overhang*), whether the firm is in technology industry dummy[15] (*Tech Dummy*) or in Inernet Business (*Internet Dummy*), whether the IPO is listed in Nasdaq exchange (*Nasdaq Dummy*), the total amount of raised proceeds (*Log (Proceeds)*), price revision (*Price Revision*), market condition at the time of IPO (*Market Return*) and how hot the IPO activity is (*Log (1+Hot)*). We also control for the industry and year fixed effect.[16] Robust Standard errors are clusered by industry.

[14] See Heeley et al., (2007), Loughran and Ritter (2004), Lowry and Shu (2002), Chambers and Dimson (2009), Ljungqvist and Wilhelm (2003), Liu and Ritter (2011), Bradley, Kim, and Krigman (2015) and among others

[15] Following Loughran and Ritter (2004), Tech firms are defined as those in SIC codes 3571, 3572, 3575, 3577, 3578 (computer hardware), 3661, 3663, 3669 (communications equipment), 3671, 3672, 3674, 3675, 3677, 3678, 3679 (electronics), 3812 (navigation equipment), 3823, 3825, 3826, 3827, 3829 (measuring and controlling devices), 3841, 3845 (medical instruments), 4812, 4813 (telephone equipment), 4899 (communications services), 7371, 7372, 7373, 7374, 7375, 7378, and 7379 (software) and 3559,3576,7389 (updated in 2018).

[16] In the regressions, we control for industry fixed effect at Fama French 12 industry level. However, our baseline regressions are robust if we control industry fixed effect at 2-digit (or 3-digit) SIC industry level.

Table 3 present our baseline regression results. The independent variable is *Trademark dummy* in the Columns (1) and (2) and *Log*(*1+Trademark*) in the Columns (3) and (4). The coefficients estimate for both *Trademark dummy* and *Log*(*1+Trademark*) are negative and statistically different from zero at the 5% level. In terms of the economic magnitude, firms with at least one trademark granted before the IPO date experience a 2.6% reduction in IPO underpricing, which represent 13.5% decrease in first-day underpricing relative to the average underpricing of 19.2% in our full sample. It implies that the value of the informational content behind trademarks is economically meaningful. Overall, our baseline results support that trademarks reduce information asymmetry and lead to a decline in IPO underpricing.

The estimated coefficients of other control variables are largely consistent with prior literature. For example, the coefficients associated with firm age and size are negative and highly significant. This is perhaps because larger and older firms are associated with a lower level of information asymmetry. The effect of prior market returns is positive and highly significant, which suggests that recent market conditions are not fully incorporated into the IPO offer price. Moreover, the positive coefficients of Tech, Internet and Nasdaq dummy indicate that firms in technology industry, Internet firms and firms listed in Nasdaq on average have higher IPO underpricing.

[Insert Table 3 about here]

4.2 Identification strategy

In the baseline results, we show that corporate trademarks prior to the IPO have a significantly negative predict power on IPO underpricing. However, we recognize that the documented association could be due to firms' endogenous trademark choices or other unobserved factors. For example, firms of good quality tend to register more trademarks and may suffer less IPO underpricing simultaneously. To address potential endogeneity issues, we

introduce the 1996 Federal Trademark Dilution Act (FTDA) as a quasi-natural experiment and adopt an instrumental variable approach in the following subsections.

4.2.1 The impact of the 1996 Federal Trademark Dilution Act

The FTDA is aimed to strengthen the protection of "famous" trademarks and mitigates the trademark dilution phenomenon[17]. Under the Lanham Act, trademarks are only protected within the range of their registered classes, which are specified when the trademarks are filed. Trademark dilution denotes that a trademark (or a mark similar enough to confuse customers) can be legally used by an entity other than the trademark owner for *non-competing* products or services, i.e., products or serves out of the protected classes of the registered trademark (Mermin, 2000; Morrin, lee, and Allenby, 2006). To address the prevalent and serious infringement issues brought by the trademark dilution, the FTDA was enacted on 16 January 1996 and intended to enhance the protection for trademark owners against dilution. In particular, it enables a trademark holder to obtain an injunction without proving actual infringement, but only convincing a judge of the likelihood of dilution (Kim, 2001; Bickley, 2011). After 1996, litigation cases related to trademark dilution increases significantly (Morrin and Jacoby, 2000). A key limitation of the FTDA is that only "famous" trademarks are qualified for the federal protection against likely dilution. However, the FTDA does not give the definition of the term "famous". In practice, whether a trademark is famous or not is judged on a case-by-case basis, which incurs much debate (Becker, 2000; Dollinger, 2001).

Several recent studies in finance adopt the FTDA as an exogenous shock that increases trademark protection and examine how it affects firm outcomes. For example, Heath and Mace (2019) exploit the FTDA as a quasi-natural experiment and find that stronger trademark protection has negative effects on firm innovation and product quality. Using the same setting,

[17] See Heath and Mace (2019) for a detailed discussion.

Chiu, Hsu, and Wang (2019) show that enhanced brand value through trademark protection could lower a firm's borrowing cost from the bank.

To build a causal link between trademark and IPO underpricing in our paper, we follow them and conduct tests using the setting of FTDA. We hypothesize that enhanced trademark protection can strengthen the signaling role played by trademarks. If trademarks indeed reduce firms' IPO underpricing, we should expect the effect is stronger after the enact of FTDA. To test this conjecture, we run the following regression for the sub-period 1989-2002:

$$Underpricing_{i,t} = \beta_1 * PostFTDA_t \times Log\ (1 + Famous_i) + \beta_2 * Log\ (1 + Famous_i) + \beta_3 * Controls + Year\ dummy + Industry\ dummy + \varepsilon_i$$

Where $PostFTDA$ equals one if the IPO is completed after January 1996 and otherwise 0. Since the FTDA only affects those famous trademarks, we follow Heath and Mace (2019) and construct a variable, $Log\ (1 + Famous)$, which is the log of one plus the number of famous trademarks (registered earlier than 1974 and was still active on January 16, 1996) hold by a firm prior to the IPO date. The variable of our interest is the interaction term $PostFTDA_t \times Log\ (1 + Famous_i)$, We expect the estimated coefficient β_1 to be negatively significant.

