Collateral Constraints, Trademarks, and Corporate Activities

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Keywords: Trademarks, Collateral, Debt Financing, Investments, Employment.

JEL Classification: G31, G32, O34, Ol6.

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1 Introduction

The literature on collateral constraints shows that collateralizable tangible assets affect the real economy through a collateral channel.[1] As intangible assets represent a large fraction of firm value, today's companies often lack tangible assets as collateral.[2] How firms cope with such a shortage of tangible collateral and the economic consequences are less understood. To shed light on these issues, we focus on one of the most valuable and widely used intangible assets, i.e., trademarks, which have not been investigated in prior studies. By exploiting an exogenous shock that causes a shortage of tangible collateral, we provide the first direct evidence that trademarks can relax tangible collateral constraints, thereby affecting firms' financing, investments, and employment.

Using a novel sample of security interests in trademarks recorded with the United States Patent and Trademark Office (USPTO) from 1975 to 2015, we first document a dramatic increase in the number of U.S. firms pledging trademarks as loan collateral over the past two decades (Figure 1). Recent studies find that patents can also be used to secure debt financing for firm innovation. Since a relatively small percentage of U.S. firms own patents, studying trademarks can help us understand the broader impact of intangible collateral beyond patenting firms and innovation activities. Particularly, we extend the investigation to the role of trademarks in relaxing tangible collateral constraints and helping firms recover from adverse shocks, as well as the impacts on employment that are not examined in prior studies.[3] We find that trademarks are even more widely used as collateral than patents and less industry specific. The unique characteristics, valuation, and transferability of

[1] Previous studies suggest that collateral in the form of physical assets has an important impact on the real economy because the value of collateralizable assets affects firms' borrowing and thus investments (Kiyotaki and Moore, 1997; Bernanke et al., 1999; Chang and Dasgupta, 2007; Aivazian et al., 2015). More recently, Gan (2007) and Chaney et al. (2012) show that firms with less valuable real estate collateral as a result of declined property prices invest less. Such a link between collateral values of tangible assets and firm investments is attributable to collateral-based lending constraints.

[2] According to the 2015 Annual Study of Intangible Asset Market Value conducted by Ocean Tomo, an intellectual property (IP) merchant bank, on average, intangible assets accounted for 84% of the market value of S&P 500 companies in 2015, representing a significant increase from the 1975 level of 17%. By studying U.S. listed firms, Doidge et al. (2018) find that the fixed assets of average listed firms were only 19.6% of the total assets in 2016, while the ratio was 34.4% in 1975.

[3] Graham et al. (2018) link granted patents to firms at the U.S. Census Bureau databases and document that less than 1% of firms in the U.S. economy are granted a patent between 2000 and 2011. The proportion of firms with patents is much higher among large firms than small firms. Amable et al. (2010), Hochberg et al. (2018), Mann (2018), and Suh (2019) show patents can increase debt ratios of both publicly traded firms and startups, which will promote innovation. Although these studies show that patents pledged as collateral broaden the scope of financing for innovative firms, they do not examine whether intangible assets can relax collateral constraints caused by a shortage of tangible assets. Understanding different forms of collateral constraints is important because they have different implications for credit allocation and efficiency, economic recovery, and responses to monetary policy. If firms are less vulnerable to collateral damage associated with tangible assets, the amplification mechanism of the collateral-based financial accelerator in Kiyotaki and Moore (1997) might be mitigated. Moreover, none of these studies investigate the impacts of intangible assets as collateral on employment.

trademarks make them particularly suitable for collateral.[4] When trademarks are pledged as collateral, firms' secured debt ratios increase.

Although an increasing number of firms pledge trademarks to secure debt financing, it is difficult to identify whether trademarks help relax collateral constraints and establish the quantitative importance of trademark collateral. The main challenge lies in the fact that firms may have sufficient tangible collateral for their borrowing needs and face no constraints. To circumvent this issue, we adopt an identification strategy that uses hurricanes as exogenous shocks to the collateral value of tangible assets and explore the role of trademarks in overcoming the collateral constraints of affected firms. Hurricanes present a rare opportunity to investigate how firms use intangible assets as a buffer against exogenous negative shocks to tangible collateral. Our research design also enables us to uncover the importance of intangible assets in helping firms recover from catastrophic events, which is new to the literature.

Our empirical strategy uses two sources of identification. The first source is based on a comparison of changes in financing, investments, and employment of comparable firms with and without trademarks located in affected areas. Since hurricanes cause severe damage to factories, equipment, and buildings in disaster areas, affected firms might have difficulties using damaged tangible assets as collateral to secure debt financing for recovery. In contrast, trademarks are intangible by nature and are usually not destroyed in a hurricane. If trademarks have collateral value, firms with active trademarks (TM firms) potentially have more pledgeable assets than those without trademarks (non-TM firms) that have similar tangible assets, market-to-book ratios, cash flows, and other characteristics. The activities of comparable non-TM firms represent the counterfactual outcome if TM firms have no trademarks available as collateral.[5] If trademarks have no collateral value, we should expect no difference in the responses of comparable TM and non-TM firms. The second source is based

[4] We discuss differences between trademarks and patents in the Online Appendix Section A.2 and provide a theoretical foundation and anecdotal evidence of trademark collateral in Section 3. Although it might also be interesting to explore how trademarks and patents differ in their collateralizability and thereby affect debt financing, data required to answer these questions, such as collateral pledged on each loan, the loan-to-value ratios for each type of collateral asset, and the corresponding loan terms, are unfortunately unavailable.

[5] The effects of registered trademarks as collateral will be underestimated if non-TM firms have unregistered trademarks that may be collateralizable. Unregistered trademarks provide limited protection for the owner and are generally less valuable. Although TM and non-TM firms are similar in size and tangibility, they do not necessarily have similar intangible assets because most intangible assets are not reported on balance sheets. Our analyses do not effectively compare the outcomes of firms with an equal value of total, tangible, and intangible assets and have no implications for the relative pledgeability of different types of intangible assets.

on a comparison of the impacts on firms with variations in the collateral values of their trademark portfolios. If trademarks are valuable collateral that affects firms' borrowing capacities, firms with high-value trademarks should be able to borrow more than firms with low-value trademarks.

We first establish the importance of hurricanes as shocks to firms' tangible assets by showing that firms suffer significant losses in the value of fixed assets when hit by Hurricanes Sandy and Isaac. Since matched TM-firms and non-TM firms experience similar losses, the observed differences in the firms' responses to the hurricanes cannot be easily attributed to the differences in the degree of property damage between the two groups of firms. There is also no significant difference in insurance payments received by TM and non-TM firms after hurricanes.

Given the shortage of tangible collateral, the difference-in-differences estimation results show that firms with active trademarks borrow more secured debt, invest more in physical assets, and employ more workers than otherwise similar firms without trademarks during the post-hurricane period. However, investments in R&D are not significantly higher among TM firms. Compared to firms without trademarks, the secured debt of firms with trademarks available for collateralization increase on average by \$3.69 for every \$100 of total assets following hurricanes. This increased debt financing translates into increased fixed-asset investments, as TM firms spend on average \$1.16 more for every \$100 of total assets on capital expenditures after hurricanes. TM firms also employ approximately 58 more employees during the post-hurricane period than non-TM firms.

The cross-sectional analysis exploring heterogeneity in trademark value reveals that firms with more valuable trademark portfolios borrow more, lending further support to the finding that the collateral value of trademarks facilitates debt financing. We also provide direct evidence supporting the usage of trademarks as collateral by showing that firms pledge trademarks more frequently during the post-hurricane period. Such behavior mainly occurs in firms that experience worse damage to their tangible assets. Additionally, more constrained firms that intend to issue debt to mitigate liquidity problems are more likely to use trademarks to secure debt financing when the collateral values of their tangible assets are impaired by hurricanes. Moreover, the observed more debt financing and better responses of TM firms than non-TM firms after hurricanes are mainly concentrated among

firms experiencing greater tangible asset damage. These findings confirm that firms indeed use trademarks to mitigate the adverse effects of shocks to their tangible assets. Trademarks can serve as buffer collateral to secure financing for investments and employment, which helps firms recover from negative shocks.

As a natural experiment, the use of hurricanes helps address several common concerns. First, their occurrence is exogenous to customer demand and economic conditions, and they randomly affect a large number of firms. Consequently, any variation in firms' responses to hurricanes cannot be easily attributed to reverse causality. Second, the trademark portfolio of a firm is predetermined relative to the shock to tangible assets, since hurricanes are difficult to forecast (Emanuel, 2017). Thus, it is unlikely that firms alter their trademark portfolios in anticipation of the occurrence of hurricanes. Although trademarks are not randomly assigned, the predetermination of trademark portfolios relative to hurricanes helps ease the endogeneity concern that the status of owning trademarks is driven by unobserved factors that influence firms' financing and investments in the post-hurricane period. Third, the affected firms' need for bank credit does not depend on whether they have trademarks but on their need for recovery and rebuilding during the aftermath of hurricanes. Since there is no obvious reason for firms with trademarks to be more likely hit by hurricanes systematically, it is more difficult to attribute the difference in the changes in activities before and after hurricanes between TM firms and non-TM firms to differences between the two groups.

Notwithstanding the advantages of hurricanes as a natural experiment for estimating causal effects, we conduct a series of tests to invalidate alternative interpretations. First, our analyses focus on a sample of matched firms with similar characteristics and control for the determinants of firms' financing and investment decisions to minimize the possibility that the results are driven by observed differences between TM and non-TM firms. The difference-in-differences approach combined with propensity score matching removes the unobserved permanent differences between TM and non-TM firms and any common trend affecting both groups. Second, the results of placebo tests show that TM firms do not perform better than non-TM firms in the absence of an exogenous shock to their tangible collateral, which indicate that having trademarks *per se* does not necessarily mean that firms will have more debt, investments, and employment. Third, we address the concern that TM and

non-TM firms might face different demand shocks by showing that our results are not explained by geographic diversification or differences in product markets. Fourth, by tracing the timing of the changes, we find that increases in debt financing, investments, and employment do not occur prior to hurricanes and manifest only after tangibility shocks, suggesting that pre-existing divergences between TM and non-TM firms are unlikely to explain our findings. Fifth, we show that differences in post-hurricane secured debt financing and investment between TM firms and non-TM firms are not due to their different stages of product development innovation or different demand for credit. Lastly, our results are not because TM firms might have better access to finance even without using trademarks as collateral after hurricanes. We find no support for the view that TM firms have more patents or tangible assets as collateral, rely more on equity financing, or have lower *ex ante* credit risk and information asymmetry than non-TM firms.

In sum, we find that trademarks can improve firms' access to debt capital, especially in the case of a shortage of tangible collateral. Such improved debt financing has real impacts on fixed-asset investments and employment. Recognizing the importance of trademarks as collateral can help us gain a better understanding of firms' capital structure and the real effects of collateral constraints. The pledgeability of trademarks helps relax collateral constraints, thereby facilitating investments and employment that are vital for economic growth. Trademarks can also help firms recover from adverse shocks to their tangible collateral.

2 Related Literature

Our study is related to the literature on the real effects of collateral constraints. Collateral is an important mechanism for reducing credit rationing (Stiglitz and Weiss, 1981). Firms' abilities to pledge collateral affect the real economy, as propagated through a collateral channel (Kiyotaki and Moore, 1997; Bernanke et al., 1999). Collateral constraints reduce debt capacity, which depresses firms' investments on the downside of the business cycle. Decreased investments further deteriorate firms' ability to borrow, which leads to a vicious cycle called the financial accelerator.

Numerous theoretical and empirical studies show that tangible assets play an important role in increasing firms' abilities to raise external funding and affect their investment policies (Gan, 2007; Chaney et al., 2012).

Conventional wisdom argues that intangible assets have little if any collateral value (Rampini and Viswanathan, 2013).[6] This view is challenged by the recent works by Amable et al. (2010), Hochberg et al. (2018), Mann (2018), and Suh (2019), who show that firms with more valuable patents as collateral have higher debt ratios and future innovation. These studies, however, do not examine the impacts on fixed-asset investments and employment that are essential for economic growth.[7] Adding to this literature stream, our study provides the first systematic evidence regarding the role of one of the most valuable and important intangible assets, i.e., trademarks, in firms' debt financing, investments, and employment.[8] We extend the inquiry beyond patenting firms, which represent a relatively small proportion of U.S. firms and investigate the impacts of using trademarks as collateral on business activities beyond innovation. Differing from prior studies on patents, we focus on whether trademarks help relax collateral constraints that can amplify and propagate adverse shocks.[9] Our novel evidence underscores the importance of intangible collateral for firms' financing, investments, and employment, which has implications for evaluating the effects of collateral constraints on the real economy.

By exploring a large and unique dataset of security interests in trademarks, we document the frequent usage of this valuable but underexplored asset class as eligible collateral. The availability of trademarks enlarges the menu of assets that can be used as collateral, enabling firms to borrow beyond the value of their tangible assets. These results may also help to explain the puzzling finding reported by Graham et al. (2015) showing that U.S. firms' debt usage dramatically increased over the past century, while asset tangibility generally decreased, given the previous evidence of a positive relationship between leverage and asset tangibility (Rajan and Zingales, 1995). Since intangible assets complement tangible assets in mitigating credit frictions, the fast growth of intangible capital over time might improve debt capacity limited by tangible assets. The pledgeability of intangible assets

[6] Intangible assets are traditionally considered unsuitable as collateral because they are difficult to value, and most intangible assets are not reported on balance sheets. Under U.S. generally accepted accounting principles (GAAP), only externally acquired intangible assets and assets with an identifiable value and useful lifespan that can thus be amortized are reported on a firm's balance sheet. Internally developed intangible assets, such as trademarks, patents, and trade secrets, do not appear on a firm's balance sheet. Peters and Taylor (2017) document that only 19% of firms' intangible assets on average are purchased externally.

[7] The only exception is Mann (2018), who finds that strengthened creditor rights to patents have no impact on capital expenditures.

[8] The Business R&D and Innovation Survey, conducted by the National Science Foundation and the U.S. Census Bureau, finds that businesses identify trademarks and trade secrets as the most important forms of intellectual protection, followed by copyrights and patents (Jankowski, 2012).

[9] Kiyotaki and Moore (1997); Bernanke et al. (1999); Liu et al. (2013) show that collateral constraints can contribute to the amplification and propagation of adverse shocks because of a negative feedback loop between collateral values and tightening funding constraints that depress investments.

might affect credit allocation and the dynamics of aggregate- and firm-level debt.

