Essays on Empirical Corporate Finance

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Submitted in partial fulfillment of requirements for
the degree of Philosophiae Doctor at NHH

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Feburary 2019

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Acknowledgements

First of all, I wish to express my deepest gratitude to my supervisor Xunhua Su for his endless guidance and support during my Ph.D. study. His continuous encouragement and excellent guidance help me become a better researcher. His enthusiasm about research, unbreakable optimism about life, and energetic attitude towards everything are contagious and have been an inspiration for me as well as other colleagues. I sincerely appreciate his contribution of time and efforts to make my Ph.D. experience rewarding and productive. He has undoubtedly set an example of excellence as a researcher, mentor, instructor and role model.

I am grateful to my co-advisors Wenxuan Hou at University of Edinburgh and Greg Nini at Drexel University. Wenxuan coauthors with me the third paper in this dissertation, and I have learned tremendously during the cooperation. I especially thank his generosity with his knowledge and time. I met Greg during my research stay at Drexel University. He always has an open door for me, providing me insightful discussions about the research and giving me advice and feedback on my papers. I am immensely impressed by his passion for research.

I would also like to sincerely thank Prof. Michelle Lowry and Prof. An Yan for giving me the opportunity to spend the last year of my PhD study at Drexel University and Fordham University. I am immensely grateful to Prof. Michelle Lowry for her invaluable advice and feedbacks on my research and for showing me what a real researcher should look like. I am enormously inspired by her patience, rigor, passion, and devotion as a researcher.

I must also thank all the finance faculty members and administrative staffs at NHH for providing me support during the Ph.D. life. I have learned a lot from the interactions with Karin Thorburn, Tore Leite, Jøril Mæland, Aksel Mjøs, Francisco Santos, Konrad Raff, Michael Kisser, Nils Friewald, Kyeong Hun Lee, Nataliya Gerasimova, Darya Yuferova, Carsten Bienz, Walter Pohl, Jørgen Haug, Svein-Arne Persson, Tommy Stamland, among others.

I also feel blessed with all the lovely colleagues at NHH, including but not limited to Yun Tang, Loreta Rapushi, Negar Ghanbari, Chunbo Liu, Yi Lin, Giovanni Bruno, Jing Lan, Stig Lundeby,

Debashis Senapati, Varun Verma, Raffaele Giuliana, Johan Mellberg, Michael Axenrod, Markus Lithell, Zhou Lu and Damiano Maggi. They have encouraged me and have been a constant support for me through all these years.

I want to thank all my friends (too many to list here but you know who you are!). Thank you all for making my past four years enjoyable and unforgettable.

Last, I am highly indebted to my family. Without their unconditional love and constant encouragement, this achievement would not has been possible. In particular, I would like to thank my dad, mon, and brother. Words can not express how grateful I am for having them in my life.

Xiaoyu Zhang

Bergen, Feburary 2019

Summary

This dissertation consists of three independent papers about the effect of going public on loan contracting and how institutional investors affect investments in corporate social responsibility.

The first paper studies how going public affects bank monitoring. We propose several channels through which going public may have impact over the design of loan contracts, in particular, the use of performance-contingent terms such as performance pricing and loan covenants, which are the key means of bank monitoring. Using a large sample of DealScan loans made within 3 years before initial public offering (IPO) and 3 years after IPO, we show that loans after IPO have significantly higher bank monitoring. For example, loans after IPO have an 144% higher probability to include interest-increasing performance pricing, and a 12% higher probability to include financial covenants, after controlling for borrower, loan and IPO characteristics, as well as industry and year fixed effects. The significance maintains both statistically and economically for a large set of robustness checks and identification strategies. The findings are consistent with the argument that: First, after going public, strict regulation and more analyst coverage, both of which improve the quality of disclosure, lead to lower monitoring costs and higher supply of monitoring; second, dispersed ownership after going public aggravates the free-rider problem, which impedes shareholders' monitoring over firm decisions and thus increases the demand of bank monitoring. The results suggest that there is a shift of monitoring from concentrated shareholders before IPO to concentrated lenders after IPO.