The results are presented in Table 4. Since we constrain our sample period to 1989-2002, our sample size reduces significantly. The coefficient on *PostFTDA* × *Famous Trademark* is negatively significant. It means that stronger trademark protection leads to a greater negative effect of trademarks on IPO underpricing, implies a causal interpretation that proposed in this paper.

[Insert Table 4 about here]

4.2.2 Instrumental variable approach

To further alleviate that our baseline finding is likely driven by some unobservable factors, we perform an instrumental variable approach and conduct Two-Stage Least Square (2SLS) analysis in this section. Following Chemmanur et al. (2018), we instrument for the number of trademarks registered by a firm using a measure of trademark examiner leniency. Upon assigned to review trademark applications, the examiner has great discretion in the review process. Examiners with a higher (lower) level of leniency are more likely to accept (reject) the application. Thus, examiner leniency should be relevant for a firm's granted trademarks. It is also unclear how examiner leniency would affect IPO underpricing through ways other than a firm's trademarks.[18] Chemmanur et al. (2018) show evidence that this instrument satisfies the relevance and exclusion assumption.

To construct our instrument variable, we first calculate a time-varying measure of the leniency of each individual examiner as follow:

$$Individual\ Examiner\ Leniency_{i,j,t} = \frac{Grant_{j,t} - Grant_i}{Application_{j,t} - 1}$$

Where $Application_{j,t}$ and $Grant_{j,t}$ are the number of trademarks granted and application reviewed by examiner *j* in year *t*. Since we need an instrument for the number of trademarks granted to a firm, we take the average leniency of all trademark application that firm *i* has filed before IPO date:[19]

$$Avg\ Leniency_i = \frac{1}{n_i}\sum_j Individual\ Examiner\ Leniency_{i,j,t}$$

We conduct the 2SLS analysis using only a subsample firm with at least one trademark and present the results in Table 5. As shown in Columns (1) and (2), in the first stage, examiner

[18] Sampat and Williamns (2015), Farre-Mensa, Hedge, and Ljungqvist (2017), Gaule (2018) and Melero, Palomeras, and Wehrheim (2017) use patent examiner leniency as instrument for patents in their research.
[19] For firms without any trademark, this variable is missing and they are not included in our two-stage-least-square analysis.

leniency is positively related to a firm's granted trademarks. The F-statistic is larger than 10 in Column (2), reject the null of a weak instrument. After instrumentation, in Columns (3) and (4), the coefficients on the predicted value of our trademark measures are still negative and statistically significant. Taken together, the 2SLS regression results provide us with greater confidence that pre-IPO patents causally affect IPO underpricing.

[Insert Table 5 about here]

4.3 More nuanced trademark proxies

In the above analysis, we have shown that a firm that holds larger stock of trademarks experiences a lower IPO underpricing. In this part, we examine additional nuanced proxies related to trademarks.

We first look at the quality of a firm's trademarks. First, following Hsu, Li, Liu, and Wu (2017), we calculate the age of each trademark as the difference between IPO year and the trademark application year and take the log form (*Log* (*1+Trademark Age*)). We further calculate the log of the number of famous trademarks that a firm held (*Log*(*1+Famous*)) following Heath and Mace (2019). The two variables capture the quality of an IPO firm's trademark portfolio. We also construct two dummy variables, *Trademark Age Dummy* which equal to one for firms with above the sample median *Trademark Age*, and *Famous Dummy*, which equal to one for firms with at least one famous trademark before IPO. The results are presented in Panel A of Table 6. Most coefficients on the quality proxies are negatively significant. It suggests that, besides the quantity of a firm's trademark holding, the quality also matters for underpricing

We also study whether different trademarking strategies affect the underpricing. Following Hsu, Li and Nozawa (2018) and Hsu, Li, Teoh, and Tseng (2018), *Trademark Diversity* is the log of one plus total unique classes that a firm's trademark portfolio covers. *Log* (*1+Exploration*) and *Log* (*1+Exploitation*) represent the number of explorative trademarks and exploitative

trademarks held by an IPO firm, respectively. A trademark is defined as an explorative trademark if the firm has not registered any trademarks in this trademark's class (assigned by the USPTO) over the last 10 years. Otherwise, the trademark is defined as exploitative trademark. As shown in Panel B of Table 6 we find that firms with more diversified and explorative trademarks are associated with less IPO underpricing.

Finally, we separate all trademarks into product trademarks and marketing trademarks. Following Hsu et al. (2017), we defined a trademark as a marketing trademark if the mark has no text (i.e., pure logos), or have text comprising four or more words (i.e., advertising slogans), The rests are defined as product trademark. In Panel C of Table 6, we find both of the two types of trademarks are negatively associated with underpricing. In sum, we find consistent and robust results when using these more nuanced measures for a firm's trademarking activities.

[Insert Table 6 about here]

4.4 Economic channel

In the above results, we have shown that pre-IPO trademark has a significantly negative impact on IPO underpricing. Now, in this part, we further investigate the economic channels through which trademark affects IPO underpricing. We propose that trademarks reduce underpricing since it can mitigate information asymmetry by signaling firm quality. In this section, we seek to provide supportive empirical evidence to this argument.

4.3.1 The impact of information asymmetry

If there is no information asymmetry and outside investors have complete information on the IPO firm's intrinsic value, the signaling role of trademarks takes no effects. On the contrary, if information asymmetry is severe, the information content carried by the intellectual property, i.e., trademarks, becomes critical. Thus, the importance of the signaling role played by a firm's trademarks increases with a firm's information asymmetry (Leland and Pyle,1977; Amit,

Glosten, and Muller, 1990; Cao and Hsu, 2011). Motivated by this rationale, we expect the negative association between trademark and IPO underpricing should be more pronounced for firms with greater information asymmetry.