This paper adds to the literature that examines the relationship between firms' intellectual property and capital structure (Mann, 2018; Saidi and Zaldokas, 2021; Heath and Sertsios, 2019) by showing that intangible assets are important for securing debt financing, not only during normal times, but also when firms recover from negative shocks. Trademark collateral is particularly beneficial when firms face shortages in tangible collateral. Our study extends the literature by expanding the scope of inquiry beyond capital structure and investigating the economic impacts on investments in fixed assets, R&D, and employment. The results provide novel evidence that the ability to use trademarks to ease collateral constraints helps firms recover from catastrophic events, leaving them less vulnerable to adverse shocks to tangible assets.

Our paper also contributes to the nascent finance literature on trademarks. Recent studies establish the importance of trademarks and trademark protection for new product development (Faurel et al., 2020), firm profits (Crass et al., 2016; Heath and Mace, 2020), capital structure (Heath and Sertsios, 2019), bank lending (Chiu et al., 2021), mergers and acquisitions (Hsu et al., 2017), market value (Sandner and Block, 2011), venture capital valuation (Block et al., 2014), and venture capital investments (Chemmanur et al., 2019). To the best of our knowledge, this paper is the first to use a large sample of security interests in trademark data to investigate firms' trademark pledge activities and their impacts on firms' financing, investments, and employment. Our findings indicate that trademarks are important not only for product differentiation and firm competition in product markets, but also for mitigating credit constraints.

3 Trademark Collateral

In the presence of information asymmetries, lenders face *ex-ante* adverse selection and *ex-post* moral hazard risks, which can result in credit rationing (Stiglitz and Weiss, 1981). Such credit frictions can be ameliorated by collateral, which acts as a signaling device to attenuate adverse selection and as an incentive device to reduce moral hazard problems (Boot and Thakor, 1994). The unique features of trademarks qualify them to play the role of collateral for two reasons.[10]

[10]The basics of trademarks and differences between trademarks and patents are presented in the Online Appendix Section A.

First, a trademark provides the owner the exclusive right to use it to identify goods or services. Such legal protection incentivizes firms to invest in product quality and development to distinguish their products and achieve a competitive advantage (Landes and Posner, 1987). Since firms are required to demonstrate the use of registered trademarks in commerce for the associated products or services, registered trademarks convey valuable information to the market regarding the commercialization of products or services. Therefore, trademarks signal not only product and service quality, but also the financial value of branding (Krasnikov et al., 2009). The signaling role of trademarks reduces the adverse selection problem.

Second, trademarks are valuable assets and contribute to firm value (Sandner and Block, 2011).[11] Trademarks protect firm identity and reputation and insulate firms from competition and infringement on their products or services. Trademark rights can last indefinitely, as long as the registered trademarks are in use. This perpetual legal protection for registered trademarks makes them particularly valuable to firms. The ownership of pledged trademarks will be transferred to the creditor if the debtor fails to meet its obligation; then, the trademarks can be sold to recover the creditor's losses.[12] The threat of losing pledged trademarks in the case of default disciplines the borrower and, hence, mitigates the moral hazard problem.

Although trademarks can reduce credit rationing problems, the valuation of intangible assets is usually considered difficult. However, this is less of an issue for trademarks since the usage of trademarks in products or services can easily be identified. Additionally, with the rapid growth of trademark-related transactions, appraisers have developed various methods for measuring and monitoring trademark value.[13] Moreover, trademarks are transferable and can retain significant value upon a company's bankruptcy. For example, Nine West sold

[11] In an interview in *Forbes* magazine, David Haigh, the founder of Brand Finance, a brand-valuation consultancy, stated that "the single largest source of intangible value in a company is its trademark." According to Brand Finance's 2018 ranking of the most valuable brands worldwide, Amazon was the most valuable brand with a value of U.S.$150.811 billion, which was worth 92.27% of its total assets, reported as $162.648 billion.

[12] For example, the Polaroid and Sharper Image trademarks were sold after bankruptcy protection was filed in 2008. As explained by the representative of the creditors in the bankruptcy process, "For Polaroid and Sharper Image, buyers have been able to use the name and make products within a category of electronics that have a meaning to the consumer. Instead of having a non-name camera or a non-name appliance, suddenly you have a Polaroid camera or a Sharper Image one." See `https://money.cnn.com/2012/01/11/markets/brands_bankruptcy/index.htm`.

[13] According to the International Trademark Association, the following four approaches are commonly used to value a trademark. (1) The income approach estimates a trademark's value based on the past and expected future profits associated with the mark. (2) The market approach uses market-based indicators of value by comparing transactions (e.g., selling or buying) involving similar assets. (3) The cost approach considers the cost of creating a trademark and replacing an existing trademark with another trademark with the same market power. (4) The relief from royalty method estimates the expected royalty savings created by trademark ownership. Brand valuation firms, such as Brand Finance and Interbrand, evaluate brands across all sectors and geographies and rank them annually. Trademarks protect the brand and represent the legal basis upon which the brand is built. Trademarks are linked to the brand in the minds of consumers. Trademarks are considered virtually synonymous with brand (Peterson et al., 1999).

its trademarks to Authentic Brands Group, which surpassed shoe retailer DSW, for more than $340 million at a bankruptcy auction in July 2018. Gildan Activewear Inc. purchased the American Apparel trademarks for $88 million in January 2017, but did not buy any of its stores.[14] The transferability of trademarks in the event of default makes them suitable as collateral.

Trademarks are also often used as collateral in practice. For example, Levi Strauss & Co., regarding their trademarks as the "most valuable assets", borrowed against its Levi's® trademarks along with other tangible assets for a $350 million term loan in 2001 and a $500 million senior secured term loan in 2003. In 2006, Ford Motor Company pledged its trademarks and other assets as collateral to back the $23.5 billion loan arranged with Citigroup, J.P. Morgan Chase, and Goldman Sachs Group. In 2014, Kate Spade & Company entered into a credit agreement with the Bank of America for a $400 million term loan secured by its trademark portfolio.

When trademarks are used as collateral, the firm and its creditor(s) enter into a security agreement that contains the terms and conditions of their agreement and identifies the marks being pledged as collateral. The creditor will take an interest in the trademarks to secure payment on a loan. During the existence of this security agreement, the owner of the trademarks retains all rights to the marks. The creditor can take ownership of the trademarks only in the event of default by the borrower. Therefore, a security agreement does not involve an ownership change unless the borrower defaults. A creditor who receives a security interest in the debtor's trademarks must perfect the security interest to ensure creditor priority over subsequent third-party claims to the collateral. To perfect a security interest, the creditor usually records the security interest with the USPTO so that subsequent purchasers and creditors are on notice of the creditor's security interest in the collateral (Murphy, 2002). Under U.S. legislation and regulations, creditors have compelling motivation to file trademark security interests with the USPTO. If a security interest in a trademark is unrecorded with the USPTO, it is void against subsequent creditors and purchasers. The subsequent recorded assignment takes priority over the

[14] After completing the acquisition of the Nine West and Bandolino brands, Authentic Brands Group announced that the company "received an outpouring of interest from retailers, distributors and new licensing partners" and planned to expand the acquired brands into "new categories, including sportswear, outerwear, swimwear, intimates, fragrance, sleepwear and home". See https://www.retaildive.com/news/nine-west-sells-key-brands-for-340m/525505/. By acquiring the trademarks of American Apparel, Gildan was able to "keep American Apparel alive, only dial down the made-in-America part". American Apparel's e-commerce site was relaunched with the same logo in July 2017. See https://www.gq.com/story/american-apparel-relaunch-globally-made.

unrecorded assignment, which means that the creditor of the previous, unrecorded security interest loses the rights to the mark.[15]

4 Data and Measures

4.1 Data and Sample

We collect trademark registration and assignment data from the USPTO.[16] We limit our sample to trademarks successfully registered and owned by U.S. corporations and their domestic subsidiaries. Since many firms hold trademarks under wholly-owned subsidiaries established in low corporate income tax states, such as Delaware or Nevada, we include the trademark information of subsidiaries.[17] We obtain a list of trademark owners and merge them with the Compustat firms and their subsidiaries. As Compustat contains companies' current names, we use CRSP to retrieve their historical names. We obtain subsidiary information from Dun & Bradstreet (D&B). Since D&B only provides a snapshot of current subsidiaries, it is unknown when a subsidiary became owned by the parent company. To partially address this issue, we identify the year that a firm became a subsidiary using merger & acquisition information from the Securities Data Company database or the founding year from the D&B database if a subsidiary is not acquired. We then map the trademarks registered by the firms and their subsidiaries in the registration year to the Compustat firm-years. A firm's trademark portfolio is adjusted if the firm sold or purchased trademarks from a third party.

The transaction of pledging a trademark as collateral is identified by security interest agreements in the trademark assignment database. The assignment data are then matched with the financial data of Compustat firms and their subsidiaries by assignor and company names, as well as assignment and fiscal years. We develop name matching algorithms to clean and standardize the company names in various databases and select exact

[15] Article 9 of the Uniform Commercial Code (UCC), which governs the perfection of security interests in IP, also requires an initial financing statement (UCC-1) to be filed with the applicable UCC filing office. For due diligence purposes, a lender must search the USPTO's database and UCC records to ensure that any pledged trademark rights are in fact owned by the debtor. When a security interest is terminated, a termination statement (UCC-3) is filed with the same UCC filing office where the related UCC-1 was filed and a release of the security interest is recorded with the USPTO.

[16] We exclude certification and collective membership marks. According to the USPTO, a certification is "used by a person other than the owner to certify that goods or services originate in a specific geographic region, meet certain quality, materials, or mode of manufacturing standards, or resulted from work performed by a member of a union or other organization." A collective membership mark is "used by members of a cooperative, association, or other collective group to identify and distinguish membership."

[17] For example, Toys 'R' Us established a subsidiary named Geoffrey, Inc. in Delaware, which holds the Toys 'R' Us trademarks and licenses the marks to affiliated companies that own Toys 'R' Us stores. These companies paid royalties to Geoffrey, shifting income from other states to Delaware, where the royalty income was not subject to state income tax. The funds were then remitted to Toys 'R' Us as dividends or lent to affiliates charging interest.

matches. We manually check to ensure the accuracy of the matches. In cases where the names are not identical, we use the available location information and conduct Internet searches. This observation is included in the dataset only if we are confident of the match. The sample period is from 1975 to 2015.

We also collect the granted utility patents and security interest in patent data (available since 1980) from the USPTO. We obtain information regarding the assignee names, patent numbers, application dates, grant dates, and pledging dates. These data are then matched with the Compustat firms and their subsidiaries using name matching algorithms similar to those used for the trademark sample and manually checking the names to ensure matching accuracy. Firms in the financial and utilities industries (SIC codes 6000-6999 and 4900-4999) are excluded. We require firms to have complete data on total assets and a positive value on sales. Firm-years with total assets below $1 million are excluded. The ratios are winsorized at 1% and 99% to avoid outlier effects. All variables are defined in the Online Appendix D.

4.2 Trademark Measures

Trademarks successfully registered with the USPTO must be maintained and renewed to remain live. The owner of a trademark is required to provide evidence of use-in-commerce and pay a maintenance fee in the sixth year after the initial registration and a renewal fee in the tenth year. For every tenth year thereafter, the owner must provide evidence of the continued use of the trademark and apply for renewal. Failure to perform these actions results in the cancellation/expiration of the registered mark. The registrations can be renewed indefinitely.

We obtain registration, renewal, cancellation, abandonment, and current status information to identify the lifecycle of a trademark and count the number of active trademarks owned by each firm in each year. A trademark remains active if it has been successfully registered, maintained, and renewed with proof of actual use. To identify all live trademarks, we collect approximately 8.61 million trademark registrations issued by the USPTO since January 1870 and trace the status of these trademarks over time. A firm's trademark portfolio contains all active trademarks. After building the firm-year-level trademark portfolios, we construct several measures to capture the portfolio characteristics.

The size of the trademark portfolio owned by a firm in a given year is measured as the logarithm of one plus the number of active trademarks ($ln(1 + No.\ of\ Active\ TM)$). For each active trademark, we calculate the trademark age using the trademark registration date. The trademark portfolio age is measured as the average age of all active trademarks owned by a firm in that year.

The collateral value of an asset depends on its liquidation value, which is influenced by market liquidity (Shleifer and Vishy, 1992), as an asset is more likely to be sold in a more liquid market. We construct a trademark market liquidity measure to capture the annual likelihood that trademarks in a firm's portfolio will be traded. To compute this measure, we scale the number of traded trademarks by the number of tradeable trademarks within each goods and service class each year. The number of traded marks is measured by identifying the trademarks transferred to another owner through the assignment of an assignor's interest in a registered mark or mergers & acquisitions. All of the results are robust to an alternative measure, excluding mergers & acquisitions. All live trademarks in a trademark class are considered tradeable in that year. A trademark has a greater market liquidity if more trademarks are traded relative to the trademarks available for trade in the goods and service class. If a trademark is registered under several goods and service classes, the market liquidity of the trademark is measured as the average market liquidity across all registered classes. We compute the annual market liquidity of each trademark owned by a firm and measure the trademark portfolio market liquidity as the annual average of all active trademarks in the firm's portfolio.

A trademark gives the owner the exclusive right to sell products or provide services, and the scope of legal protection is only effective for the registered goods and service class(es). The market scope of a trademark is captured by the number of registered Nice classes. Obviously, the more classes a trademark is registered under, the broader the scope of legal protection. We identify the market scope of each active trademark in a firm's portfolio and use the annual average to measure the trademark portfolio's market scope.

5 Empirical Analysis

5.1 Descriptive Analysis

Figure 1 shows that the number of U.S. firms using trademarks as loan collateral has increased rapidly in recent years. The number of trademark-pledging firms reached the highest level of 7,025 in 2014. There is also an upward trend in the number of patent-pledging firms, with a maximum of 4,783 firms in 2015. In most years during the sample period, more firms used trademarks than patents as collateral. The noticeable exception is from 2001–2003, likely due to the substantial increase in the number of technology firms in 1999 and 2000.

Among the 10,923 firms with at least one active trademark in our sample, 3,088 firms (28.27%) are involved in one or more security interest agreements in trademarks (Table 1). Among patenting firms, 2,268 of 5,457 firms (41.56%) have used patents as collateral since 1980. When we limit the trademark sample to 1980 onwards for comparison, approximately 32.57% of trademarking firms have borrowed using trademarks as collateral. Although the percentage of trademark-pledging firms is lower, significantly more firms own active trademarks and use them to secure borrowing. Firms may also pledge both trademarks and patents. A higher proportion of patent-pledging firms than trademark-pledging firms engage in security interest agreements in both trademarks and patents. Specifically, 1,345 of 2,268 (59.30%) patent-pledging firms use both trademarks and patents to secure debt financing, while 1,408 of 3,088 trademark-pledging firms (45.60%), pledge both assets as collateral. To ensure that the results are not driven by patent collateral, we perform robustness analysis by excluding patent-pledging firms from the sample and find similar results.