The second paper tries to answer one question: Why issuers do not get upset by IPO underpricing? We in particular provide evidence from the loan market. The majority of IPOs have been underpriced in the past decades. Despite leaving substantial amount of money on the table, issuers rarely get upset and high-underpricing underwriters constantly gain market share. It is puzzling that issuers seem not to be upset about IPO underpricing. For an explanation, extant literature focuses on studying three main players in the IPO market: the IPO firm (entrepreneurs and managers), the underwriter(s), and stock investors. This paper instead looks out of the IPO market and, as the first, link underpricing with the benefit of going public from the loan market. We show that IPO underpricing is associated with significantly lower borrowing costs of the issuer after going public. The average reduction in the loan interest spread for firms with above-median IPO under-

pricing is about 23.7% of their pre-IPO loan spreads, which almost doubles the 12.6% reduction for firms with below-median underpricing, after controlling for firm and loan characteristics, and important factors that affect IPO underpricing. This larger reduction in borrowing costs amounts to about U.S. $0.79 billion per year for our sample firms, which is substantial relative to the total amount of money left on the table due to higher underpricing (U.S. $21.06 billion).

The third paper develops a risk-management view of CSR by arguing that CSR provides insurance-like effects in adverse corporate events. Since passive investors have diversified away most idiosyncratic risks, we predict that they demand less CSR as a strategic approach to manage risks. Employing unique setting of the annual reconstitution of the Russell 1000 and 2000 indexes that bring exogenous shocks to passive investor ownership, we find that firms with higher passive fund ownership exhibit significantly lower CSR engagement. Specifically, we show that on average a one percent increase in passive ownership leads to a 0.3 point decrease in CSR score (i.e., 0.16 standard deviation). The results are robust to alternative bandwidth and polynomial order, additional control variables and various subsamples. The effects are more pronounced among better-diversified passive investors and firms that are not in CSR-sensitive industries. We also find that passive investors hold back CSR activities through the channel of "voice" by reducing the number of socially responsible investment (SRI) proposals. Overall, the findings shed light on the risk-management function of CSR and provide original evidence that passive investors imprint their preference on firm policy.

1 Going Public and Bank Monitoring

Going public significantly changes a firm's information environment and ownership structure (e.g., Lowry, Michaely, and Volkova, 2017), which are important divers of financial contracting (e.g., Sufi, 2007; Ivashina, 2009). We in particular study how going public affects the design of syndicated loan contracts. To mitigate conflicts of interest between borrowers and lenders, loan contracts typically include state-contingent terms, such as performance pricing and loan covenants, which as the key means of bank monitoring directly link firm performance to the cost of loans (e.g., Rajan and Winton, 1995; Bradley and Roberts, 2004; Asquith, Beatty, and Weber, 2005; Garleanu and Zwiebel, 2008; Manso, Strulovici, and Tchistyi, 2010). As going public is followed by sub-

stantial information production and ownership change, does it affect bank monitoring through the state-contingent terms?

There are a few channels through which going public matters for bank monitoring. First, after IPO, stricter disclosure requirements and more analyst coverage improve information transparency of the firm, and mitigate information asymmetry and agency problems between the firm and external financiers (Miller, 2006). In addition, the public stock price reveals the market value of the firm, notifying or alerting banks about performance of the firm more timely. Therefore, going public should reduce the need of bank monitoring, and we should see less performance-contingent terms in post-IPO loans. We henceforth call this the *information asymmetry channel*.

Second, contract enforcement and bank monitoring relies on reliable measures of firm performance. After going public, strict requirements on financial reporting and auditing improve firm's accounting quality, reducing the costs to verify firms' state and to enforce performance-based contract terms. It is thus easier for banks to monitor the IPO firm. Such a reduction in monitoring costs increases the supply of bank monitoring, and we thus should see more performance-contingent terms in post-IPO loans. This is henceforth called the *monitoring costs channel*.

Third, large shareholders are capable of monitoring the firm whereas small shareholders free-ride on these activities (e.g., Stoughton and Zechner, 1998; Gilson, 2005). Before IPO, concentrated ownership as a governance mechanism ensures managers to perform in the best interest of shareholders. After IPO, however, this mechanism is less efficient due to dispersed ownership, and hence bank monitoring becomes more desirable. Such an increase in the demand of bank monitoring leads to more performance-contingent terms in post-IPO loans. In other words, there is a shift of monitoring from concentrated owners before IPO to bank lenders after IPO. We henceforth call this the *ownership channel*.