To test this conjecture, we borrow four proxies for private firms' information asymmetry in the literature. First, following Leary and Roberts (2010) and Zhang (2006), we measure a firm's information environment using firm sales and firm age. Small and young firms are less diversified and have less information available to the market. Next, we measure information asymmetry based on a firm's R&D expenses following Aboody and Lev (2000) and Sufi (2007). They show that firms with high R&D intensity tend to be more opaque. Finally, we construct an industry-level measure relying on the information environment of public firms that are in the same industry with the IPO firm. In particular, we calculate the return residual volatility based on the Fama French three factors model (Blackwell, Marr, and Spivey, 1990; Clarke, Fee, and Thomas, 2004; Cao and Hsu, 2011).[20] We conduct subsample analysis and check if the effect of trademarks on IPO underpricing is different between high- and low- information asymmetry firms.

We present the results in Table 7.We find consistent results that the negative impact of trademark on IPO underpricing is only significant for firms with severe information asymmetry problem (e.g., young firms, small firms, firms with intensive R&D activities and firms in industries with high return residual volatility). The Wald test indicates that the difference on the coefficients between the two subsamples is also negatively significant. Collectively, the

[20] We construct the measure of return residual volatility based on the following process. First, we regress each stock's daily excess return on daily market excess returns, the daily small-minus-big factor and the value-minus-growth factor of Fama and French (1993) for every public firm in each year, and then estimate their daily return residuals. Secondly, we compute the variance of each individual stock's daily return residuals as the firm-level return residual volatility. Finally, for each of the two-digit SIC industries in each year, we calculate their average firm-level return residual volatility as the proxy for industry-level information asymmetry. We use these IPO firms' industry-level information asymmetry as their individual information asymmetry when they go public.

results suggest that trademarks are more effective in reducing IPO underpricing when information asymmetry is high, confirming the signaling hypothesis.

[Insert Table 7 about here]

4.3.2 The impact of product market competition

One of the benefits of trademarking is to insulate competition (Heath and Mace, 2019). By exclusively own the legal use of certain brand names, trademarking can assist a firm to differentiate its products and to prohibit imitation by its competitors. Trademarking thus can gain the firm more competitive advantage in the product market (Chamberlin, 1933). The intensity of competition an IPO firm is confronted is likely to increase the protective value of trademarks and strengthen the signaling role played by these trademarks. We thus conjecture that the negative effect of trademarks on underpricing should be stronger for IPO firms in more competitive industries.

To test our prediction, we measure the competitive environment that an IPO firm faces using the Herfindahl-Hirschman Index (*HHI*) of public firms within the same industry (3-digit SIC). An industry is considered to be highly competitive if its *HHI* is above the sample median in the year prior to the IPO. We conduct subsample analysis and the results are presented in Table 8. The negative effect of trademarks on underpricing is only significant for firms in highly competitive industries. The Wald test also indicates the difference in the coefficients between industries with high- and low- competition is negatively significant. The results are consistent with our prediction that the impact of trademarks on IPO underpricing is more pronounced for firms in more competitive industries, which again confirms our information channel.

[Insert Table 8 about here]

4.3.3 Evidence from other IPO outcomes

In this part, we test how pre-IPO trademarks predict other outcome variables related to the IPO, including the probability of IPO withdrawal, IPO delisting, and post IPO long-run performance. We argue that trademarks benefit a firm in various ways, including help firms lock in monopoly rent, secure bank loan financing and so on. If trademarks do signal firm quality, we should observe they are able to positively predict these performance measures.

We first test whether the pre-IPO trademarks are able to predict a firm's probability of IPO withdrawal. We include both successful and failed IPOs and use a dummy variable to indicator the status (successful or withdraw). Since financial data for failed IPOs is quite limited, we are only able to control *Underwriter*, *Tech Dummy*, *Internet Dummy*, *Nasdaq Dummy*, *Market Return*, and *Log (1+Hot)* in this test.

We further test another two performance measures after the IPO. One is whether the IPO firm gets delisted and the other is post-IPO long-run performance. We construct an indicator, which equals one if the IPO firm delisted within 5 years after the IPO. To measure the post-IPO performance, we follow Ritter (1991) and Jain and Kini (1994) and calculate the monthly market-adjusted return over 36 months after the IPO (*Return_adj*) and the return on assets (*ROA*) in the third fiscal year after the IPO.

The results are presented in Table 9. Consistent with our expectation, pre-IPO trademarks negatively predict IPO withdrawal and IPO delisting, but positively predict post-IPO long-run performance. These results, in general, are consistent with the role of signaling quality played by trademarks.

[Insert Table 9 about here]

4.5 Robustness Checks

4.5.1 Propensity Score Matching Results

Since many firms do not possess any trademark prior to their IPO date, to balance our sample we adopt the Propensity Score Matching (PSM) technique as a robustness check. First, we regress our proxy for trademark against several matching variables, including, *VC*, *Underwriter*, *Log (1+Age)*, *Log (Asset)*, and calculate the propensity score based on a Probit regression model. For each firm that has at least one trademark (*Trademark_dummy*=1), we find a matched (control) firm without any trademark (*Trademark_dummy*=0) with the nearest score and re-run our baseline regression using the matched sample.

In Table 10, we first show that there is no significant difference in our matching variables between the treatment and control sample. The regression results using the matched sample are presented in Panel B. Although the sample size shrinks significantly, we still find trademarks have a negative impact on IPO underpricing and the economic magnitude is similar to that reported in our baseline regression. The PSM analysis reinforces our main results that trademarks act as an effective high-quality signal to reduce firms' IPO underpricing.