As shown in Table 1, firms that secure loans with their trademarks have, on average, more active trademarks than firms that do not (30.57 versus 16.03). The trademark portfolios of firms with pledged trademarks are more liquid and relatively older than those of firms without pledged trademarks. TM-pledging firms also have more patents than non-TM-pledging firms (11.13 versus 5.46). Among patenting firms, on average, patent-pledging firms have significantly more patents (23.62 versus 1.74) and larger (46.18 versus 14.59), more liquid (0.04 versus 0.03), and older trademark portfolios (7.32 versus 5.72) than non-patent-pledging firms. Firms that pledge trademarks as collateral are larger in size and have lower market-to-book ratios, more cash flows, lower

tangibility, lower cash holdings, higher secured debt ratios, and higher leverage ratios than non-TM-pledging firms. Similar differences are observed among patent-pledging firms and non-patent-pledging firms.

Figure 2 shows that firms' secured debt ratios increase when trademarks or patents are pledged as collateral (event window 0). The average secured debt ratio increases up to 22.08% from 16.07% when trademarks are used to secure loans, while the ratio increases from 11.60% to 14.57% as patents are pledged. Firms that use trademarks as collateral experience a larger increase in the secured debt ratio than firms that use patents as collateral (6.01% versus 2.97%).

We also investigate the industry distributions of trademark- and patent-pledging firms based on the two-digit SIC codes. The results are reported in Table A2 of the Online Appendix. Despite the difference in rankings, the top five industries with more firms involved in secured borrowing with trademarks are also the top-five industries in terms of the largest number of firms using patents to secure loans. Patent-pledging firms are more industry concentrated than trademark-pledging firms. Approximately 65.65% of patent-pledging firms are concentrated in the top-five industries, while the percentage is 48.86% for trademark-pledging firms.

5.2 Decision to Pledge Trademarks as Collateral

To understand the decision to pledge trademarks as collateral, we estimate a logit model to analyze the factors influencing a firm's decision to engage in trademark security agreements. To explore the cross-sectional variation in the determinants, we estimate the model using the averages of the firm and trademark portfolio characteristics. The results are reported in the Online Appendix. Column (1) of Table A3 shows that larger firms are more likely to pledge trademarks. The probability of trademark collateral usage is greater when a firm has lower tangible assets, cash flows, or cash holdings. Column (2) includes the characteristics of a firm's trademark portfolio as independent variables. Firms with larger trademark portfolios (i.e., more active trademarks) are more likely to use trademarks as collateral. The probability of pledging trademarks is negatively related to the average age of a firm's trademark portfolio. The market liquidity of the trademark portfolio increases the probability that a firm pledges trademarks as collateral.

6 Tangibility Shocks and Trademark Collateral

We next investigate whether trademarks alleviate collateral constraints and the economic consequences of pledging trademarks as collateral. It is challenging to provide causal evidence that trademarks are valuable collateral that facilitates debt financing, since firms might have adequate tangible assets as collateral and face no collateral constraints. Therefore, to disentangle the role of trademark collateral, we exploit a natural experiment that causes exogenous damage to firms' tangible collateral and investigate whether trademarks help firms buffer against such negative shocks.

6.1 Empirical Strategy

Since trademark values are not publicly available and are difficult to estimate precisely using available data, our primary focus is not on quantifying the marginal effect of the collateral value of trademarks but on establishing the causal effects of trademark portfolios as a whole in facilitating firms' debt financing. Our main empirical strategy accomplishes identification via an exogenous shock to tangible collateral, which allows us to identify the role of trademarks in relaxing collateral constraints caused by an unexpected shortage of tangible assets. We estimate the economic impacts of trademark collateral by investigating the financing, investments, and employment of firms with varying abilities to use trademarks as collateral when facing negative shocks to tangible collateral. Nevertheless, we provide suggestive evidence on the magnitude and impact of the collateral value of trademarks by exploring variation in the values of trademark portfolios of affected firms.

We use Hurricanes Sandy and Isaac, which hit the Eastern United States in 2012, as exogenous shocks to the tangible assets of firms located in the affected counties. We hand collect the counties declared as major disaster areas by the Federal Emergency Management Agency (FEMA) and identify firms with headquarters located in the affected counties.[18] While other hurricanes have affected the United States, Hurricane Sandy is particularly

[18]The Federal Emergency Management Agency declared counties in four states as disaster areas hit by Hurricane Isaac and most counties in the 12 states and the District of Columbia along the east coast of the United States as disaster areas that suffered severe damage by Hurricane Sandy. Since we do not have access to the establishment-level data from the U.S. Census Bureau and the Environmental Protection Agency's toxic release inventory database only has factory location information for manufacturing industries (SIC codes 2000–3999), we follow Chaney et al. (2012) and assume that headquarters and production facilities tend to cluster in the same state. Using headquarters to identify affected firms should not affect our conclusions for the following reasons. First, our focus is on affected firms, rather than comparing affected and unaffected firms. If firms with headquarters in unaffected areas are not included, it is not likely to cause a bias towards finding that affected TM firms can use trademarks to borrow more than affected non-TM firms. Second, firms with headquarters in unaffected areas may use tangible assets in unaffected areas

suitable for our analysis due to its unprecedented strength, scale, path, and nature. Its storm tide and surge are record-breaking, a phenomenon not observed since 1821 (Brandon et al., 2014). Specifically, Hurricane Sandy caused rare magnitude floods and substantial damage to buildings and infrastructure. Since the path of Hurricane Sandy was highly uncertain, it was more challenging for firms to prepare for its effects. The hurricane eventually made landfall in regions with large commercial areas and high population densities, causing damage of $72.2 billion, based on the estimation of the National Oceanic and Atmospheric Administration's National Centers for Environmental Information.[19] It caused substantial damage, which likely led to binding collateral constraints. Additionally, no other major natural disasters hit the affected counties in the subsequent years, which minimizes potential confounding effects from repeated disasters.

Hurricanes cause severe damage to the affected firms' collateral values of tangible assets, such as buildings or machinery, which limit these firms' abilities to use tangible assets as collateral. During the aftermath of hurricanes, firms have an increased demand for bank credit to recover and rebuild their businesses. Damaged physical assets impose collateral constraints on firms, limiting their abilities to borrow. Trademarks are intangible by nature and thus are less likely to be damaged by hurricanes. Therefore, if trademarks have collateral value, firms with active trademarks may use them to secure debt financing and overcome the borrowing constraints caused by the loss of tangible collateral. Consequently, hurricane events allow for the use of a difference-in-differences identification strategy to explore the differential impacts on debt financing, investments, and employment between firms with and without trademarks available as collateral.

6.2 Comparability of TM and non-TM firms

We identify TM firms and non-TM firms based on whether they own any active trademarks when affected by hurricanes. Since hurricanes are difficult to forecast, it is unlikely for firms to change their trademark ownership

as collateral, which might enable them to gain access to finance without trademark collateral. The inclusion of firms that have headquarters in unaffected areas and some properties in affected areas in the sample will make the analysis more subject to the alternative explanation of geographic diversification as discussed in Section 7.1.1. Finally, the unreported tables show that our results remain robust when including firms with headquarters in unaffected areas and a significant proportion of properties or subsidiaries exposed to hurricanes.

[19] Hurricane Sandy was among the costliest storms in the U.S. Many businesses in New York City and other large East Coast cities, including the New York Stock Exchange, were closed for two days or more. According to the reports by City of New York (2013), approximately 17% of the city's total land mass was flooded, exceeding the 100-year floodplain boundaries by 53% citywide. This hurricane caused $19 billion in damage to the city, leaving nearly 90,000 buildings flooded and nearly 2 million people without power. We likewise include Hurricane Isaac, which also occurred in 2012, to increase the sample size. Nevertheless, similar results are obtained when the sample is limited to firms affected by Hurricane Sandy.

status in anticipation of the occurrence of hurricanes. Hence, the decision to register a trademark before a hurricane is not driven by unobserved factors that might influence firms' financing and investments following the hurricane. This predetermination of trademark portfolios relative to hurricanes helps minimize any potential endogenous effects of owning registered trademarks. Moreover, since hurricane occurrence is exogenous to firm characteristics, trademark ownership, consumer demand, and economic conditions, variations in activities observed after a hurricane cannot easily be attributed to unobserved heterogeneity or reverse causality.

One potential concern is that TM and non-TM firms may not be comparable. As shown in Panel A of Table 2, TM firms on average are larger and have lower tangibility, lower sales growth, and lower cash ratios than non-TM firms. To ease this concern, we select a sample of similar TM and non-TM firms using the propensity score matching method. We estimate the propensity score from a logit regression with a dummy variable indicating whether a firm has active trademarks when affected by the hurricanes as the dependent variable, and the mean values of $size$, M/B, PPE, CF, $S.Growth$, and $Cash$ during the period before the hurricanes (2008–2011) as the independent variables. As a robustness check, we also include firm age as an independent variable to ease the concern that TM firms may be older than non-TM firms and find similar results. Since the sample size is smaller due to missing firm age data, the results without firm age as a matching variable are reported. We use propensity scores to conduct nearest neighbor matching without replacement. TM and non-TM firms are required to be in the same two-digit SIC code industries. The final matched sample contains 320 TM firms and non-TM firms, yielding a total of 2,449 firm-year observations. The sample period spans from 2008 to 2015.

After matching, the firm characteristics are indistinguishable between TM and non-TM firms (Panel A of Table 2). We notice that TM firms appear more profitable as measured by CF than non-TM firms, although the difference is insignificant. One potential concern is that TM firms can borrow more because of their higher profitability. However, a robust finding in the capital structure literature is the negative association between profitability and leverage (Rajan and Zingales, 1995). Our estimations also show that firms with more cash flows have lower debt ratios and are less likely to pledge trademarks, which should help mitigate this concern.

To further disqualify the possibility that the differences in these characteristics, rather than the availability of trademarks as collateral, influence firm activities across TM and non-TM firms, we also control for these variables throughout our analyses. Nevertheless, similar results are found when firm characteristic variables are not included.

6.3 Damage to Tangible Assets

Before performing the analysis, we first check whether firms indeed experience declines in their tangible assets following the hurricanes. We use two approaches to capture the decrease in asset value. The first is asset write-downs/impairment in the post-hurricane period. Since this measure also includes other assets, such as accounts receivable, the second measure used is changes in tangibility before and after the hurricanes. Table 2 Panel B shows that TM firms on average write down $95.36 million assets in 2012-2013, while non-TM firms write down $27.25 million. TM firms write down more assets than non-TM firms although the difference in asset write-downs is statistically insignificant. The tangible assets of TM firms decrease 0.41% of the total assets, while the decrease is 0.44% among non-TM firms. The difference in the decreases in asset tangibility between TM-firms and non-TM firms is not statistically significant. Therefore, if firms with trademarks are observed to perform better during the post-hurricane period, the results cannot be attributed to less property damage experienced by the TM firms.

The direct damage from hurricanes is economically significant. For example, Verizon Communications Inc. disclosed that the estimated direct impact from Superstorm Sandy was approximately $1 billion in the form 8-K filed on January 7, 2013. For firms in our sample, the average loss of value of the tangible assets of TM firms is approximately $23.82 million, while the average loss of non-TM firms is approximately $10.13 million. Since TM firms on average experience a larger dollar amount decrease in tangible assets than non-TM firms, any better performance of TM firms is unlikely a result of being less affected than non-TM firms by hurricanes.

The drop in tangible assets following hurricanes is sizable, given that the average size of term loans is $259 million for the sample firms before hurricane using the merged syndicated loan data from DealScan. Notably, syndicated loans tend to be much larger than standard bank loans. The relative size of the tangible asset loss

compared to term loans would be even larger if non-syndicated loans are also considered. Since the decrease in tangible assets is considerable relative to the average size of term loans, the damage is likely to result in tangible collateral constraints. Additionally, the tangible assets of matched TM firms constitute 16.68% of total assets before hurricanes (Table 2 Panel A) and the average secured debt of TM firms is 13.06% of total assets. Hence, the average secured debt is approximately 78% of the tangible assets of TM firms before hurricanes. Holding all else constant, a decrease in tangibility by 0.41% would increase the ratio of secured debt to tangible assets to 80% after hurricanes. Since lenders typically only lend up to a fraction of collateral value, it would be difficult for firms to borrow additional funds against their tangible assets after hurricanes.

6.4 Insurance

Although hurricanes cause damage to tangible assets, such damage may be partially covered by insurance. Firms that recoup more losses from insurance might be able to respond better after catastrophic events. Therefore, we examine whether TM firms receive more insurance claim proceeds than non-TM firms following the hurricanes. Since data about insurance recoveries related to natural disasters are not publicly available, we approximate them using the insurance recovery/proceeds item from Compustat.[20] We compute the percentage of insurance proceeds to total assets and test the difference between TM and non-TM firms.

As shown in Table 2 Panel C, the compensation that TM firms receive from insurance is approximately 0.019% of their total assets after the hurricanes, while that of non-TM firms' recovery is approximately 0.016%. The difference in the rate of recovery is negligible and statistically insignificant. Although firms might have insurance to cover damage from hurricanes, insurance payouts account for only a small percentage of assets. This finding is consistent with the existing evidence that inefficiencies in the catastrophe insurance market lead to insufficient supply and partial coverage of catastrophe risk (Garmaise and Moskowitz, 2009). The results indicate that the difference in insurance is unlikely to explain the (potentially different) responses of TM and non-TM firms to exogenous shocks to their tangible collateral.

[20]Since the available insurance proceeds data may also include payments from insurance claims for purposes other than hurricane damage and reserves for litigation and settlements, the amount of recovery could be overestimated. Hence, the results should be interpreted with caution.

6.5 Government Funds

Firms may have less need to raise secured debt if government funds are the primary financing source for recovery. Although government disaster assistance is mainly for households, nonprofit organizations, and small businesses, large publicly traded firms may qualify for the Small Business Administration (SBA)'s Business Physical Disaster Loans (BPDL) for the repair or replacement of disaster-damaged property. Qualified businesses located in a FEMA declared disaster area can borrow up to $2 million to cover verified disaster losses not fully covered by insurance or other sources. Collateral is required for loans over $25,000 with real estate as the preferred collateral.

On January 29, 2013, Congress passed a $50.5 billion aid package to several federal agencies for Sandy disaster relief efforts, which appropriated $520 million to the SBA for disaster loans. Despite this, businesses experienced extensive delays in the disaster loan application, processing, and disbursement process. According to the U.S. Government Accountability Office's (GAO) Report in September 2014, GAO-14-760, the average processing time for BPDL applications was 45 days, which reached an average of nearly 60 days for applications processed in March 2013. Approved loans required an average of an additional 66 days for closing and initial disbursement. The SBA approved 45% of BPDL applications, but 38% of approved business loan applications were cancelled as of January 31, 2014.[21] Given the delays, approval and cancellation rates, loan amount, and collateral requirements, it is less likely that government disaster relief assistance is the main financing source for firms in the sample to recover from the aftermath.