Concerning how going public affects bank monitoring, the first channel has predictions that are opposite to the other two. It is thus an empirical issue which channel(s) dominates. If the *information asymmetry channel* dominates, we should see lower bank monitoring, or less performance-contingent terms in post-IPO loan contracts; otherwise, we would see more. It is thus a pure empirical question which channel(s) dominates. This is the research question of the current paper.

We show a significant increase in bank monitoring after firms' going public by comparing loans made within 3 years before IPO with loans made within 3 years after IPO. Specifically, relative to loans before IPO, loans after IPO have a significantly higher probability to use performance-contingent terms, including both performance pricing and covenants. In particular, loans after IPO have an 156% higher probability to include interest-increasing performance pricing, and a 16% higher probability to include financial covenants. Even in multivariate analyses after controlling for borrower, loan and IPO characteristics, as well as industry and year fixed effects, the two figures are still 141% and 12% respectively. We show that this increase is neither driven by the firm life cycle nor by equity increase during IPO, and is robust to various model specifications and identification strategies. The findings show that going public is indeed followed by more bank monitoring, supporting the dominance of the monitoring costs channel and the ownership channel.

The contributions of this paper is three-folds. First, our study contributes to the growing literature on the differences between private and public firms, for example, in terms of innovation, corporate governance, investments, cash holdings, among others. The literature in general finds that public firms on average have lower borrowing costs, i.e., a cross-sectional difference (Saunders and Steffen, 2011), or going public reduces the borrowing costs of the IPO firm, i.e., an over-time difference (Zhang and Su, 2018). We instead focus on bank monitoring and, as the first, identify a significant increase in bank monitoring after firm's going public. Second, the findings also add to the literature on the governance structure of IPO firms. This literature focuses on the governance structure related to shareholders or firm owners, as well as firm management. We instead study another type of external governance – bank monitoring and, as the first, identify a shift of monitoring from concentrated shareholders before IPO to concentrated lenders after IPO. Third, the results are also consistent with the contract theory of state verification costs and enforcement costs (e.g., Gale and Hellwig, 1985; Krasa and Villamil, 2000). We show that a reduction in enforcement costs, or state verification costs, raises bank monitoring.

2 The Benefit of Going Public and IPO Underpricing

The majority of U.S. initial public offerings (IPOs) have been underpriced in the past decades. Despite leaving substantial amounts of money on the table, issuers rarely get upset (Krigman,

Shaw, and Womack, 1999; Loughran and Ritter, 2002), and high-underpricing underwriters constantly gain market share (Hoberg, 2007). Why don't issuers get upset about IPO underpricing? For an explanation, extant literature focuses on studying three main players in the IPO market: the IPO firm (entrepreneurs and managers), the underwriter(s), and stock investors (see, e.g., reviews by Ritter and Welch, 2002; Ljungqvist, 2007; Lowry, Michaely, and Volkova, 2017). In this paper, we instead look out of the IPO market, and link underpricing with the benefit of going public from the loan market.

We find that firms with higher IPO underpricing experience larger reduction in post-IPO (vs. pre-IPO) borrowing costs. The average reduction in the loan interest spread for firms with above-median IPO underpricing is about 23.7% of their pre-IPO loan spreads, which almost doubles the 12.6% average reduction for firms with below-median underpricing, after controlling for firm and loan characteristics, and firm and year fixed effects. This larger reduction (11.1%) in borrowing costs amounts to over U.S. $0.79 billion *per year* for our sample firms, and is substantial relative to the total amount of money left on the table due to higher underpricing (U.S. $21.06 billion).[1] That is, the loss of issuers due to underpricing, to a large extent, can be compensated by the benefit of going public from the loan market.

One may think that the positive association reflects some coincidences. First, IPO underpricing is typically larger in hot markets (e.g., Lowry and Schwert, 2002; Lowry, 2003), which happen during economy booms and hence credit booms with lower borrowing costs, resulting in the positive association. This hot-markets effect, however, does not drive our results. The reduction in loan spreads for underpriced firms is larger not only during hot market periods, but also in all the three years after IPO. Even if we exclude IPOs in hot markets, such as those in 1998-2000, the positive association maintains.