[Insert Table 10 about here]

4.5.2. Remove the confounding effect of patents

Although both trademarks and patents serve as important classes of a firm's intangible assets or intellectual property, as we mentioned earlier, they exhibit great distinctions. Since a firm's trademarks may positively correlate with its patents, that is, firms with more trademarks are likely to possess more patents, it is likely that our findings are driven by a firm's patenting activities. Also, a firm's trademarking behavior may also positively relate to its advertising activities (Bereskin et al., 2018). To disentangle these confounding effects, we conduct more tests in this part.

First, we control for a firm's patenting activities to see if trademarks could have an incremental effect on underpricing. To do this, we collect information on U.S firm's patents from the NBER Patent Database and calculate the number of patents that an IPO firm filed and eventually granted prior to the IPO. As shown in Column (1) in Table 1, the coefficient on *Log (1+Patent)* is not significant, which is consistent with Heeley et al. (2007)'s finding that a firm's overall stock of patents has no effect on underpricing. In Columns (2) and (3), after controlling for a firm's patent holdings and advertising expense, we still find a significant negative relation between trademarks and underpricing.

To further remove the confounding effect of patents, we conduct tests by focusing on a subsample of firms that haven't file any patents but filed at least one trademarks prior to the IPO. After imposing this restriction, we are left with 443 observations. However, our baseline finding still holds in this much smaller sample. To sum, the negative effect of trademarks on underpricing is unlikely to be explained by the patents.

[Insert Table 11 about here]

5. Conclusion

In this study, we examine how trademarks hold by an IPO firm affects IPO underpricing in the United States. We find robust evidence that trademarks negatively predict the underpricing, consistent with the notion that trademarks convey important information and signal firm quality and reduce overall information asymmetry among various participants in the IPO process. The results are both statistically and economically significant. To establish the causality, we exploit the 1996 Federal Trademark Dilution Act as an exogenous shock on trademark protection and adopt the examiner leniency as the instrument for a firm's trademarking intensity. The results support our causal interpretation.

We further find that the effect of trademarks on underpricing is stronger for firms with higher information asymmetry and firms in more competitive industries. Trademarks also positively predict other IPO performance measures. This empirical evidence supports our argument that trademarks reduce underpricing by signal firm quality.

Overall, our paper contributes to the IPO literature by showing that trademarks are an important determinant of a firm's IPO underpricing. Our study also contributes to the emerging literature that studies the impact of trademarks on firm outcome. Since trademark is an essential type of corporate intangible asset but not recognized in a firm's financial statement, our findings can help investors better understand the valuation of an IPO firm.

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Appendix

Table A1. Sample Selection Criteria

Sample Selection Step	No. Firms
Total number of US common stocks IPOs	13,533
Less: IPOs with proceeds under $1.5 million	(706)
Less: IPOs with offer price under $5 per share or missing	(1,113)
Less: Unites offers, Spin-offs, limited partnership, ADRs, LBO, REITs, Close-end fund and financial institutions	(4,731)
Subtotal:	6,983
Less: Observation lacking values for the close price	(871)
Less: Other observation lacking values for control variables: asset, age, share overhang	(1,791)
Final Sample	4,321

Table A2. Variable Definitions

Variable	Definition	Data Source(s)
	Trademark characteristics	
Log (1+ Trademark)	The log of one plus total number of trademarks that the firm has registered prior to the IPO	USPTO
Trademark Dummy	Equal to 1 if the firm has at least one trademark filed before the IPO and 0 otherwise	USPTO
Log (1+ Trademark Age)	The log of the average age (the difference between IPO year and trademark application year) of all trademarks in a firm's portfolio at the time of IPO date	SDC, USPTO
Trademark age Dummy	Equal to 1 if the average age of all trademarks in a firm's portfolio is larger than the median of all the IPO firms, and 0 otherwise	SDC, USPTO
Log (1+ Famous)	The log of one plus the number of famous trademarks that the firm has filed for prior to the IPO. Famous trademark is defined as trademarks that registered in 1974 or earlier and were still active on January 16, 1996	USPTO
Famous Dummy	Equals to 1 if a firm held at least one famous trademark before the IPO and 0 otherwise	USPTO
Trademark Diversity	The natural log of one plus the total number of unique trademark classes of trademarks filed by a firm before IPO	USPTO
Log (1+ Exploratory)	The sum of recent 3-year exploratory trademarks filed before IPO. An exploratory trademark is defined as a trademark that the firm has not registered any trademarks in this trademark's class (assigned by the USPTO) over the last 10 years	USPTO
Log (1+ Exploitation)	The sum of recent 3-year exploitation trademarks filed before IPO. An exploitation trademark is defined as trademark that the firm has already registered at least one trademark in this trademark's class (assigned by the USPTO) over the last 10 years	USPTO
Log (1+ Product)	The log of one plus the number of product trademarks that the firm has filed for prior to the IPO.	USPTO
Log (1+ Marketing)	The log of one plus the number of marketing trademarks that the firm has filed for prior to the IPO.	USPTO
	IPO characteristics	
Underpricing	IPO underpricing, calculate as the first day return: (*close price-offer price*)/*offer price*	CRSP, SDC
Return_Adjust	Cumulative 3-year monthly market-adjusted returns post IPO	CRSP
ROA	Return on assets, defined as operating income before depreciation scaled by total assets	COMPUSTAT
IPO Withdrawn	Equal to 1 if IPO is withdrawn and 0 otherwise	SDC
IPO Delisting	Equal to 1 if the firm is delisted within five years period after the IPO	CRSP
VC	The indicator variable for venture capital backed firms	SDC
Underwriter	Equal to 1 if the underwriter reputation score is equal to or greater than 8. The reputation score is according to Loughran and Ritter's (2004)	Ritter's website
Log (1+ Age)	The log of Firm age, which is the difference between firm IPO year and founding year	Ritter's website
Log (Asset)	The log of book asset measured in the last financial statement year just prior to the IPO (inflation adjusted in millions of 2010 dollars)	COMPUSTAT
Share Overhang	The ratio of retained shares to the public float	SDC
Tech Dummy	Equals to 1 if the IPO firm is in the technology business and 0 otherwise	Ritter's website
Internet Dummy	Equals to 1 if the IPO firm is in the Internet business and 0 otherwise	Ritter's website
Nasdaq Dummy	Equals to 1 if the IPO firm is listed at Nasdaq exchange	SDC
Log (Proceeds)	The log of total amount of money raised in the IPO from investors in millions. (inflation adjusted in millions of 2010 dollars)	SDC
Price Revision	The percentage change from the amended mid-point of the offer price range to the offer price	SDC
Market return	Compounded value-weighted market return for 20 calendar days before the IPO date	CRSP daily
Log (1+ Hot)	The log of one plus the number of IPOs in the same industry as the IPO firm in the preceding year	SDC
Log (1+ Patent)	Log of one plust the number of patents that the firm has filed for prior to the IPO	NBER
A&D Intensity	The ratio of advertising expenditures divided by Sales before the IPO	Compustat
	Other variables	