6.6 Tangibility Shocks and Firm Activities

After providing evidence that hurricanes indeed reduce the collateral value of affected firms' tangible assets, we investigate whether differences exist in the changes in debt financing, investments, and employment between TM and non-TM firms around the hurricane periods. We apply the difference-in-differences method to the

[21] The SBA received 14,938 business loan applications, including both BPDLs available to qualified businesses of all sizes and economic injury disaster loans (EIDLs) available only to small businesses. Of the 14,558 business loan applications that had reached a decision status by January 31, 2014, 4,715 (approximately 32.4%) were withdrawn by either the SBA or the applicant. The overall approval rate for business loan applications was 42%. The approval rate for BPDL applications was 45%, while the approval rate for EIDLs was 28%. Of the 4,180 approved business loan applications, 1,578 (38%) were cancelled as of January 31, 2014, with 74% cancellation at the borrower's request. Since data about BPDL applicants are not publicly available, we are not able to estimate the loan amount received by firms in the sample.

matched sample of TM and non-TM firms located in the disaster areas and estimate the following model:

$$Y_{ijt} = \alpha + \beta_1 Post_t \times TMFirm_i + \beta_2 X_{ijt-1} + \eta_i + \gamma_{jt} + \varepsilon_{ijt}, \quad (1)$$

where i indexes the firm, t indexes time, and j indexes the industry. The dependent variable Y is a proxy for firms' debt, investment, and employment activities. $TM\ Firm$ is an indicator variable that equals 1 if the firm owns any active trademarks in the hurricane year and 0 otherwise. $Post$ equals 1 for the post-hurricane period (2012–2015) and 0 otherwise. We include a set of determinants of firms' financing, investment and employment decisions, including $Size$, M/B, CF, PPE, $S.Growth$, and $Cash$, to control for the impacts of variation in firm characteristics on the decisions. Firm fixed effects, η_i, are included to control for time-invariant differences between TM and non-TM firms. To control for industry-level demand shocks, we include industry-year fixed effects. The standard errors are clustered at the industry level to adjust for correlations within industries caused by common unobserved random shocks at the industry level. The results are robust to standard errors clustered at the firm level or county level.[22]

We estimate the model with and without the control variables. Our preferred specification includes the covariates since they improve the precision of the estimate and can account for variation in the response without the treatment as discussed by Angrist and Pischke (2008) and Roberts and Whited (2013).[23] Since the estimation results of tests with the control variables (Table 3 Panels A) and those without the control variables (Table A4 Online Appendix) are similar, the discussions focus on the results with the control variables. The variable of interest is $Post \times TM\ Firm$. The coefficients are positive and significant in all specifications, except for the R&D ratios. The positive estimates of β_1 indicate that TM firms borrow more secured debt, have higher debt ratios, spend more on capital expenditures, and hire more employees than otherwise similar firms without trademarks during the post-hurricane period. These differences are also economically significant. As shown in Panel A, the secured debt to total asset ratios of TM firms increase by 3.69% and the capital expenditure ratios increase by 1.16%, relative to non-TM firms. For an average TM firm with a secured debt-to-assets ratio

[22] Cameron and Miller (2015) suggest that "The consensus is to be conservative and avoid bias and to use bigger and more aggregate clusters when possible, up to and including the point at which there is concern about having too few clusters". Hence, we report the results with standard errors clustered at the industry level.

[23] Angrist and Pischke (2008); Roberts and Whited (2013) provide reasons for including covariates in difference-in-differences estimations. Notably, time-varying control variables are not necessarily bad controls, which are the outcomes of the treatment themselves.

of 13% and capital expenditures-to-asset ratio of 4% in the matched sample before hurricanes, the estimates represent a 28% increase in the secured debt ratio and a 29% increase in the capital expenditure ratio. Firms with trademarks available as collateral also employ 58 more employees than similar firms without trademarks after the hurricanes.[24] This finding is consistent with the prediction of standard theories of investment with collateral constraints positing that more debt secured by collateral facilitates firms' investments (Kiyotaki and Moore, 1997).

6.7 Dynamics of the Effects

The above results may simply capture pre-existing divergent trends or differences in TM and non-TM firms that are unrelated to the trademark collateral's mitigation of credit constraints. To explore this possibility, we follow Bertrand and Mullainathan (2003) by investigating the dynamics of firms' financial and investment policies surrounding the tangibility shock. If the alternative explanation holds true, we should observe more debt usage, investments, and employment prior to the hurricanes.

We replace *Post* in equation (1) with the following five indicator variables associated with the years surrounding the hurricane year: Pre^2 Pre^1, $Post^0$, $Post^1$, and $Post^{2+}$. Pre^1 and Pre^2 are indicator variables that equal 1 for one and two years before the hurricane event, respectively. $Post^0$, $Post^1$, and $Post^{2+}$ are indicator variables that equal 1 for 2012, 2013, and 2014–2015, respectively. The variables of interest are $Pre^2 \times TM\ Firm$ and $Pre^1 \times TM\ Firm$, which indicate whether any relation exists between firms' activities and trademark collateral before the shock to tangible collateral. In Table 3 Panel B, we report the results obtained after controlling for all variables in the baseline model in equation (1). The coefficients of $Pre^2 \times TM\ Firm$ and $Pre^1 \times TM\ Firm$ are insignificant in all specifications, except for R&D. The results indicate that no differences exist in debt financing, investments, and employment prior to the hurricanes. Therefore, there is no evidence of pre-existing divergent trends or reverse causality. In the absence of the hurricane, the changes in the debt ratio, capital expenditures, and employment of TM firms would have been similar to those of non-TM firms.

We also conduct placebo tests using the fictitious years of hurricanes to exclude the possibility that the results are driven by other factors unrelated to trademark collateral. The analyses are reported in the Online Appendix.

[24] The employee variable from Compustat is in thousands. The coefficient of 0.056 corresponds to 58 employees ($[e^{0.056}-1]\times 1000$).

As shown in Table A5, there are no significant differences in debt financing, investments, or employment between TM firms and non-TM firms during the pseudo-post-event period. The results indicate that TM firms do not use more secured debt to finance their investments and employment than non-TM firms in the absence of tangible collateral constraints.

6.8 Trademark Pledge

Thus far, the results support the role of trademarks in facilitating firms' debt financing, especially when firms face shortages in tangible collateral. To confirm that firms indeed pledge trademarks as collateral to mitigate credit constraints caused by tangibility shocks, we investigate their involvement in trademark security agreements before and after hurricanes.

We first examine whether firms whose tangible assets were damaged more by hurricanes are more likely to pledge trademarks as collateral. We classify TM firms located in the affected counties into more (less) affected firms based on a larger (smaller) decrease in their tangible assets compared to the median value of the industry. The linear probability model is estimated with a dummy variable that equals 1 if a firm pledges trademarks in that year as the dependent variable. The *Post* dummy coefficient indicates the difference in the likelihood that trademarks are used as collateral before and after the hurricanes. The results in Panel A of Table 4 show that firms use trademarks, on average, to secure loans more often after the hurricanes (Column (1)). Such an increased frequency of trademark pledging is concentrated in firms that experience more damage to their tangible assets (Columns (2) and (3)). These results indicate that firms use trademarks more often to secure their debt financing when they have a shortage of tangible collateral.

To strengthen the evidence that trademarks help to mitigate borrowing constraints due to their tangible collateral limitations, we investigate whether more constrained firms tend to engage in trademark security agreements more often after the shock to their tangible assets. If trademarks as collateral can improve firms' access to debt financing, then we expect that more constrained firms will be more likely to secure loans with trademarks when their tangible assets are impaired.

We measure the financial constraint using a proxy developed by Hoberg and Maksimovic (2015), which is

based on a textual analysis of the Capitalization and Liquidity Subsection of the Management's Discussion and Analysis section in 10-Ks. This proxy is constructed using a firm's disclosure of liquidity challenges and the discussion regarding the sources of external capital that the firm intends to use in addressing its financing needs.[25] The measure identifies firms indicating that (1) they might have to delay their investment due to the existence of challenges to their liquidity and (2) they plan to issue debt to solve the problems. A higher value of this measure indicates that a firm is more financially constrained and intends to issue debt to solve its liquidity problems. A firm is considered more (less) constrained if the constraint measure is greater (less) than the industry median value.

We compare the trademark pledge activities of firms during the period before (after) hurricanes. Table 4 Panel B shows that more constrained firms intending to use debt to address the issues are more likely to pledge trademarks when their tangible assets are damaged by hurricanes (Column (2)). In contrast, more constrained firms are not more likely to use trademarks as collateral before experiencing damage to their tangible assets, which might occur due to the availability of tangible assets as collateral (Column (3)). Overall, these results indicate that trademarks are particularly important for firms' debt financing when they lack tangible collateral.

6.9 Heterogeneity of Damage to Tangible Assets

To further strengthen the link between trademark collateral and access to secured debt, we exploit the cross-sectional heterogeneity of damage to firms' tangible assets. As shown in Table 4 Panel A, TM firms experiencing more damage to their tangible assets are more likely to pledge trademarks after hurricanes. We then examine whether more secured debt financing by TM firms than non-TM firms following hurricanes mostly is concentrated in more affected firms. Since firms experiencing greater tangible asset damage are more likely to face tangible

[25] As described in Hoberg and Maksimovic (2015), SEC Regulation S-K obligates firms to discuss liquidity by identifying "any known trends or any known demands, commitments, events, or uncertainties that will result in . . . the registrant's liquidity increasing or decreasing in any material way. If a material deficiency is identified, indicate the course of action that the registrant has taken or proposes to take to remedy the deficiency." "Liquidity is further clarified in Instruction 5 as the ability of an enterprise to generate adequate amounts of cash to meet the enterprise's needs for cash...Liquidity generally shall be discussed on both a long-term and short-term basis." Since hurricanes disrupt normal business, firms could face liquidity issues due to the inability to generate sufficient cash flow to meet operating needs. As a result, firms would be concerned about liquidity, although they have pledgeable trademarks. Since Hoberg and Maksimovic (2015)'s financial constraint measure identifies firms that declare the possibility of delaying investment due to liquidity challenges, it is preferable to popular financial constraint indices (the Kaplan and Zingales (1997), Whited and Wu (2006), and Hadlock and Pierce (2010) indexes), which have been shown not to identify plausibly constrained firms. Farre-Mensa and Ljungqvist (2016) demonstrate that the constrained firms identified based on those indexes are found to have no difficulty obtaining external capital. Additionally, Hoberg and Maksimovic (2015)'s measure identifies firms that intend to raise debt to overcome financial constraints, which can better capture their needs for debt capital.

collateral constraints, we should observe that more affected TM firms are able to borrow more secured debt than non-TM firms if trademarks as collateral help to relax the constraints.

To this end, we classify the firms into more (less) affected firms based on a larger (smaller) decrease in their tangible assets compared to the median value of the industry. Table 5 Panel A shows that TM firms with more damage to their tangible assets borrow more, invest more in fixed assets, and hire more than non-TM firms in the post-hurricane period. There are no significant differences between TM and non-TM firms with less damage to tangible assets (Panel B). These results are consistent with the view that trademark collateral enables firms facing tangible collateral constraints to meet their financing needs by borrowing more secured debt. Trademarks complement tangible assets in mitigating credit constraints and can help firms to ease collateral constraints tied to tangible assets.

6.10 Heterogeneity in the Collateral Value of Trademarks

To provide further evidence that the collateral value of trademarks matters for securing debt capital, we explore cross-sectional variation in trademarks. We hypothesize that firms with more valuable trademarks can borrow more if the collateral value of trademarks affects firms' debt financing. Since data about trademark value are not available, we use two approaches to capture the value. In the first approach, we construct an index of trademark portfolio value using a principal component analysis based on firms' trademark portfolio size, age, market liquidity, and market scope.

Trademark characteristics are associated with trademark value. Registered trademarks capture a firm's goods or services that are distinct from those of its competitors. A larger trademark portfolio is possibly more valuable, as it indicates a greater number of distinctive products or services provided by firms. Trademarks are more likely to remain alive when more financial resources are invested in the brand. As long as the cumulative amount of such investments increases over time, trademarks that exist longer tend to have a higher value. Trademark market liquidity also affects trademark value. Trademarks in a more liquid market are more likely to be sold and retain more value. A trademark portfolio registered in more goods-and-services classes possesses greater value since it protects the owner against rival providers in more markets and induces consumer purchasing

behavior by leveraging brand equity in different markets (Aaker and Keller, 1990). Hence, a higher value of the index constructed using these characteristic variables indicates a more valuable trademark portfolio.

Since the importance of trademarks varies across industries, we categorize the TM firms into tertiles within each two-digit SIC industry based on the index of their trademark portfolio value in the hurricane year. Firms in the third (first) tertile are identified as firms with a higher (lower) value trademark portfolio. We then investigate whether affected firms with more valuable trademarks raise more debt than firms with less valuable trademarks. As shown in Table 6 Panel A, firms with a higher value trademark portfolio borrow more, spend more on fixed-asset investments, and hire more workers but do not invest more in R&D than firms with a lower value trademark portfolio during the post-hurricane period. Their secured debt ratios increase, on average, by 3% more than those of firms with a lower value trademark portfolio, which is economically significant, given that the average secured debt ratio of firms with a lower value trademark portfolio increases 4.69% following the hurricanes. For an average firm with a more valuable trademark portfolio and $12.34 billion total assets before the hurricanes, the estimate translates into $370 million more in debt. The results indicate that a higher collateral value of trademarks enhances firms' borrowing capacities.

In the second approach, we explore the variation in spending on advertising. Previous studies show that advertising influences consumers' brand choice behavior and increases brand awareness (Mela et al., 1997; Herremans et al., 2000). We conjecture that trademarks are more valuable in industries investing more in advertisements. We estimate industry-level advertising spending as a fraction of sales as of 2012 and classify firms in industries with an above (below) median advertising spending as high (low) advertising.[26] As reported in Table 6 Panels B and C, the better responses of TM firms after the hurricanes are stronger in industries that spend more on advertising *ex ante*. These findings are consistent with our hypothesis that firms with more valuable trademarks obtain more debt financing for their investments and employment.