Second, certain omitted variables may drive both underpricing and the post-IPO reduction in borrowing costs, resulting in the positive association. For example, underpricing is larger for firms with greater pre-IPO information asymmetry or uncertainty (e.g., Rock, 1986; Benveniste and Spindt, 1989), while these firms benefit more from the information creation of going public and hence experience a larger reduction in post-IPO financing costs. In this case, the positive

[1] All dollar amounts in this paper are in 2010 real dollars.

association may only reflect ex-ante information asymmetry of the issuer. Largely alleviating this concern, we show that the positive association is not affected by underwriter quality, VC-backed or not, firm size, firm age, and issue size, which in the literature are important proxies for information asymmetry or uncertainty (e.g., Beatty and Ritter, 1986; Ljungqvist and Wilhelm, 2003; Loughran and McDonald, 2013).

Finally, to further establish a causal relationship, we employ exogenous variations of underpricing in an instrumental variable (IV) approach. Previous research documents that underpricing is positively related to recent market movements (e.g., Loughran and Ritter, 2002), while there is little reason to believe that short-term market movements affect the IPO firm's borrowing costs in the next three years without through the channel of underpricing. We thus use the 3-week (15 trading days) Nasdaq return prior to IPO as an instrument for underpricing and conduct 2-stage Least Squares (2SLS) analyses. The IV tests confirm a causal effect of underpricing on the post-IPO reduction in the loan spread.

Why does IPO underpricing lead to lower borrowing costs of the issuing firm? The literature documents various marketing benefits of underpricing. Underpricing attracts media attention, generates great publicity, and hence raises investor and customer recognition of the issuer. First, higher investor recognition increases the firm's investor base, stock liquidity and stock price (e.g., Merton, 1987; Aggarwal, Krigman, and Womack, 2002; Grullon, Kanatas, and Weston, 2004; Ellul and Pagano, 2006), and enhances the firm's bargaining power when dealing with lenders (e.g., Pagano, Panetta, and Zingales, 1998; Abreu and Gul, 2000). Second, greater customer recognition saves advertising expenses and enhance competitive advantages of the IPO firm in product markets (e.g., Demers and Lewellen, 2003; Chemmanur and Yan, 2009). Third, underpricing promotes post-IPO information production and improves transparency, for example, by attracting more analyst coverage that improves disclosure quality and corporate governance (e.g., Loughran and Ritter, 2004; Cliff and Denis, 2004; Brown, 2016). This moderates lenders' monitoring costs and reduces cost of external financing.

Our findings highlight an important trade-off in IPO pricing and provide a rationale for why issuers don't get upset about underpricing. Underpricing incurs a direct loss to the issuer by leaving money on the table, but it brings substantial gains, for example, from the loan market. As we show,

the money saved from lower post-IPO borrowing costs for firms with high underpricing can largely recover their loss due to underpricing, not to mention that there are other benefits of underpricing such as those from product markets. With these benefits compensating the loss, it is not difficult to understand why issuers don't get upset about underpricing.

3 Passive Investors and Corporate Social Responsibility

Institutional investors play an increasingly important role in the U.S. stock market. Passive investors, in particular, has experienced a dramatic explosion in the past two decades, increasing from 10% of the total assets of US funds in 1997 to 45% in 2017 (Morning Star, 2017[2]). Meanwhile, more funds started engaging corporate social responsibility (CSR) by applying ESG (environmental, social and governance) screen criteria in their investment. Since passive funds need to minimize tracking error, it's unlikely for their managers to apply these criteria in selecting stocks. This raises an important question about whether and how passive investors influence portfolio companies' CSR.

Previous literature mostly focus on the governance implications of institutional investors (see, e.g., Edmans and Holderness, 2016), while the passive funds remain under-researched. Unlike other institutional investors, passive ones are not able to discipline management through exit. But they can still exert their influence through proposals and voting. For example, existing literature document that that an increase in passive fund ownership is associated with more independent boards, the removal of takeover defenses, a lower chance of unequal voting rights, and a decline in support for management proposal (Appel, Gormley, and Keim, 2016a), but the benefits are limited to low-cost governance activities (Schmidt and Fahlenbrach, 2017). In addition, passive funds could also facilitate the tactics and successes of activists (Appel, Gormley, and Keim, 2016b). While the literature provides evidence that passive funds play a governance role and have the voting power to exert their influence on firm policy and outcome, their impact on CSR is still not clear.