PostFTDA	Equals to 1 if the IPO year in 1996 or after and 0 otherwise	SDC
Examiner Leniency	Examiner leniency averaged over all the trademark applications filed by a firm prior to the IPO	USPTO
Young	Equals to 1 if firms' age smaller than the median age and 0 otherwise	Ritter's website
Mature	Equals to 1 if firms' age larger than the median age and 0 otherwise	Ritter's website
High R&D	defined as firm that reports positive R&D expense	Compustat
Low R&D	defined as firm that reports zero or missing R&D expense	Compustat
Small firm	Equals to 1 if firms' sales smaller than the median sales and 0 otherwise	Compustat
Large firm	Equals to 1 if firms' sales larger than the median sales and 0 otherwise	Compustat
High Volatility	Equals to 1 if return residual volatility is larger than the median value and 0 otherwise; Return residual volatility volatility is calculated based on Fama-French three factors model for the two-digit SIC industry	CRSP
Low Volatility	Equals to 1 if return residual volatility smaller than the median value and 0 otherwise	CRSP
High Competition	Equals to 1 if the IPO firm's industry Compustat HHI (in the year before IPO) is smaller than the median value and 0 otherwise; Compustat HHI is the Herfindahl-Hirschman Index based on 3-digit SIC code computed using Compustat Public firms.	Compustat
Low Competition	Equals to 1 if the IPO firm's industry Compustat HHI (in the year before IPO) is larger than the median value and 0 otherwise.	Compustat

Table 1 Descriptive Statistics

This table reports summary statistics of main variables used in regression analyses. The sample contains IPO firms in SDC from 1980 to 2016. All continuous variables are winsorized at 1% and 99% levels. Detailed variable definitions are provided in the Appendix Table A2.

Variable	Observations	Mean	Median	Min	Max	Std
Underpricing	4,321	0.192	0.079	-0.167	2.018	0.346
Trademark	4,321	0.664	0.000	0.000	17.000	2.515
Famous trademark	4,321	0.058	0.000	0.000	3.000	0.382
VC	4,321	0.468	0.000	0.000	1.000	0.499
Underwriter	4,321	0.440	0.000	0.000	1.000	0.496
Firm age	4,321	15.268	8.000	0.000	95.000	19.199
Asset	4,321	181.210	36.982	0.695	3597.580	485.496
Share overhang	4,321	3.054	2.585	-0.501	11.863	2.066
Proceeds	4,321	89.490	52.362	5.968	760.413	120.729
Price revision	4,321	-0.006	0.000	-0.375	0.333	0.131
Market return	4,321	0.008	0.009	-0.068	0.073	0.028
Hot market	4,321	21.960	9.000	0.000	213.000	35.393
Patent	4,321	0.857	0.000	0.000	18.000	2.836
A&D intensity	4,038	0.021	0.000	0.000	0.530	0.068
Nasdaq dummy	4,321	0.706	1.000	0.000	1.000	0.456
Tech dummy	4,321	0.402	0.000	0.000	1.000	0.490
Internet dummy	4,321	0.083	0.000	0.000	1.000	0.276

Table 2 Sample Distribution

This table reports the industry and year distribution of IPO average underpricing and trademark. The sample contains IPO firms in SDC from 1980 to 2016. The industry classification is based on the Fama French 12 industry classifications. Detailed variable definitions are provided in the Appendix Table A2.

Panel A: Industry distribution of IPO average underpricing

Industry	# of IPO	Mean		
		IPO Underpricing	Trademark dummy	Trademark stock
1: Consumer NonDurables	188	0.138	0.138	1.479
2: Consumer Durables	98	0.089	0.224	1.969
3: Manufacturing	339	0.091	0.124	1.050
4: Enrgy	109	0.049	0.028	0.110
5: Chemicals and Allied Products	62	0.114	0.242	2.710
6: Business Equipment	1,394	0.318	0.165	0.664
7: Telecom	163	0.185	0.061	0.160
8: Utilities	30	0.040	0.133	0.300
9: Shops	552	0.130	0.134	0.763
10: Health	758	0.125	0.115	0.377
12: Others	628	0.179	0.088	0.306
Total	4,321			

Panel B: Year distribution of IPO average underpricing

Year	# of IPO	Mean		
		IPO Underpricing	Trademark dummy	Trademark stock
1980	33	0.185	0.364	2.970
1981	87	0.083	0.161	0.345
1982	32	0.142	0.281	1.688
1983	201	0.125	0.244	1.159
1984	84	0.043	0.214	0.774
1985	95	0.065	0.242	1.211
1986	200	0.070	0.275	1.635
1987	147	0.080	0.272	2.027
1988	56	0.070	0.446	2.107
1989	60	0.096	0.400	3.317
1990	61	0.126	0.295	2.164
1991	150	0.114	0.173	1.500
1992	218	0.102	0.083	0.913
1993	282	0.135	0.004	0.060
1994	240	0.109	0.004	0.071
1995	268	0.212	0.004	0.019
1996	224	0.203	0.004	0.076
1997	236	0.156	0.013	0.161
1998	141	0.221	0.021	0.043
1999	281	0.698	0.004	0.007
2000	219	0.529	0.187	0.420
2001	37	0.203	0.027	0.027
2002	38	0.095	0.158	0.526
2003	43	0.111	0.023	0.070
2004	116	0.128	0.172	0.474
2005	95	0.103	0.084	0.137
2006	96	0.120	0.125	0.302
2007	104	0.157	0.135	0.404
2008	14	0.080	0.143	0.500
2009	33	0.114	0.182	1.788
2010	57	0.089	0.158	0.561