Overall, these results show that trademarks help TM firms to secure the debt financing needed for their

[26]We use industry-level advertising spending because a significant number of firms do not disclose advertising expenses separately. According to the Securities and Exchange Commission's Financial Reporting Release No. 44 (FRR44) in 1994, separate disclosure of advertising expenses is optional. U.S. GAAP requires firms to disclose the amount of advertising expenses when it is material information. The Financial Accounting Standards Board defines information to be material when its absence makes financial statements misleading.

investment and employment after hurricanes. There might be several reasons for the more frequent usage of trademarks as collateral following hurricanes. First, banks are likely to require collateral when extending loans to firms located in the neighborhood of disaster areas because they believe that these firms face greater disaster risk (Huang et al., 2021). Moreover, banks will require borrowers to provide additional collateral to make up for the shortfall if the fair value of the loan collateral deteriorates. The inability of borrowers to make up for the shortfall could cause banks to assess individual loans for impairments in accordance with the accounting requirements of ASC 310-10-35.[27] Second, firms face a shortage of tangible assets as collateral because their properties are damaged by hurricanes. Such reduction in tangible collateral capacity would make it difficult for firms to borrow additional funds against their tangible assets in the post-hurricane period. Third, trademarks have collateral value and are not destroyed by hurricanes. The availability of trademarks enlarges the menu of assets that can be used as collateral, enabling firms to borrow beyond the value of their tangible assets and secure the capital needed for repair and recovery in the post-hurricane period. TM firms' borrowing is secured by collateral beyond tangible assets, as evidenced by an average secured debt-to-tangible assets ratio of 112% after hurricanes. In contrast, the average secured debt is approximately 70% of the tangible assets of non-TM firms after hurricanes, indicating that non-TM firms do not borrow more than their tangible collateral. Additionally, Table 4 and Table 5 show that more affected firms are more likely to pledge trademarks, enabling them to secure the debt financing needed for their investments and employment. These results are consistent with the result in Table A3 that firms with low tangibility are more likely to pledge trademarks as collateral. Moreover, the results that firms with more valuable trademark portfolios borrow more secured debt indicate that the collateral value of trademarks enhances firms' borrowing capacities (Table 6). Taken together, these results indicate that firms depend more on trademarks to secure capital when they have fewer tangible assets. Trademarks help firms to ease tangible collateral constraints, enabling them to meet their financing needs by borrowing more secured debt.

[27] Under ASC 310-10-35, "an individual loan is impaired when, based on current information and events, it is probable that a creditor will be unable to collect all amounts due according to the contractual terms of the loan agreement."

7 Alternative Explanations

Hitherto, the results show that trademarks help to overcome collateral constraints and thus improve firms' access to debt financing and facilitate investments in fixed assets and employment. A natural concern is that the results may be driven by the differences between TM firms and non-TM firms or unobserved factors that drive the decision to register a trademark before hurricanes and firms' access to finance after hurricanes. Although whether a firm owns active trademarks is predetermined when hit by hurricanes and the difference-in-differences approach using a comparable sample removes the permanent differences between TM and non-TM firms and any common trend affecting both groups, there may still be some other unobservable differences affecting the results. In this section, we further investigate whether the findings are driven by other economic factors, such as demand shocks, product development, credit demand, or access to finance without pledging trademarks.

7.1 Difference in Demand Shocks

One potential explanation for TM firms' better access to debt capital could be that TM firms experience better demand shocks after hurricanes than non-TM firms. The potential difference in consumer demand is less likely to fully explain our results for several reasons. First, the difference-in-differences estimate removes the permanent difference in consumer demand between TM and non-TM firms located in the affected areas. Second, the result of no significant differences in the changes in the activities of TM and non-TM firms from the placebo tests further reduces the possibility that consumer demand is the underlying driver. Third, there is no obvious reason for hurricanes to affect TM and non-TM firms in a systematically different way. Fourth, controlling for firms' sales growth and industry-year fixed effects also helps mitigate the influence of time-varying demand shocks. Fifth, even if TM firms in the affected areas can better attract consumers than affected non-TM firms after hurricanes, it takes time for this shift in consumer demand to result in better access to financing. Hence, the *immediate* increase in secured debt financing of TM firms following hurricanes, as shown in Panel C of Table 3, is less likely explained by potentially increased consumer demand. Despite the evidence, we conduct additional tests to further minimize the influence of potential differences in demand shocks.

7.1.1 Non-Geographically Diversified TM Firms

A firm may have business operations in multiple states. Such geographical diversification could help the firm mitigate the effects of shocks to hurricane-affected properties. In other words, geographically diversified firms may be less sensitive to local economic dynamics, such as demand shocks or competition. In addition, firms may use the tangible assets located in non-disaster areas as collateral, which can enable access to finance without trademark collateral.

To rule out the possibility that our results may be explained by more geographic diversification of TM firms, we narrow the sample to TM firms that have no properties located in non-disaster areas (non-geographically diversified TM firms). Since properties in multiple disaster areas may be affected differently, we also narrow the sample to firms that have properties in one state. We use two approaches to capture geographic diversification. In the first approach, we identify the physical properties of a firm by extracting state names from the properties section on annual reports filed with the Securities and Exchange Commission using textual analysis method. In the second approach, we identify the locations of a firm's subsidiaries.[28] A firm is considered non-geographically diversified if the firm has no physical properties or subsidiaries in non-disaster areas or has properties only in one affected state.

We match each non-geographically diversified TM firm in hurricane-affected areas with a non-TM firm with similar characteristics. Using this matched sample, we perform the test in equation (1) and report the results in Table 7 Panel A. Because using the two measures of geographic diversification or the sample of firms with properties in one state yields similar results, only the results for firms with no physical properties in non-disaster area are reported for brevity. The robustness of the results using the sample excluding geographically diversified firms indicates that our findings are less likely driven by TM firms being able to secure their debt with tangible assets in non-hurricane-affected areas or potentially facing smaller demand shocks.

[28] Since a proportion of firms in our sample are non-manufacturing firms that have no plants, we measure geographic diversification using physical properties or subsidiaries instead of plants.

7.1.2 Differences in Product Markets

Although the above results do not support the view that our findings are driven by the lower sensitivity of TM firms to local economic dynamics resulting from geographic diversification, they cannot fully rule out this possibility. TM firms may reach broader product markets without a physical presence because registered trademarks provide legal protection at a national level. Hence, TM firms may be better able to compete with non-TM firms nationally and have less sensitive demand.

To further address the concern that the differences in the responses of TM firms and non-TM firms might be due to different demand shocks in product markets, we perform a difference-in-difference-in-differences test using firms in unaffected areas as another control group. Since TM firms in both hurricane and non-hurricane areas compete in national markets, they are exposed to similar demand shocks. The DDD analysis removes the common trend of TM firms that might differ from the trend of non-TM firms, which helps exclude the possibility that the findings are due to TM firms and non-TM firms being subject to systematically different demand shocks in product markets.

We identify a matched sample of TM firms and non-TM firms located in areas not affected by the hurricanes and with no significant proportion of properties exposed to hurricanes.[29] To conduct the DDD test, we add an $Affected$ dummy, which equals one for firms in hurricane areas and zero otherwise, and the interaction terms to the baseline model. The results of the DDD tests are reported in Table 7 Panel B. The insignificance of the coefficients of Post×TM firms implies no significant difference in changes between TM firms and non-TM firms in non-hurricane areas around the hurricane year. The results indicate that the potential broader product markets of TM firms do not necessarily lead to better debt financing and more investments during the post-hurricane period when firms are not affected by hurricanes. Potentially greater demand for TM firms' products, if any, does not lead to more secured borrowing by TM firms. The results exclude the possibility that the activities of TM firms and non-TM firms are subject to systematically different changes in the absence of shocks to tangible collateral.

[29] A firm is considered to have a significant proportion of properties exposed to hurricanes if it has more than 50% of properties located in the states hit by hurricanes. The locations of properties are extracted from the properties section on the firm's annual report. The results are robust when using a larger proportion of exposed properties as the cutoff point.

The coefficients on Post×TM firms×Affected are positive and significant, except for R&D, indicating that TM firms borrow more, spend more on capital expenditures, and employ more workers than non-TM firms afterwards in hurricane-affected areas. As the difference-in-differences estimate removes the permanent differences in consumer demand between TM and non-TM firms in the affected areas, the DDD estimate further removes the common trend of TM firms across all areas that might differ from the trend of non-TM firms. It is less likely that more secured borrowing by affected TM firms post-hurricane is driven by different demand shocks. Taken together, these results further minimize the possibility that our findings are due to systematic differences between TM and non-TM firms.

7.2 Difference in Product Development Innovation

Since trademarks reflect product development innovation (Faurel et al., 2020), it might be possible that the differences in post-hurricane secured debt financing and investment between TM firms and non-TM firms are due to the differences in their product development. TM firms might have launched products or projects associated with the trademarks that are already or are close to generating value, while non-TM firms are much further behind in the process. If our results are explained by the differences in new product development, TM firms should be expected to generate more sales and profits than non-TM firms in the post-hurricane period.

To test this possibility, we examine whether there is a difference in the changes in sales and profitability between TM firms and non-TM firms using a difference-in-differences analysis. As shown in Columns (1) and (2) of Table 7 Panel C, the coefficients on $Post \times TM\ Firm$ are insignificant, indicating that TM firms do not generate significantly more sales or produce more profits than non-TM firms following hurricanes. These results are not consistent with the interpretation that TM firms borrow more secured debt because they have new products or projects that can generate more immediate profits after hurricanes.

7.3 Difference in Demand for Credit

Another alternative explanation is that TM firms and non-TM firms might have different demand for credit after being affected by hurricanes because they are in different stages of product development innovation. Non-TM firms might be more likely to shut down their early-stage projects to save costs and have a reduced demand

for credit, while TM-firms have a more stable and consistent demand for credit since their projects are in the advanced stage of being commercialized.

We use two approaches to examine whether our results are explained by different demand for credit. First, we investigate whether non-TM firms disinvest more than TM firms after being affected by hurricanes. Two measures are used to capture disinvestment: sale of investments and discontinued operations. As reported in Columns (3) and (4) of Table 7 Panel C, the coefficients of Post×TM Firm are insignificant, indicating that non-TM firms do not disinvest more than TM firms following hurricanes.

Second, we investigate whether TM firms borrow more unsecured debt, credit lines, or bonds than non-TM firms following hurricanes. If the difference in debt financing between TM and non-TM firms is driven by the difference in demand for credit, then we would expect that TM firms also use more unsecured debt, lines of credit, or bonds to meet greater demand. To investigate this possibility, we obtain drawn credit line and bond data from Capital IQ.[30] Unsecured debt is defined as the difference between total debt and secured debt scaled by total assets. As shown in Columns (5)–(7) of Table 7 Panel C, there are no significant differences in changes in unsecured debt, credit lines, or the usage of bonds between TM firms and non-TM firms after hurricanes.[31] Additionally, the inclusion of firm fixed effects and industry-year fixed effects in the estimations helps to control for time invariant firm-level unobservable factors such as credit demand and time-varying unobservable industry demand differences. These results are inconsistent with the explanation that different demand for credit is the main reason for the difference in secured debt financing between TM firms and non-TM firms in the post-hurricane period. More post-hurricane secured borrowing by TM firms is most likely driven by the pledge of their trademarks as collateral, helping them to overcome credit constraints tied to tangible assets. Considered together with the result that TM firms' secured debt exceeds their tangible assets in the post-hurricane period, these results provide further evidence that trademarks as buffer collateral enable TM firms to borrow more when facing tangible collateral constraints.

[30] We obtain the latest available filings data from 10-K forms in Capital IQ. The data are aggregated to the firm-year level after cleaning up the duplicate observations for debt items.

[31] The results of unreported tests without controlling for industry-year fixed effects show that the coefficients on the Post dummy are positive and insignificant, indicating that the average usage of unsecured debt, credit lines, or bonds after hurricanes by non-TM firms is greater but not statistically significant in the post-hurricane period. The coefficients on Post×TM Firm remain insignificant.

7.4 Access to Finance

Another potential explanation for TM firms' better responses during the post-hurricane period is that they may have more access to finance even without pledging their trademarks. Thus far, our analyses are designed to minimize this possibility, since they are based on a sample of TM firms and non-TM firms that have comparable tangible assets and other firm characteristics that might affect their access to capital. We also find that firms indeed pledge trademarks more frequently after hurricanes. Additionally, the evidence that non-geographically diversified TM firms borrow more secured debt than non-TM firms confirms that the results are not because TM firms can better use resources from other unaffected areas to assist their financing. To further rule out the possibility that TM firms might have better access to financing without trademark collateral, we conduct four additional analyses.

7.4.1 Live Patents

Since firms may pledge other intangible assets such as patents as collateral, TM firms' increased debt may be due to the collateral value of the patents pledged along with the trademarks. To isolate the collateral value of trademarks, we narrow our focus to firms that have no live patents available as collateral after hurricanes. We identify live patents during 2012–2015. A patent is considered live if it expires after 2012 and was granted by 2015. Firms owning active patents during the post-hurricane period are excluded from the sample. We perform the tests in equation (1) using the sample of firms without live patents as collateral. As shown in Table 8 Panel A, the results remain similar. The coefficients on $Post \times TM\ Firm$ are positive and significant in all specifications, except for the R&D ratios. Firms with trademarks but no live patents raise more debt, invest more in fixed assets, and employ more workers than firms without trademarks and patents after hurricanes. The results further confirm that the increased debt financing is facilitated by trademark collateral.

Although our results show that TM firms without live patents still borrow more, firms without patents might constitute a subsample distinct from the overall sample. Since only approximately 30% of the affected firms have live patents, the inclusion of the size of patent portfolios in the propensity score matching results in a matched sample that is too small to make an inference. As an alternative approach, we test whether more debt

financing by TM firms is associated with their ownership of more patents. A comparison of the number of live patents owned by TM and non-TM firms in our sample shows that TM firms on average have 16 patents, while non-TM firms have 22 patents. This result provides further support that the better responses of TM firms to shocks to tangible assets are not driven by patents.

7.4.2 Securities Issues

Although TM firms are closely matched with similar non-TM firms based on observable characteristics, there may still be some unobserved reasons that firms with trademarks have better access to other sources of finance than firms without trademarks. Perhaps TM firms raise more equity capital that requires no collateral to fund their investments. Therefore, we investigate whether there is a difference in equity or debt issues between TM-firms and non-TM firms before and after the hurricanes. Table 8 Panel B shows that TM firms issue significantly more secured long-term debt and total long-term debt than non-TM firms during the post-hurricane period. However, there is no significant difference in equity issues between TM firms and non-TM firms. These results boost our confidence in the view that the observed higher debt ratio, more fixed-asset investments, and employment by TM firms are due to the contribution of trademarks in helping overcome collateral constraints.

7.4.3 Credit Risk

TM firms may be able to borrow more than comparable non-TM firms because they have lower *ex ante* credit risk. As such, TM firms may better respond to adverse shocks by raising more debt than non-TM firms. To explore this potential explanation, we investigate whether TM firms and non-TM firms differ in borrower risk before being affected by a hurricane. We measure credit risk using the Altman Z-Score and debt ratio. As shown in Table 8 Panel C, there are no significant differences in the Altman Z-Score and debt ratio between TM firms and non-TM firms before hurricanes. The results indicate that more debt financing secured by TM firms does not exist because they have lower credit risk which enables them to borrow more after the shock. The unreported result using the unmatched firms also shows that TM firms do not have higher debt ratios than non-TM firms before hurricanes. This result further confirms that having trademarks by itself does not necessarily mean that firms will always have more debt. However, trademarks are useful collateral that can

help firms overcome constraints caused by a shortage of tangible collateral.