On the one hand, CSR has become an increasingly important business activity that brings necessary legitimacy. Proponents of CSR believe in "doing well by doing good," where CSR brings

[2]2017 *Global Asset Flows Report* by Moringstar, 16 May 2018. See https://newsroom.morningstar.com.

material benefits through the channels of governance (Ferrell, Liang, and Renneboog, 2016; Appel, Gormley, and Keim, 2016a,b), financing cost (Dhaliwal, Li, Tsang, and Yang, 2011; Goss and Roberts, 2011), forecast accuracy (Dhaliwal, Radhakrishnan, Tsang, and Yang, 2012), and corporate culture (Kim, Park, and Wier, 2012), among others. Therefore, passive funds have incentive to strengthen the CSR activities of portfolio firms and to reap the benefits, and we would see a positive association between passive investors and CSR.

On the other hand, passive funds also have good reasons not to engage in CSR. For example, Hoi, Wu, and Zhang (2013) indicate that risk management is an important motivation of CSR activities, and the cost of CSR activities amounts to an insurance premium to reduce the loss in negative corporate events (Lins, Servaes, and Tamayo, 2017). Since the idiosyncratic risks can be mitigated through diversification, it is reasonable to believe that a CSR-based risk-management strategy would be different for undiversified and diversified investors. While extreme negative corporate events are rare, undiversified investors without such "CSR insurance" can suffer unbearable losses when they happen. For index funds, however, they diversify away firm-specific risk of negative corporate events with their low-turnover and high-diversification strategy. The "CSR insurance" on each portfolio company brings little net benefits. Since passive funds charge a lower management fee, they are more sensitive to costs. Therefore, passive investors are less likely to spend on CSR insurance which appears to be redundant. Accordingly, we should see a negative association between passive investors and CSR.

Overall, the net effects of passive funds on CSR activities pose a timely and important research question. There is an empirical challenge in examining the causal effects because of the possible endogeneity issue. Ownership by institutional investors could be correlated with factors – such as firms' access to capital, investment opportunities or cash constraints – that directly affect their CSR choices. Failure to control for such factors could introduce an omitted variable bias that confounds inferences. Moreover, a reverse causality or simultaneity bias might exist because firms' CSR policies could affect firm performance and thus the likelihood of getting included in indexes.

To address the problem, we follow the recent studies on the causal effects of passive investors by employing unique setting of the annual reconstitution of the Russell 1000 and 2000 indexes that bring exogenous shocks to passive investor ownership. Overall, our estimates show firms with

higher passive fund ownership exhibit significantly lower CSR engagement. In particular, a one percent increase in passive ownership leads to a 0.3 point decrease in CSR score (i.e., 0.16 standard deviation). The results are robust to alternative bandwidth and polynomial order, additional control variables and various subsamples.

To explore the influencing channels of passive investors on firms' CSR choices, we investigate the firms' probability of initiating Socially Responsible Investment (SRI) proposals in the annual meeting. The results reveal a negative association between passive investor ownership and the probability of initiating, and the number of, CSR projects, providing evidence that institutional investors exert their influence through their voice, i.e., by communicating with management and using their ownership stake to ensure conformity with their views on corporate policy. Finally, by decomposing the net CSR score into a strength score and a concern score, we find the lower total CSR scores are mainly driven by a lower strength score, rather than a higher concern score. This suggests that passive investors strategically reduce CSR costs.

This paper contributes to the literature in two important ways. It adds to the CSR literature by shedding new light from a risk-management perspective (Minor and Morgan, 2011; Hoi, Wu, and Zhang, 2013). Existing literature largely focuses on the impact of CSR on incremental value gain, leaving its function of risk mitigation or insurance-like effects under-researched. We provide original evidence of the risk-management incentives of CSR engagement, and we look beyond management to understand the role played by passive investors. We show that passive investors' intention to engage CSR is weak, in that they have already diversified the majority of idiosyncratic risks away and do not demand the insurance effects of CSR activities.

Second, it extends the growing literature on causal effects of passive investors on firm outcome by using the unique setting of the annual reconstitution of the Russell 1000 and 2000 indexes that bring exogenous shocks to passive investor ownership. The popularity of passive investment solutions is growing at an accelerated pace. Studies on institutional investors are abundant in the literature, but few explore the motivation and influence of passive investors on corporate governance and tax avoidance (see, e.g., Appel, Gormley, and Keim, 2016a,b; Schmidt and Fahlenbrach, 2017; Bird and Karolyi, 2016). This paper extends the scope to passive investors' influence on CSR activities.