2011	53	0.150	0.396	1.472
2012	58	0.175	0.362	1.224
2013	82	0.248	0.293	1.122
2014	99	0.186	0.253	0.475
2015	58	0.200	0.259	0.534
2016	23	0.120	0.000	0.000
Total	4,321			

Panel C: Summary statistics for trademark and non-trademark samples

	Trademark dummy=1 (N=568)	Trademark dummy=0 (N=3753)
Variable	Mean	Mean
Underpricing	0.160	0.197
Trademark	5.048	0.000
VC	0.535	0.458
Underwriter	0.444	0.439
Firm age	17.298	14.961
Asset	187.824	180.209
Share overhang	3.577	2.975
Proceeds	95.494	88.582
Price revision	-0.010	-0.005
Patent	0.968	0.840
A&D intensity	0.022	0.021

Table 3 Baseline Regression Results

This table reports the results from our baseline regressions. The dependent variable is IPO underpricing, the independent variable is *Trademark Dummy* in columns (1) to (2) and *Log(1+Trademark)* in columns (3) to (4). Detailed variable definitions are provided in the Appendix Table A2. Robust t-statistics, adjusted for industry-level clustering, are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All continuous variables are winsorized at 1% and 99% level.

Variables	Underpricing			
	(1)	(2)	(3)	(4)
Trademark Dummy	-0.024**	-0.026**		
	(-2.426)	(-2.678)		
Log (1+Trademark)			-0.016**	-0.017**
			(-2.414)	(-2.465)
VC	0.035**	0.025**	0.035**	0.025**
	(2.715)	(2.639)	(2.725)	(2.623)
Underwriter	0.000	-0.017***	0.000	-0.017***
	(0.012)	(-3.589)	(0.005)	(-3.604)
Log(1+Age)	-0.016***	-0.012***	-0.016***	-0.012***
	(-5.506)	(-3.914)	(-5.412)	(-3.738)
Log(Asset)	-0.007	-0.022**	-0.006	-0.021**
	(-1.801)	(-2.926)	(-1.771)	(-2.920)
Share Overhang	0.036***	0.033***	0.036***	0.033***
	(3.866)	(4.363)	(3.872)	(4.365)
Tech Dummy	0.044**	0.038**	0.044**	0.038**
	(2.784)	(2.415)	(2.754)	(2.399)
Internet Dummy	0.205***	0.166***	0.205***	0.166***
	(6.085)	(5.063)	(6.091)	(5.072)
Nasdaq Dummy	0.007	0.012*	0.007	0.012*
	(0.702)	(1.962)	(0.685)	(1.927)
Log (Proceeds)		0.039**		0.040**
		(2.883)		(2.863)
Price Revision		0.755***		0.754***
		(7.673)		(7.667)
Market Return		0.774***		0.778***
		(3.207)		(3.232)
Log (1+Hot)		-0.002		-0.002
		(-0.259)		(-0.244)
Industry fixed effect	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
Observations	4,321	4,321	4,321	4,321
R-squared	0.336	0.430	0.336	0.430

Table 4 The impact of the 1996 Federal Trademark Dilution Act

This table reports the results of the impact of the 1996 Federal Trademark Dilution Act. The dependent variable is IPO underpricing, the explanatory variable of interest is the interaction term between *PostFTDA* and *Famous Dummy* or *Log(1+Famous)*. All baseline controls from Table 3 column (2) are included in regressions, whose coefficients are not reported for brevity. Detailed variable definitions are provided in the Appendix Table A2. Robust t-statistics, adjusted for industry-level clustering, are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All continuous variables are winsorized at 1% and 99% level.

	Underpricing	
Variables	(1)	(2)
Famous Dummy × Post_FTDA	-0.115**	
	(-2.326)	
Famous Dummy	-0.020	
	(-0.816)	
Log(1+Famous) ×Post_FTDA		-0.086*
		(-1.734)
Log(1+Famous)		-0.013
		(-0.622)
Baseline control	Yes	Yes
Industry fixed effect	Yes	Yes
Year fixed effect	Yes	Yes
Sample Period	1989-2002	1989-2002
Observations	2,455	2,455
R-squared	0.405	0.405

Table 5 Two-Stage-Least-Square Analysis

This table reports the regression results of the 2SLS analysis. We use trademark examiner leniency as the instrumental variable for the trademark stock and trademark dummy, respectively. Columns (1) and (2) reports the first-stage regression results, with *Trademark Dummy* and *Log(1+Trademark)* as the dependent variable, respectively. Results from the second-stage regressions are reported in columns (3) and (4), with IPO underpricing as the dependent variable. The independent variable of interest in the second stage is the predicted values of *Trademark Dummy* or *Log(1+Trademark)* from the first-stage regression. All baseline controls from Table 3 column (2) are included in all regressions, whose coefficients are not reported for brevity. Detailed variable definitions are provided in the Appendix Table A2. Robust t-statistics, adjusted for industry-level clustering, are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All continuous variables are winsorized at 1% and 99% level.