7.4.4 Information Asymmetry

TM firms may obtain more debt financing after hurricanes because they are preferred borrowers with lower information asymmetries *ex ante*. To examine the possibility that our results are driven by the difference in information asymmetry instead of trademark collateral, we investigate whether TM firms are less subject to information asymmetry than non-TM firms. We capture the degree of information asymmetry by five measures used in the literature: number of analysts, analyst forecast dispersion, analyst forecast accuracy, Fog index, and 10-K readability. We obtain analyst forecast data from the Institutional Brokers Estimate System (I/B/E/S). We identify the number of analysts providing annual earnings per share (EPS) forecasts. Forecast dispersion is measured by the standard deviation of analysts' EPS forecasts. Forecast accuracy is the absolute value of the difference between the EPS forecast and realized EPS. The Fog Index is the annual report readability measure developed by Li (2008). A higher value of the Fog Index indicates that the report is more difficult to understand. 10-K *Readability* is a measure of a firm's 10-K document file size for that year constructed by Loughran and McDonald (2014), which reflects the underlying complexity of the firm's business. A firm has less asymmetric information if it has more analyst coverage, lower analyst forecast dispersion, better accuracy in analyst forecasts, a lower Fog index, and more readable 10-K filings.

We test the differences in the degree of information asymmetry between TM firms and non-TM firms before hurricanes using t-tests and report the results in Table 8 Panel C. The test results show no significant differences between the two groups. The results are inconsistent with the view that TM firms can borrow more because they have a lower degree of asymmetric information than non-TM firms. Overall, our results indicate that more secured debt borrowed by TM firms is because they have buffer collateral in the form of trademarks that help them relax collateral constraints.

8 Conclusions

This paper provides novel evidence for the role of trademarks in relaxing collateral constraints, thereby facilitating debt financing for investments in fixed assets and employment. We find that an increasing number of

firms actively use trademarks as collateral. Trademarks are even more widely used as collateral to secure debt financing than patents and are less industry concentrated. Secured debt ratios increase more when trademarks are pledged as collateral than when patents are pledged.

Exploiting an exogenous shock to the collateral values of tangible assets, we find that firms with active trademarks available as collateral raise more debt, spend more on capital expenditures, and employ more employees but do not invest more in R&D than similar firms without trademarks following the shock. Such differences in financial and employment activities are not driven by the availability of patent collateral, the geographic diversification of TM firms, pre-existing divergent trends, differences in demand shocks, product development innovation, demand for credit, access to finance between TM firms and non-TM firms, or other economic factors. The effects are stronger among firms with more valuable trademark portfolios and firms experiencing greater tangible asset damage. Furthermore, firms are more likely to pledge trademarks when they experience more damage to their tangible assets. Trademark pledge activities are observed more often when more constrained firms face a shortage of tangible collateral.

Although we conduct our tests based on a closely matched sample and control for potential confounding influences and perform numerous robustness tests, our findings are subject to two caveats. First, it is impossible to completely eliminate the possibility that some time-varying unobservable economic forces may still have an influence. Second, our results show that trademarks have collateral value and can help to mitigate frictions in debt financing, especially during adverse shocks. However, our results do not necessarily imply that firms with trademarks will always use more debt just because trademarks can be used as collateral. Nevertheless, trademarks, if pledged as collateral, enable firms to secure more debt financing.

Overall, our findings indicate that trademark collateral is particularly valuable when firms lack tangible assets. More debt secured by trademark collateral improves firms' investments and employment, which are vital for driving economic growth. Our results highlight the importance of trademarks for alleviating collateral constraints and helping firms overcome negative shocks and restore growth.

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Figure 1: Number of U.S. Firms Pledging Trademarks versus Patents as Collateral

This figure shows the number of U.S. firms that pledged trademarks as collateral per year during 1975–2015 versus the number of U.S. firms that pledged patents as collateral per year during 1980–2015. The sample firms are obtained from the USPTO database.

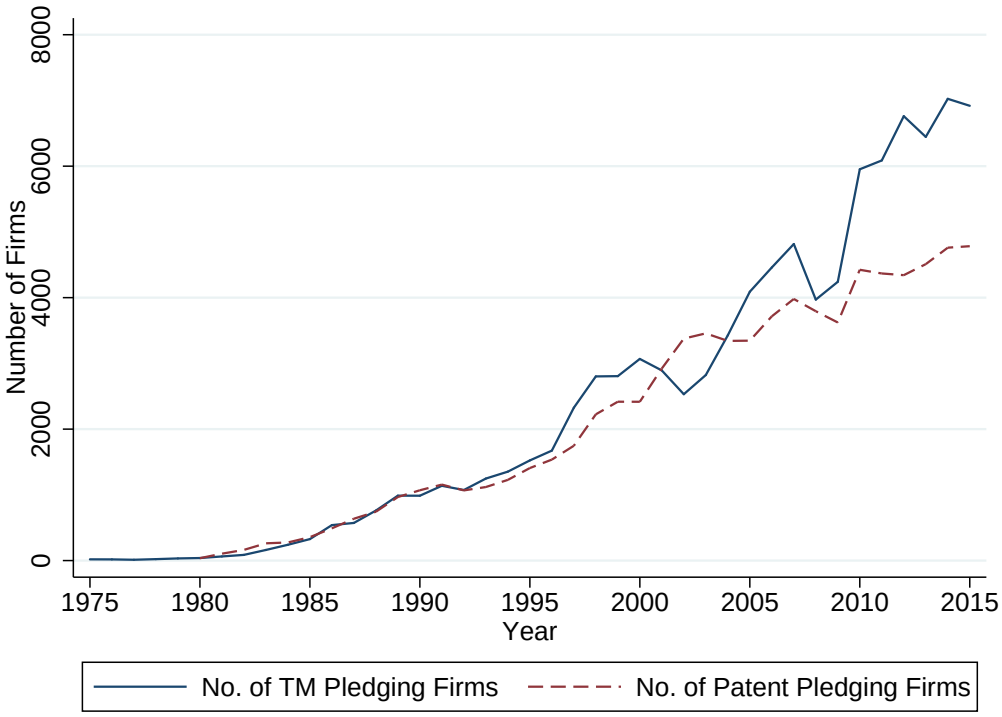

Figure 2: Secured Debt Ratios around the Pledging Event

This figure shows the secured debt ratio around the time when trademarks or patents were pledged as collateral. The secured debt ratio is collateralized long-term debt scaled by total assets. Event window 0 is the year of trademarks or patents being pledged as collateral.

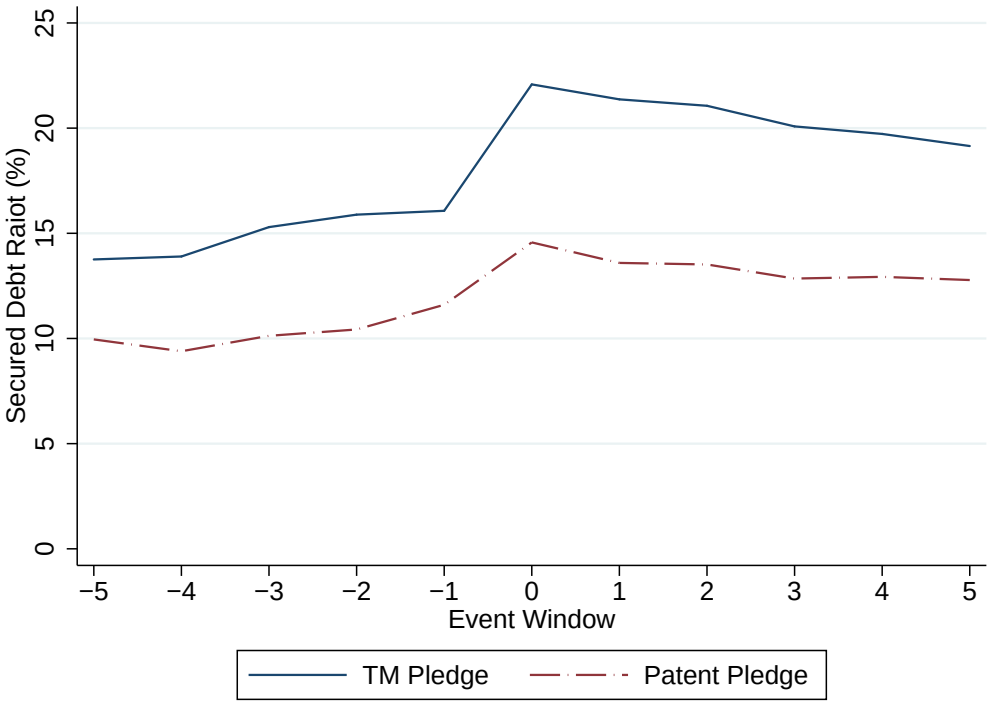

Table 1: Summary Statistics

This table reports the characteristics of trademark portfolios, patents, and sample firms. Panel A includes Compustat sample firms that have at least one active trademark from 1975 to 2015. The subsample of TM Pledged consists of firms that pledge their trademarks at least once during the sample period. Firms that never pledge their trademarks are in the subsample of No TM Pledged. Panel B shows firms that have at least one patent from 1980 to 2015. The subsample of Patent Pledged consists of firms that pledge their patents at least once during the sample period. Firms that never pledge their patents are in the subsample of No Patent Pledged. The definitions of variables are shown in the Online Appendix D. *CF*, *Tangibility*, *Cash*, *Secured Debt*, and *Debt* are reported as percentages.

	Panel A: TM Firms			Panel B: Patenting Firms		
	All	No TM Pledged	TM Pledged	All	No Patent Pledged	Patent Pledged
TM and Patent Portfolio Characteristics						
No. of Active TM	21.28	16.03	30.57	31.24	14.59	46.18
TM Portfolio Market Liquidity	0.04	0.03	0.04	0.04	0.03	0.04
TM Portfolio Age	6.18	6.09	6.35	6.56	5.72	7.32
No. of Patents	7.51	5.46	11.13	13.27	1.74	23.62
Firm Characteristics						
Size	4.72	4.46	5.18	5.05	4.46	5.59
M/B	2.11	2.17	1.99	2.26	2.33	2.20
CF	0.70	-0.02	1.97	-0.47	-2.46	1.28
Tangibility	26.58	27.52	24.92	24.94	25.80	24.17
Cash	18.43	20.27	15.17	20.85	22.54	19.33
Secured Debt	12.88	11.26	15.75	10.55	9.63	11.36
Debt	25.34	23.73	28.18	22.62	21.36	23.74
No. of Firms	10,923	7,835	3,088	5,457	3,189	2,268

Table 2: Matched Sample, Tangible Damage, and Insurance

This table compares characteristics of TM versus non-TM firms affected by exogenous shocks to tangible assets due to hurricanes, damage to assets, and insurance proceeds of matched TM and non-TM firms in the affected counties. The raw sample comprises firms located in counties affected by the 2012 Hurricanes Sandy and Isaac from 2008 to 2015. The matched sample is constructed using the propensity score matching method based on average firm size, market-to-book, cash flows, tangibility, sales growth, and cash holdings prior to the hurricanes for firms in the same two-digit SIC code industry. The mean values of the variables used in matching are reported in Panel A. Panel B shows the differences in the average write-downs of assets and the change in tangibility, defined as the difference in tangibility between 2013 and 2011, for matched TM and non-TM firms. Panel C reports the difference in insurance claim proceeds between matched TM and non-TM firms after the hurricanes. $Diff$ represents the differences in mean values. $t\text{-}Stat$ is the t-statistic of the t-test.

		Panel A: Quality of Matching			
		TM firms	Non-TM firms	Diff	t-Stat
Size	Raw	5.83	5.32	0.52	2.63
	Matched	5.55	5.21	0.34	1.22
M/B	Raw	2.08	2.30	-0.22	-1.35
	Matched	2.15	2.03	0.12	0.58
CF	Raw	-1.12	0.48	-1.60	-0.60
	Matched	0.11	-3.37	3.48	0.92
Tangibility	Raw	17.70	20.39	-2.69	-1.67
	Matched	16.68	17.48	-0.80	-0.37
S.Growth	Raw	0.07	0.18	-0.11	-3.75
	Matched	0.07	0.08	-0.01	-0.35
Cash	Raw	23.29	27.44	-4.14	-2.24
	Matched	25.17	26.25	-1.07	-0.42

	Panel B: Difference in Decline of Tangibility			
	TM firms	Non-TM firms	Diff	t-Stat
Write-downs	-95.36	-27.25	-68.11	-1.35
ΔTangibility	-0.41	-0.44	0.03	0.04

	Panel C: Difference in Insurance Proceeds			
	TM firms	Non-TM firms	Diff	t-Stat
Insurance Proceeds	0.016	0.019	0.003	0.256

Table 3: Tangibility Shocks, Debt, and Firm Activities

This table presents debt usage, investments, and employment of TM versus matched non-TM firms affected by the exogenous shocks to tangible assets due to hurricanes. In Panels A, *Post* is an indicator equal to 1 for the years since the onset of the hurricanes, and 0 otherwise. *TM Firm* is a dummy variable that equals 1 if a firm has at least one active trademark in the hurricane year and 0 otherwise. Panel B presents the dynamic responses of matched TM versus non-TM firms to exogenous shocks to their tangible assets. Pre^2 and Pre^1 are indicators equal to 1 for two and one years before the hurricanes and 0 otherwise. $Post^0$, $Post^1$, and $Post^{2+}$ are indicators that capture the years subsequent to the hurricanes. A set of firm characteristics, namely *Size*, *M/B*, *CF*, *Tangibility*, *S.Growth*, and *Cash*, is controlled for. Firm and industry-year fixed effects are included. Clustered standard errors at the industry level are reported between brackets. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Panel A: Differences in Changes of Firm Activities				
	(1)	(2)	(3)	(4)	(5)
	Secured Debt	Debt	CAPEX	R&D	Employment
Post×TM Firm	3.688***	3.617*	1.158*	0.656	0.056**
	[1.153]	[1.864]	[0.569]	[0.453]	[0.027]
Controls	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes
Observations	2006	2006	2001	2006	1951
Adjusted R^2	0.671	0.749	0.611	0.837	0.986