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Going Public and Bank Monitoring: Evidence from Syndicated Loans*

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Abstract

Going public may influence bank monitoring through a few channels. First, going public improves information transparency of the IPO firm and reduces lender-borrower information asymmetry, thereby lowering the demand of bank monitoring. Second, public firms are subject to strict regulation and more analyst coverage, both of which improve the quality of disclosure, leading to lower monitoring costs and higher supply of monitoring. Third, after going public, dispersed ownership aggravates the free-rider problem, which impedes shareholders' monitoring over firm decisions. Bank monitoring is thus more desired to reduce managerial agency problems. These three channels have opposite predictions over how going public affects bank monitoring, and it is thus an empirical issue which channel dominates. In this paper, we examine this issue through studying the use of state-contingent terms in loan contracts, such as performance pricing and loan covenants. These terms, as the key means of bank monitoring, link firm performance to borrowing costs, and help mitigate conflicts of interest between lenders and borrowers. We provide strong evidence of a significant increase in bank monitoring after firms' going public. This increase is neither driven by the firm life cycle nor by equity increase during IPO, and is robust to various model specifications and identification strategies. Overall, our results support the presence and importance of the second and third channels.

Keywords: *IPO, Loans, Going public, Bank monitoring, Performance pricing, Covenant*

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*First draft, Aug. 2018; this version, Nov. 2018. I am deeply indebted to Michelle Lowry, Gregory Nini, and Xunhua Su (supervisor) for their invaluable help, support and encouragement. I also thank Carsten Bienz, Nataliya Gerasimova, Thore Johnsen, Michael Kisser, Tore Leite, Katharina Lewellen, Alexander Ljungqvist, Ron Masulis, David Mauer, Darya Yuferova, and seminar participants at University of Exeter, Norwegian School of Economics (NHH), Queensland University of Technology (QUT), Shanghai Tech, VU Amsterdam, University of Technology Sydney (UTS) for helpful comments and suggestions. This paper was partly written during my visit at Drexel University, sponsored by Prof. Michelle Lowry.

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1 Introduction

Going public significantly changes a firm's information environment and ownership structure (e.g., Lowry, Michaely, and Volkova, 2017), which are important divers of financial contracting (e.g., Sufi, 2007; Ivashina, 2009). An interesting question is thus: How does going public affect financial contracting of the firm? Take bank loans as an example. Bank loans are one of the main sources of corporate external finance, so it is important to understand whether the changes in information and ownership have impact over the design of bank loans. To mitigate conflicts of interest between borrowers and lenders, loan contracts typically include state-contingent terms, such as performance pricing and loan covenants, which as the key means of bank monitoring directly link firm performance to loan costs (e.g., Rajan and Winton, 1995; Bradley and Roberts, 2004; Asquith, Beatty, and Weber, 2005; Garleanu and Zwiebel, 2008; Manso, Strulovici, and Tchistyi, 2010). As going public is followed by substantial information production and ownership change, does it affect bank monitoring through the use of state-contingent terms?

There are a few channels through which going public matters for bank monitoring. First, after IPO, stricter disclosure requirements and more analyst coverage improve information transparency of the firm, and mitigate information asymmetry and agency problems between the firm and external financiers (Miller, 2006). In addition, the public stock price reveals the market value of the firm, notifying or alerting banks about performance of the firm more timely. Therefore, going public should reduce the need of bank monitoring, and we should see less performance-contingent terms in post-IPO loans. We henceforth call this the *information asymmetry channel*.

Second, contract enforcement and bank monitoring relies on reliable measures of firm performance. After going public, strict requirements on financial reporting and auditing improve firm's accounting quality, reducing the costs of verifying firms' state and to enforce performance-based contract terms. It is thus easier for banks to monitor the IPO firm. Such a reduction in monitoring costs increases the supply of bank monitoring, and we thus should see more performance-contingent terms in post-IPO loans. This is henceforth called the *monitoring costs channel*.

Third, large shareholders are capable of monitoring the firm whereas small shareholders free-ride on these activities (e.g., Stoughton and Zechner, 1998; Gilson, 2005). Before IPO, concen-

trated ownership as a governance mechanism ensures managers to perform in the best interest of shareholders. After IPO, however, this mechanism is less efficient due to dispersed ownership, and hence bank monitoring becomes more desirable. Such an increase in the demand of bank monitoring includes more performance-contingent terms in post-IPO loans. In other words, there is a shift of monitoring from concentrated owners before IPO to bank lenders after IPO. We henceforth call this the *ownership channel*.