	First Stage		Second Stage	
VARIABLES	Trademark Dummy	Log(1+Trademark)	Underpricing	
	(1)	(2)	(3)	(4)
Examiner Leniency	0.419***	2.133***		
	(3.093)	(5.969)		
Predicted Trademark Dummy			-0.862**	
			(-2.544)	
Predicted Log(1+Trademark)				-0.169***
				(-2.934)
Baseline controls	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes
F-Statistics	9.56	35.63		
Prob>F	0.003	0.000		
Observations	552	552	552	552
R-squared	0.184	0.424		

Table 6 More nuanced measures on trademarks

This table examines the relation between trademark characteristics and IPO underpricing using several more nuanced measures on trademarks. The explanatory variables in Panel A, Panel B, and Panel C are proxies for trademark quality, trademark strategy, and trademark type, respectively. The dependent variable is IPO underpricing. All baseline controls from Column (2) in Table 3 are included in the regressions, whose coefficients are not reported for brevity. Detailed variable definitions are provided in the Appendix Table A2. Robust t-statistics, adjusted for industry-level clustering, are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All continuous variables are winsorized at 1% and 99% level.

Panel A: Trademark quality

VARIABLES	Underpricing			
	(1)	(2)	(3)	(4)
Log (1+Trademark Age)	-0.012			
	(-1.210)			
Trademark age dummy		-0.054***		
		(-6.483)		
Log(1+Famous)			-0.041***	
			(-4.984)	
Famous Dummy				-0.040**
				(-2.744)
Baseline controls	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
Observations	568	568	568	568
R-squared	0.412	0.415	0.414	0.413

Panel B: Trademark strategies

VARIABLES	Underpricing		
	(1)	(2)	(3)
Trademark Diversity	-0.056***		
	(-3.784)		
Log(1+Exploratory)		-0.014**	
		(-2.326)	
Log(1+Exploitation)			-0.012
			(-1.774)
Baseline controls	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes
Observations	570	4,321	4,321
R-squared	0.417	0.429	0.429

Panel C: Trademark types

VARIABLES	Underpricing	
	(1)	(2)
Log(1+ Product Trademark)	-0.016**	
	(-2.417)	
Log(1+ Marketing Trademark)		-0.034*
		(-2.181)
Baseline controls	Yes	Yes
Industry fixed effect	Yes	Yes
Year fixed effect	Yes	Yes
Observations	4,321	4,321
R-squared	0.430	0.430

Table 7 The impact of information asymmetry

This table conduct subsample tests whether the negative effect of trademarks on underpricing is stronger when information asymmetry is higher. The dependent variable is IPO *Underpricing*. The independent variable is *Trademark Dummy* in panel A and *Log(1+Trademark)* in panel B. We use firm age, R&D expense, firm sales and return residual volatility from Fama French three-factor model as information asymmetry proxies. *Young* firm is defined as firms' age smaller than the median age; *Mature* firm is defined as firms' age larger than the median age; *High-R&D* firm is defined as a firm that reports positive R&D expense and *Low R&D* firm is defined as a firm that reports zero or missing R&D expense. *Small* firm is defined as firms' sales smaller than the median sales; *Large* firm is defined as firms' sales larger than the median sales. *High Volatility* is defined as return residual volatility lager than median value; *Low volatility* is defined as return residual volatility smaller than median value; All baseline controls from Column (2) in Table 3 are included in the regressions, whose coefficients are not reported for brevity. Detailed variable definitions are provided in the Appendix Table A2. Robust t-statistics, adjusted for industry-level clustering, are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All continuous variables are winsorized at 1% and 99% level.

Panel A: Explanatory variable: *Trademark dummy*

VARIABLES	Underpricing							
	(1) Young	(2) Mature	(3) High R&D	(4) Low R&D	(5) Small	(6) Large	(7) High volatility	(8) Low volatility
Trademark Dummy	-0.051**	-0.005	-0.046***	0.004	-0.046*	0.003	-0.042**	-0.001
	(-3.013)	(-0.766)	(-5.004)	(0.445)	(-1.882)	(0.357)	(-3.045)	(-0.107)
Differences	-0.046***		-0.050***		-0.049*		-0.041**	
Chi-Square	8.29		18.19		3.01		5.27	
P-value	0.004		0.000		0.083		0.022	
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,213	2,108	2,315	2,006	2,211	2,110	2,105	2,216
R-squared	0.444	0.373	0.474	0.330	0.450	0.402	0.459	0.273

Panel B: Explanatory variable: *Log(1+Trademark)*

VARIABLES	Underpricing							
	(1) Young	(2) Mature	(3) High R&D	(4) Low R&D	(5) Small	(6) Large	(7) High volatility	(8) Low volatility
Log(1+Trademark)	-0.038**	-0.007	-0.029**	-0.004	-0.028*	-0.006	-0.026***	-0.005
	(-2.475)	(-1.601)	(-2.933)	(-0.815)	(-2.086)	(-1.094)	(-3.524)	(-1.304)
Differences	-0.031**		-0.025***		-0.022*		-0.021***	
Chi-Square	5.62		7.09		3.01		6.92	
P-value	0.018		0.008		0.083		0.009	
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,213	2,108	2,315	2,006	2,211	2,110	2,105	2,216
R-squared	0.444	0.374	0.474	0.330	0.450	0.402	0.459	0.273

Table 8 The impact of product market competition

This table conduct subsample tests whether the negative effect of trademarks on underpricing is stronger when product market competition is higher. The dependent variable is IPO underpricing. *High Competition* firm is defined as a firm in an industry whose HHI is smaller than the median value. *Low Competition* is defined as a firm in an industry whose HHI is greater than the median value. The HHI is calculated based on the public firm's sales in the same industry (3-digit SIC) as the IPO firm. All baseline controls from Column (2) in Table 3 are included in the regressions, whose coefficients are not reported for brevity. Detailed variable definitions are provided in the Appendix Table A2. Robust t-statistics, adjusted for industry-level clustering, are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All continuous variables are winsorized at 1% and 99% level.