	Panel B: Dynamic Effects				
	(1)	(2)	(3)	(4)	(5)
	Secured Debt	Debt	CAPEX	R&D	Employment
Pre^2×TM Firm	1.090	2.567	-0.866	0.811**	-0.000
	[1.000]	[1.930]	[0.574]	[0.352]	[0.019]
Pre^1×TM Firm	0.291	2.153	-0.463	1.986*	0.011
	[1.274]	[1.914]	[0.555]	[1.058]	[0.021]
$Post^0$×TM Firm	3.753**	4.721*	1.007*	1.734	0.034
	[1.725]	[2.454]	[0.524]	[1.088]	[0.037]
$Post^1$×TM Firm	4.668**	5.482**	1.380*	1.358	0.054
	[2.139]	[2.207]	[0.687]	[0.959]	[0.034]
$Post^{2+}$×TM Firm	4.075*	5.404*	0.135	1.774***	0.079*
	[2.044]	[3.172]	[0.494]	[0.495]	[0.039]
Controls	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes
Observations	2006	2006	2001	2006	1951
Adjusted R^2	0.670	0.748	0.611	0.838	0.986

Table 4: Tangibility Shocks, Financial Constraints, and Trademark Pledges

This table presents firms' decisions of pledging trademarks as collateral before and after hurricanes that cause damage to tangible collateral. The sample contains firms located in the affected counties that have at least one trademark. Panel A compares trademark pledge activities before and after the shock to physical asset collateral for firms affected more versus those less affected by the shock. Firms that experienced a larger (smaller) decrease in tangible assets based on the median value within the same industry are classified as more (less) affected. *Post* is an indicator equal to 1 for the years since the onset of the hurricanes and 0 otherwise. Panel B reports the impact of financial constraints on trademark pledges before and after the shock to firms' tangible assets. Financial constraint is measured by the proxy developed by Hoberg and Maksimovic (2015). Firms are classified as more (less) constrained based on the median value of the constraint measure within the same industry. Pre-Shock (Post-Shock) is the period before (after) the hurricanes. The linear probability model is estimated. The dependent variable is a dummy variable that equals 1 if a firm pledges trademarks as collateral in a year and 0 otherwise. A set of firm characteristics, namely *Size*, *M/B*, *CF*, *PPE*, *S.Growth*, and *Cash*, and trademark portfolio characteristics, including *TM Portfolio Size*, *TM Portfolio Age*, *TM Portfolio Market Liquidity*, and *TM Portfolio Market Scope*, and firm fixed effects, are controlled for. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Panel A: Tangibility Shocks and TM Pledge		
	(1)	(2)	(3)
	All	More Affected	Less Affected
Post	0.033**	0.035*	0.030
	[0.016]	[0.021]	[0.023]
TM Portfolio Characteristics	Yes	Yes	Yes
Firm Characteristics	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes
Observations	2559	1381	1178

	Panel B: Financial Constraints and TM Pledge		
	(1)	(2)	(3)
	All	Post-Shocks	Pre-Shocks
Constrained	0.026	0.057**	-0.004
	[0.019]	[0.028]	[0.030]
TM Portfolio Characteristics	Yes	Yes	Yes
Firm Characteristics	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes
Observations	1857	1002	855

Table 5: Heterogeneity of Damage to Tangible Assets

This table presents the activities of firms affected more by hurricanes (Panel A) and firms affected less by hurricanes (Panel B). Firms are classified into more (less) affected firms based on a larger (smaller) decrease in their tangible assets compared to the median value of the industry. *Post* is an indicator equal to one for the post-pseudo-Hurricane period and 0 otherwise. *TM Firm* is an indicator equal to 1 if a firm has at least one active trademark in the hurricane year and 0 otherwise. A set of firm characteristics, namely *Size*, *M/B*, *CF*, *Tangibility*, *S.Growth*, and *Cash*, is controlled for. Firm and industry-year fixed effects are included. Clustered standard errors at the industry level are reported between brackets. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Panel A: More Affected Firms				
	(1)	(2)	(3)	(4)	(5)
	Secured Debt	Debt	CAPEX	R&D	Employment
Post×TM Firm	2.599**	3.286*	1.017*	-0.016	0.080***
	[1.189]	[1.622]	[0.512]	[0.367]	[0.025]
Controls	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes
Observations	1257	1257	1253	1257	1218
Adjusted R^2	0.749	0.786	0.532	0.897	0.988

	Panel B: Less Affected Firms				
	(1)	(2)	(3)	(4)	(5)
	Secured Debt	Debt	CAPEX	R&D	Employment
Post×TM Firm	4.570	2.350	1.346	3.347	-0.026
	[4.342]	[3.663]	[1.002]	[2.374]	[0.019]
Controls	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes
Observations	631	631	630	631	610
Adjusted R^2	0.464	0.680	0.486	0.805	0.985

Table 6: Heterogeneity in Collateral Value of Trademarks

This table presents activities of firms with higher value trademark portfolios versus firms with lower value trademark portfolios in hurricane affected areas (Panel A) and the comparison of firms in high versus low advertising industries (Panels B and C). We construct an index of trademark portfolio value using the principal component analysis based on firms' trademark portfolio size, age, market liquidity, and market scope. TM firms are then categorized into tertiles within each industry based on their trademark portfolio value in the hurricane year. *High Value TM* is a dummy variable that equals 1 if a firm's trademark portfolio value is in the third tertile and 0 if a firm's trademark portfolio value is in the first tertile. Industries that spend more (less) than the median on advertising before hurricanes are classified as high (low) advertising industries. A set of firm characteristics, namely *Size*, *M/B*, *CF*, *Tangibility*, *S.Growth*, and *Cash*, is controlled for. Firm and industry-year fixed effects are included. Clustered standard errors at the industry level are reported between brackets. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Panel A: Trademark Portfolio Value				
	(1)	(2)	(3)	(4)	(5)
	Secured Debt	Debt	CAPEX	R&D	Employment
Post×High Value TM	2.997*	3.117*	0.930*	0.176	0.054*
	[1.661]	[1.686]	[0.507]	[0.462]	[0.028]
Controls	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes
Observations	1538	1538	1536	1538	1538
Adjusted R^2	0.612	0.686	0.447	0.821	0.975

	Panel B: High Advertising				
	(1)	(2)	(3)	(4)	(5)
	Secured Debt	Debt	CAPEX	R&D	Employment
Post×TM Firm	3.666***	4.978***	1.840**	1.137**	0.052***
	[1.092]	[1.453]	[0.643]	[0.517]	[0.018]
Controls	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes
Observations	1239	1239	1237	1239	1199
Adjusted R^2	0.636	0.769	0.482	0.852	0.989

	Panel C: Low Advertising				
	(1)	(2)	(3)	(4)	(5)
	Secured Debt	Debt	CAPEX	R&D	Employment
Post×TM Firm	3.725	1.497	-0.026	-0.433	0.054
	[2.544]	[3.042]	[0.335]	[0.397]	[0.047]
Controls	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes
Observations	767	767	764	767	752
Adjusted R^2	0.726	0.718	0.755	0.793	0.980

Table 7: Differences in Demand Shocks, Product Development, and Demand for Credit

This table presents the debt, investments, and employment of matched TM versus non-TM firms affected by hurricanes that have no properties in non-hurricane areas (Panel A) and the results of the difference-in-difference-in-differences tests (Panel B), and the differences in changes of profits, sales, disinvestment, non-secured debt, credit lines, and bonds of matched TM versus non-TM firms affected by the hurricanes (Panel C). *Post* is an indicator equal to 1 for the years since the onset of the hurricanes and 0 otherwise. *TM Firm* is a dummy variable that equals 1 if a firm has at least one active trademark in the hurricane year and 0 otherwise. *Affected* is a dummy variable equal to 1 for firms located in hurricane areas and 0 for firms located in non-hurricane areas. *Sale of Inv* is sale of investments scaled by total assets. *Discontinued* is discontinued operations/total assets. A set of firm characteristics, namely *Size*, *M/B*, *CF*, *Tangibility*, *S.Growth*, and *Cash*, is controlled for. Firm and industry-year fixed effects are included. Clustered standard errors at the industry level are reported between brackets. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Panel A: Non-Geographically Diversified TM Firms				
	(1)	(2)	(3)	(4)	(5)
	Secured Debt	Debt	CAPEX	R&D	Employment
Post×TM Firm	3.365**	3.056**	1.235*	0.596	0.063**
	[1.526]	[1.327]	[0.610]	[0.514]	[0.024]
Controls	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes
Observations	1741	1741	1735	1741	1685
Adjusted R^2	0.723	0.762	0.558	0.813	0.987

	Panel B: Broader Product Markets				
	(1)	(2)	(3)	(4)	(5)
	Secured Debt	Debt	CAPEX	R&D	Employment
Post×TM Firm	-0.083	-1.691	-0.379	0.300	-0.004
	[1.105]	[1.379]	[0.290]	[0.224]	[0.018]
Post×TM Firm×Affected	3.669***	5.197***	1.503*	0.398	0.057*
	[1.368]	[1.196]	[0.757]	[0.678]	[0.031]
Post×Affected	-3.137**	-3.154***	-1.074*	0.02	-0.031
	[1.261]	[1.173]	[0.576]	[0.437]	[0.033]
Controls	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes
Observations	5895	5895	5886	5895	5814
Adjusted R^2	0.708	0.741	0.603	0.861	0.985

	Panel C: Product Development and Demand for Credit						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Sales	Profits	Sale of Inv	Discontinued	Unsecured Debt	Credit Lines	Bonds
Post×TM Firm	0.070	-1.363	-0.831	0.183	-0.018	-0.536	1.046
	[0.057]	[0.955]	[0.793]	[0.617]	[1.059]	[0.628]	[1.585]
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1998	2004	1937	2006	1889	1398	1398
Adjusted R^2	0.977	0.734	0.348	0.059	0.498	0.559	0.752

Table 8: Access to Finance

This table presents the activities of matched TM versus non-TM firms that have no live patents in the post-hurricane period (Panel A), debt and equity financing of matched TM versus non-TM firms located in the affected areas (Panel B), and differences in credit risk and information asymmetry of matched TM versus non-TM firms before hurricanes (Panel C). In Panels A and B, *Post* is an indicator equal to 1 for the years since the onset of the hurricanes and 0 otherwise. $TM\ Firm$ is a dummy variable that equals 1 if a firm has at least one active trademark in the hurricane year and 0 otherwise. A set of firm characteristics, namely $Size$, M/B, CF, $Tangibility$, $S.Growth$, and $Cash$, is controlled for. Firm and industry-year fixed effects are included. Clustered standard errors at the industry level are reported between brackets. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. In Panel C, we measure credit risk using Altman Z-Score and debt ratio. Information asymmetry is measured using five proxies: number of analysts, analyst forecast dispersion, analyst forecast accuracy, Fog index, and 10-K readability. $Diff$ represents the differences in mean values. $t\text{-}Stat$ is the t-statistic of the t-test.

	Panel A: Firms without Live Patents				
	(1)	(2)	(3)	(4)	(5)
	Secured Debt	Debt	CAPEX	R&D	Employment
Post×TM Firm	7.187***	4.746**	0.847*	0.466	0.073**
	[1.826]	[2.233]	[0.489]	[0.495]	[0.031]
Controls	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes
Observations	1435	1435	1430	1435	1389
Adjusted R^2	0.636	0.722	0.662	0.740	0.979

	Panel B: Securities Issues		
	(1)	(2)	(3)
	Secured Debt Issues	Debt Issues	Equity Issues
Post×TM Firm	1.437*	3.436**	-2.561
	[0.774]	[1.531]	[1.691]
Controls	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes
Observations	2006	2006	2006
Adjusted R^2	0.261	0.386	0.428

	Panel C: Credit Risk and Information Asymmetry			
	Non-TM firms	TM firms	Diff	t-stat
Altman Z-Score	1.92	1.89	-0.03	-0.05
Debt Ratio	20.25	20.10	-0.15	-0.10
No. of Analysts	6.20	6.42	0.22	0.53
Forecast Dispersion	0.51	0.52	0.01	0.05
Forecast Accuracy	1.88	1.40	-0.49	-1.19
Fog Index	18.68	18.15	-0.53	-0.97
10-K Readability	0.83	0.81	-0.02	-0.29

Online Appendix to "Collateral Constraints, Trademarks, and Corporate Activities"

Appendix A: Background on Trademarks

A.1 Trademark Basics

According to the United States Patent and Trademark Office (USPTO), a trademark is "a word, phrase, symbol, and/or design that identifies and distinguishes the source of the goods or services of one party from those of others". Trademark law requires a trademark to be inherently distinctive, meaning that it cannot be confusingly similar to other registered trademarks. For example, the trademark "Coca-Cola" distinguishes the soda of the Coca-Cola Company from the soda of another manufacturer (e.g., Pepsi). The distinctiveness feature of a trademark enables consumers to identify and infer information regarding a product through this mark. Trademarks signal product quality, influence consumers' product choices, build brand awareness among consumers, and create brand value (Economides, 1987).

A trademark registered with the USPTO is protected under a federal statute and may have the ® symbol next to the mark. A registered trademark protects the owner's brand and investments from misappropriation by third parties. The exclusive right of a trademark allows the owners to ensure their brand value and maintain market power. The functions of providing legal protection and signaling product quality enable trademarks to generate economic benefits to a firm through sales. Additionally, trademarks create value by building brand equity, in the form of brand visibility, brand associations, and customer loyalty (Krasnikov et al., 2009; Sandner and Block, 2011; Block et al., 2014). Therefore, trademarks are valuable intangible assets.

A trademark is registered within one or multiple goods-and-services classes that define the scope of the trademark protection. Based on the International Nice Classification, in total, there are 45 classes, including 34 goods and 11 services classes. The registration of a trademark requires the registrant to demonstrate "use in commerce" within the specified class. Thus, registered trademarks reflect a firm's verified products and services. The nonuse of a trademark typically results in cancellation (Graham et al., 2013).

A.2 Trademarks versus Patents

Trademarks and patents differ in several aspects. First, in contrast to the patent protection of inventions, which is for a limited period, the exclusive right to a registered trademark is perpetual when used in commerce.[32] Moreover, although the legal lives of patents span up to 20 years from the date of filing, patents may become obsolete before expiration as a result of the evolution of the underlying technology.[33] Since the value of a collateralized asset is limited by the remaining life of the asset, trademarks are potentially quite valuable collateralizable assets for corporate financing.

Second, in contrast to patents, which may or may not be commercialized, trademarks must actually be used in connection with the goods and services listed in the registration.[34] Since the usage of trademarks in products or services is identifiable, trademark valuations are relatively easier.

Third, trademarks can be used to protect products or services and their providers, while patent protection is limited to the invention in process, machine, manufacture or composition of matter.[35] Patents protect firms' technological innovation, while trademarks materialize innovation through the exclusive rights to sell products or provide services. Trademarks offer IP protection to a broader range of firms, beyond those covered by patents and they are likely the most frequently used form of IP protection (Hall et al., 2014). The practically perpetual legal protection associated with trademarks also renders trademarks attractive to firms concerned with the expiration of their patents. The main differences between trademarks and patents are summarized in Table A1.