VARIABLES	Underpricing			
	(1)	(2)	(3)	(4)
	High Competition	Low Competition	High Competition	Low Competition
Trademark Dummy	-0.054***	0.001		
	(-8.180)	(0.085)		
Log(1+Trademark)			-0.038***	-0.005
			(-5.852)	(-0.753)
Differences	-0.055***		-0.033***	
Chi-Square	9.28		17.88	
P-value	0.002		0.000	
Baseline controls	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
Observations	2,227	2,094	2,227	2,094
R-squared	0.429	0.445	0.429	0.445

Table 9 Evidence from other IPO outcomes

This table examines the relation between pre-IPO trademark and other IPO outcomes, including the probability of IPO withdrawal, IPO delisting, and post-IPO long-run performance. Panel A report the results between pre-IPO trademark and the likelihood of IPO withdrawn. The dependent variable is a dummy variable indicating whether an IPO is withdrawn, and the independent variable is *Trademark dummy* in column (1) and *Log(1+trademark)* in column (2). Panel B reports the results between pre-IPO trademark and the likelihood of IPO firm delisting. The dependent variable is a dummy variable indicating whether an IPO delisted within a five-year period after IPO and the independent variable is trademark dummy in columns (1) and log(1+trademark) in columns (2). Panel C reports the results between trademark and IPO long-run stock market and financial performance. The dependent variable is the 3-year monthly market-adjusted returns for columns (1) and (2) and the ROA in the third year after IPO in columns (3) and (4), respectively. For Panel A, we include both successful and failed IPOs and control for *Underwriter*, *Tech dummy*, *Internet Dummy*, *Nasdaq dummy*, *Market return*, and *Log (1+hot)*. For panel B and panel C, all baseline controls from Column (2) in Table 3 are included in the regressions, whose coefficients are not reported for brevity. Detailed variable definitions are provided in the Appendix Table A2. Robust t-statistics, adjusted for industry-level clustering, are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: IPO withdrawal

VARIABLES	Indicator (=1 if IPO is withdrawn)	
	(1)	(2)
Trademark Dummy	-0.111***	
	(-7.910)	
Log(1+Trademark)		-0.057***
		(-6.777)
Additional controls	Yes	Yes
Industry fixed effect	Yes	Yes
Year fixed effect	Yes	Yes
Observations	10,230	10,230
R-squared	0.171	0.170

Panel B: IPO delisting within 5 years after IPO

VARIABLES	Indicator (=1 if IPO is delisted)	
	(1)	(2)
Trademark Dummy	-0.199***	
	(-18.594)	
Log(1+Trademark)		-0.102***
		(-13.571)
Baseline controls	Yes	Yes
Industry fixed effect	Yes	Yes
Year fixed effect	Yes	Yes
Sample Period	1980-2011	1980-2011
Observations	4,001	4,001
R-squared	0.098	0.095

Panel C: Post-IPO long-run performance

VARIABLES	Return Adjust		ROA	
	(1)	(2)	(3)	(4)
Trademark dummy	0.281***		0.026**	
	(6.802)		(2.896)	
Log(1+trademark)		0.159***		0.019***
		(7.005)		(3.611)
Baseline controls	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
Observations	3,680	3,680	3,110	3,110
R-squared	0.068	0.068	0.292	0.292

Table 10 Propensity Score Matching

This table reports results from propensity score matching. For each IPO firm (treatment sample) with at least one trademark at the IPO date, we find a matched firm (control sample) with zero trademark. We use a logit regression model to calculate the propensity score and use the nearest score matching method. The matching variables include *VC*, *Underwriter*, *Log (1+Age)* and *Log (Asset)*. Panel A reports the balancing property after the match and Panel B reports the OLS regression results using the matched sample. In Panel B, the dependent variable is *Trademark Dummy* and *Log(1+Trademark)* in Column (1) and Column (2), respectively. All baseline controls from Column (2) in Table 3 are included in the regressions, whose coefficients are not reported for brevity. Detailed variable definitions are provided in the Appendix Table A2. Robust t-statistics, adjusted for industry-level clustering, are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All continuous variables are winsorized at 1% and 99% level.

Panel A: Balancing property

VARIABLES	Treatment Sample	Control Sample	Difference	t-value
	(1)	(2)	(3)	
VC	0.534	0.511	0.023	0.77
Underwriter	0.443	0.437	0.006	0.18
Log (1+Age)	2.472	2.502	-0.030	-0.57
Log (Asset)	4.022	4.069	-0.047	-0.52

Panel B: The OLS regression using the matched sample

VARIABLES	Underpricing	
	(1)	(2)
Trademark dummy	-0.023*	
	(-1.892)	
Log(1+Trademark)		-0.022**
		(-2.839)
Baseline Controls	Yes	Yes
Industry fixed effect	Yes	Yes
Year fixed effect	Yes	Yes
Observations	866	866
R-squared	0.416	0.418

Table 11 Remove the confounding effect of patents

This table conducts tests to remove the confounding effect of patents. The dependent variable is IPO underpricing, the independent variable is *Log (1+Patent)* in Column (1), *Trademark Dummy* in Column (2) and *Log(1+Trademark)* in Columns (3) and (4). In Columns (2) and (3), we further control for a firm's advertising expense (*A&D Intensity*), while in Column (4) we use a subsample of firms that do not have any patent but have at least one trademark. All baseline controls from Column (2) in Table 3 are included in the regressions, whose coefficients are not reported for brevity. Detailed variable definitions are provided in the Appendix. Robust t-statistics, adjusted for industry-level clustering, are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All continuous variables are winsorized at 1% and 99% level. A constant is always included in regressions although not reported.

VARIABLES	Underpricing			
	(1)	(2)	(3)	(4)
Trademark Dummy		-0.028**		
		(-2.516)		
Log(1+Trademark)			-0.018**	-0.063***
			(-2.370)	(-5.150)
Log(1+Patent)	0.007	0.009	0.009	
	(0.592)	(0.755)	(0.786)	
A&D Intensity		-0.107	-0.106	
		(-0.888)	(-0.882)	
Baseline controls	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
Observations	4,321	4,038	4,038	443
R-squared	0.429	0.441	0.441	0.387