[32] Regarding utility patents filed prior to June 8, 1995, the term of protection is either 20 years from the earliest application filing date or 17 years from the issue date, whichever is longer. Regarding patents filed on or after June 8, 1995, the term of the patent is 20 years from the filing date of the application. Prior to November 16, 1989, trademarks were renewed for 20-year terms. Subsequently, trademarks were renewed every 10 years. The owner of a trademark must file an acceptable affidavit or declaration of continued use (§8 affidavit) and pay a maintenance fee in the sixth year after the initial registration. Otherwise, the trademark would be cancelled. At the end of each successive 10-year period following the initial registration, the owner files a renewal application (§9 renewable application) and pays the prescribed fees. The trademark will expire if the renewal application is not filed on time or does not meet the statutory requirements.

[33] For example, the economic lives of patents in the software and semiconductor industries may only be a few years after being issued, as new versions of products are subsequently released.

[34] Although a firm with a bona fide intention to use a specific mark in commerce in relation to specific goods or services may file an application for "intent to use", the firm must use the trademark in commerce before the mark can be registered. According to a Forbes article, 95% of active patents fail to be commercialized. See `https://www.forbes.com/sites/danielfisher/2014/06/18/13633/#5556437b6f1c`.

[35] According to the USPTO, the appropriate subject matter of a patent must belong to one of the following four statutory categories: processes, machines, manufactures, and compositions of matter. To receive a patent, an invention must be novel (different from all prior art), nonobvious (more than a trivial variation of prior art), and useful (functions as claimed to benefit the public). To receive a trademark, the applicant must demonstrate that the mark is distinguishable from existing marks on the same market. A patent gives a firm the right to exclude others from making, selling, or using its invention for up to 20 years, while a registered trademark owner receives legal protection for the use of the mark for the designated product or service potentially forever.

Appendix B: Falsification Tests

In this section, we conduct placebo tests using the period when no hurricanes affected firms located in the disaster areas of Hurricanes Sandy. It is natural to question whether our results are explained by other factors unrelated to trademark collateral. One concern is that the results may be influenced by differences between TM and non-TM firms or other economic factors such as growth opportunities, demand shocks, or access to finance. This concern is partially mitigated by matching the TM and non-TM firms based on their characteristics and controlling for firm characteristics and a set of fixed effects in the analysis. To further ease this concern, we conduct falsification tests to verify whether our results remain the same in the absence of a shock to tangible assets. If the effects come from factors other than trademark collateral, we should observe similar results using the years during which there was no major hurricane damage in areas affected by Hurricane Sandy as the pseudo effective year of tangibility shocks.

In Table A5, we assume 2007 as the year when the hurricanes caused damage to the firms located in the disaster areas of Hurricanes Sandy. We examine the sample period of 2005–2009 when no major hurricanes caused severe damage to firms in the affected areas and identify a matched sample of TM and non-TM firms based on the criteria in Section 6.1. Similar effects should be observed during the pseudo-post-event period if factors other than the pledgeability of trademarks are the reasons for the higher secured debt financing of TM firms following the tangibility shock.

Table A5 shows that the coefficients of $Post \times TM\ Firm$ are statistically insignificant, suggesting that TM firms do not perform better than non-TM firms when exogenous shortages of tangible collateral do not occur. This finding suggests that differences between the TM and non-TM firms, other economic factors, or omitted variables are unlikely to explain our results. It also indicates that in the absence of tangible collateral constraints, having trademarks *per se* does not necessarily lead to more usage of debt financing.

Appendix C: Additional Results

Table A1: Trademarks versus Patents

This table illustrates the main differences between trademarks and patents.

	Trademarks	Patents
Legal conditions	Distinctiveness	Novel, non-obvious, useful
Protection	Products or services	Invention in process, machine, manufacture or composition of matter
Scope of protections	Registered goods-and-services classes International Nice Classification: 45 classes (34 goods classes and 11 services classes)	Patent claims
Protection period	Perpetual as long as use in commerce	Up to 20 years
Usage	Demonstrate "use in commerce" within specified class	May or may not be commercialized

Table A2: Industry Distributions of TM-Pledging versus Patent-Pledging Firms

This table reports the industry distribution of firms pledging trademarks versus firms pledging patents as collateral based on two-digit SIC codes. No. and Percent represent the number and percentage of firms, respectively.

		TM Pledge		Patent Pledge	
2-digit SIC	Industry	No. Firms	Percent	No. Firms	Percent
1	Agricultural Production - Crops	4	0.13	3	0.13
2	Agricultural Production - Livestock and Animal Specialties	1	0.03	1	0.04
10	Metal Mining	1	0.03	2	0.09
12	Coal Mining	8	0.26	0	0.00
13	Oil and Gas Extraction	31	1.00	34	1.50
14	Mining and Quarrying of Nonmetallic Minerals, Except Fuels	6	0.19	2	0.09
15	Construction - General Contractors & Operative Builders	8	0.26	3	0.13
16	Heamy Construction, Except Building Construction, Contractor	9	0.29	7	0.31
17	Construction - Special Trade Contractors	8	0.26	2	0.09
20	Food and Kindred Products	86	2.78	44	1.94
21	Tobacco Products	3	0.10	3	0.13
22	Textile Mill Products	30	0.97	15	0.66
23	Apparel, Finished Products from Fabrics & Similar Materials	46	1.49	13	0.57
24	Lumber and Wood Products, Except Furniture	15	0.49	9	0.40
25	Furniture and Fixtures	22	0.71	21	0.93
26	Paper and Allied Products	36	1.17	37	1.63
27	Printing, Publishing and Allied Industries	34	1.10	17	0.75
28	Chemicals and Allied Products	253	8.19	318	14.02
29	Petroleum Refining and Related Industries	12	0.39	16	0.71
30	Rubber and Miscellaneous Plastic Products	49	1.59	50	2.20
31	Leather and Leather Products	10	0.32	8	0.35
32	Stone, Clay, Glass, and Concrete Products	23	0.74	22	0.97
33	Primary Metal Industries	49	1.59	47	2.07
34	Fabricated Metal Products	48	1.55	55	2.43
35	Industrial and Commercial Machinery and Computer Equipment	244	7.90	267	11.77
36	Electronic & Other Electrical Equipment & Components	266	8.61	319	14.07
37	Transportation Equipment	74	2.40	93	4.10
38	Measuring, Photographic, Medical, & Optical Goods, & Clocks	222	7.19	298	13.14
39	Miscellaneous Manufacturing Industries	61	1.98	45	1.98
40	Railroad Transportation	3	0.10	0	0.00
41	Local & Suburban Transit & Interurban Highway Transportation	4	0.13	0	0.00
42	Motor Freight Transportation	15	0.49	4	0.18
44	Water Transportation	5	0.16	0	0.00
45	Transportation by Air	17	0.55	5	0.22
47	Transportation Services	9	0.29	1	0.04
48	Communications	120	3.89	48	2.12
50	Wholesale Trade - Durable Goods	79	2.56	18	0.79
51	Wholesale Trade - Nondurable Goods	42	1.36	14	0.62
52	Building Materials, Hardware, Garden Supplies & Mobile Homes	13	0.42	3	0.13
53	General Merchandise Stores	23	0.74	2	0.09
54	Food Stores	30	0.97	2	0.09
55	Automotive Dealers and Gasoline Service Stations	9	0.29	0	0.00
56	Apparel and Accessory Stores	40	1.30	4	0.18
57	Home Furniture, Furnishings and Equipment Stores	26	0.84	2	0.09
58	Eating and Drinking Places	63	2.04	7	0.31
59	Miscellaneous Retail	106	3.43	20	0.88
70	Hotels, Rooming Houses, Camps, and Other Lodging Places	7	0.23	0	0.00
72	Personal Services	13	0.42	4	0.18
73	Business Services	524	16.97	287	12.65
75	Automotive Repair, Services and Parking	8	0.26	4	0.18
76	Miscellaneous Repair Services	2	0.06	2	0.09
78	Motion Pictures	26	0.84	4	0.18
79	Amusement and Recreation Services	46	1.49	10	0.44
80	Health Services	81	2.62	19	0.84
82	Educational Services	14	0.45	4	0.18
83	Social Services	3	0.10	0	0.00
86	Membership Organizations	1	0.03	1	0.04
87	Engineering, Accounting, Research, and Management Services	67	2.17	32	1.41
99	Nonclassifiable Establishments	33	1.07	20	0.88
Total		3,088	100	2,268	100

Table A3: Decision to Pledge Trademarks

This table reports the probability of a firm pledging trademarks as collateral, estimated using the logit model. The sample contains firms that have at least one active trademark from 1975 to 2015. The dependent variable is an indicator equal to 1 if a firm ever pledges trademarks as collateral and 0 otherwise. The independent variables are the averages of firm and trademark portfolio characteristic variables. Clustered standard errors at the industry level are reported between brackets. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)
Size	0.289***	0.266***
	[0.023]	[0.027]
M/B	0.028	0.014
	[0.023]	[0.023]
CF	-0.007***	-0.007***
	[0.001]	[0.001]
Tangibility	-0.019***	-0.018***
	[0.003]	[0.003]
S.Growth	-0.144	-0.197*
	[0.121]	[0.118]
Cash	-0.021***	-0.022***
	[0.002]	[0.002]
TM Portfolio Size		0.118**
		[0.059]
TM Portfolio Age		-0.044***
		[0.009]
TM Portfolio Market Liquidity		13.985***
		[3.682]
TM Portfolio Market Scope		0.054
		[0.065]
Observations	10,022	10,022

Table A4: Debt Financing, Investment, and Employment around Tangibility Shocks

This table presents debt usage, investments, and employment of TM versus matched non-TM firms affected by the exogenous shocks to tangible assets due to hurricanes. *Post* is an indicator equal to 1 for the years since the onset of the hurricanes, and 0 otherwise. *TM Firm* is a dummy variable that equals 1 if a firm has at least one active trademark in the hurricane year and 0 otherwise. Firm and industry-year fixed effects are included. Clustered standard errors at the industry level are reported between brackets. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
	Secured Debt	Debt	CAPEX	R&D	Employment
Post×TM Firm	3.427***	3.118*	1.351**	0.762	0.031*
	[1.175]	[1.663]	[0.654]	[0.884]	[0.017]
Controls	No	No	No	No	No
Firm FE	Yes	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes
Observations	2443	2443	2396	2443	2343
Adjusted R^2	0.643	0.719	0.558	0.783	0.975

Table A5: Falsification Tests

This table presents the estimation results of placebo tests based on a matched sample of TM firms and non-TM firms located in the counties affected by Hurricanes Sandy during 2005–2009. The hurricane is assumed to affect the counties in 2007, when there was no major hurricane in the area. The dependent variables are *Secured Debt*, *Debt*, $CAPEX$, $R\&D$, and *Employment*. *Post* is an indicator equal to one for the post-pseudo-Hurricane period, and 0 otherwise. $TM\ Firm$ is an indicator equal to 1 if a firm has at least one active trademark in 2007, and 0 otherwise. A set of firm characteristics, namely *Size*, M/B, CF, *Tangibility*, *S.Growth*, and *Cash*, is controlled for. Firm and industry-year fixed effects are included. Clustered standard errors at the industry level are reported between brackets. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
	Secured Debt	Debt	CAPEX	R&D	Employment
Post×TM Firm	2.172	2.522	0.192	-0.097	-0.023
	[1.439]	[1.683]	[0.709]	[0.352]	[0.024]
Controls	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes
Observations	1495	1495	1490	1495	1448
Adjusted R^2	0.804	0.872	0.621	0.878	0.991

Appendix D: Definitions of Variables

Items in parentheses are variable names as in the Compustat annual database.

Firm Variables

$Size$ = natural logarithm of total assets

M/B = market value of assets/total assets (at), where market value of assets is given by total assets (at) - common equity (ceq) + market value of common equity (common shares outstanding (csho) × share price (prcc))

CF = [income before extraordinary items (ibc) + depreciation and amortization (dp)]×100 lagged total assets (at)

$Tangibility$ = net property, plant and equipment (ppent)×100/total assets (at)

$S.Growth$ = $ln(sale_t)$ - $ln(sale_{t-1})$

$Cash$ = cash and cash Equivalents (che) ×100/total assets (at)

$Secured\ Debt$ = [mortgage and other secured debt (dm) + secured notes (dn)]×100/total assets (at)[36]

$Debt$ = [short-term debt (dlc) + long-term debt (dltt)]×100/total assets (at)

$Non-Secured\ Debt$ = debt - secured debt

$CAPEX$ = capital expenditures (capx)×100/lagged total assets (at)

$R\&D$ = R&D (xrd)×100/lagged total assets (at)

$Employment$ = natural logarithm of one plus the number of employees (emp)

$Secured\ Debt\ Issues$ = change in mortgage and other secured debt (dm)×100/lagged total assets (at)

$Debt\ Issues$ = long-term debt issuance (dltis)×100/lagged total assets (at)

$Equity\ Issues$ = [sale of common and preferred stock (sstk) - purchase of common and preferred stock (prstkc)]×100/lagged total assets (at)

$Altman\ Z\text{-}Score$ = (1.2×working capital (wcap)/total assets (at) + 1.4×retained earnings (re)/total assets (at) + 3.3×earnings before interests and taxes (ebit)/total assets (at) + 0.6×market value of equity (csho×prcc_f)/total liabilities (lt) + 0.999×sales (sale)/total assets (at)

$Write\text{-}downs$ = asset write-downs or impairment (wdp)

$Insurance\ Proceeds$ = insurance proceeds (seta)×100/total assets (at)

$Profits$ = operating income before depreciation (oibdp)×100/total assets (at)

$Sales$ = natural logarithm of sales

$Sale\ of\ Inv$ = sale of investment (siv)×100/total assets (at)

$Discontinued$ = discontinued operations (do)×100/total assets (at)

$Credit\ Lines$ = drawn credit line (Capital IQ)/total assets (at)

$Bonds$ = bonds and notes (Capital IQ)/total assets (at)

Trademark Variables

$TM\ Portfolio\ Size$ = natural logarithm of one plus the number of active trademarks owned by the firm

$TM\ Portfolio\ Age$ = average age of all active trademarks owned by the firm

$TM\ Portfolio\ Market\ Liquidity$ = average market liquidity of all active trademarks owned by the firm, where market liquidity of a trademark is measured as the number of traded trademarks divided by the number of tradeable trademarks within each goods and service class

$TM\ Portfolio\ Market\ Scope$ = average number of registered Nice goods and service class(es) of all active trademarks owned by the firm

Patent Variable

$No.\ of\ Patents$ = number of granted patents owned by the firm

[36] Mortgage and other secured debt (dm) represents long-term secured debt. Secured notes (dn) represents debt with a shorter maturity period. The results are robust to the definition without secured notes.