Concerning how going public affects bank monitoring, the first channel has predictions that are opposite to the other two. It is thus an empirical issue which channel(s) dominates. If the *information asymmetry channel* dominates, we should see lower bank monitoring, or less performance-contingent terms in post-IPO loan contracts; otherwise, we would see more. In this paper, we examine how going public affects financial contracting, focusing on bank monitoring or the use of performance pricing and financial covenants in syndicated loans before and after IPO.

Performance pricing resets the loan interest spread based on borrower performance. In particular, interest-increasing performance pricing shifts the loan interest spread upwards if borrower performance deteriorates. Covenants, on the other hand, require the borrower to maintain certain levels of performance or adhere to certain terms and, in case of violation, lenders take control of the firm. These performance-contingent terms, as the main forms of bank monitoring, "punish" the borrower for bad performance. We select a large sample of loans made by IPO firms that went public in 1997-2013. At the starting point, we compare loans made within 3 years before IPO with loans made within 3 years after IPO. Relative to loans before IPO, loans after IPO significantly increase the use of performance-contingent terms, including both performance pricing and covenants. In particular, loans after IPO have an 156% higher probability to include interest-increasing performance pricing, and a 16% higher probability to include financial covenants. Even in multivariate analyses after controlling for borrower, loan and IPO characteristics, as well as industry and year fixed effects, the two figures are still 141% and 12% respectively. The results show that going public is indeed followed by more bank monitoring, supporting the dominance of the monitoring costs channel and the ownership channel.

There are two caveats in interpreting the more use of performance-sensitive terms in loan contracts after IPO as an effect of going public. First, a firm's financing behavior and financial con-

tracts could be related to its life cycle (e.g., Bradley and Roberts, 2004; Billett, King, and Mauer, 2007), so does its IPO decision (e.g., Jain and Kini, 1994). The increased use of performance-sensitive terms after IPO could only reflect a certain stage of the firm life cycle, instead of an effect of going public. To alleviate this concern, we compare two types of firms: firms that file and complete an IPO and firms that file and withdraw an IPO. Both types of firms file an initial registration statement with the SEC in an attempt to go public, indicating that they are in similar stages of the firm life cycle, but those that complete an IPO become public firms, while those that withdraw remain private. Univariate analysis shows that before IPO, both types of firms have the same probability (0.09) of having interest-increasing performance pricing included in their loan contracts. However, after IPO, this probability for IPO complete firms shifts to 0.23, i.e., an increase of over 156%, while for IPO withdrawn firms it is only 0.05, i.e., a decrease of 44%. Such a sharp contrast presents for the use of financial covenants as well (+16% vs. -43%).

We further construct a matched sample with both IPO complete and IPO withdrawn firms using a propensity score matching (PSM) approach, and conduct Differences-in-differences (DiD) analyses to compare loans made by these two types of firms. Again, the inclusion of both performance-sensitive terms in the post-filing or post-issue loan contracts is significantly larger for IPO complete firms than IPO withdrawn firms. The magnitude of the difference is similar to that from the univariate analysis. In sum, the results suggest that bank monitoring increases in the short term after a firm goes public, and this increase is not driven by the firm life cycle.

The second caveat in interpreting the increased bank monitoring after IPO as the effect of going public is: IPO increases a firm's equity and raises the firm's creditworthiness, while the literature in general finds that firms with high credit quality use more frequently performance-contingent terms in their contracts (e.g., Manso, Strulovici, and Tchistyi, 2010). One may hence argue that the increase in performance pricing and covenants of post-IPO loans could be caused by improved creditworthiness due to equity increase during IPO, instead of an effect of going public or changing the public-private status. To alleviate this concern, we first examine loan contracts made by a group of firms, which go public for the sole purpose of allowing existing shareholders to cash out, rather than of raising equity in the stock market (also called secondary IPOs). We identify 28 secondary IPOs in 1997-2007, based on Asker, Farre-Mensa, and Ljungqvist (2014).

There is indeed a significant increase in the use of all performance-contingent terms in post-IPO loans for secondary IPO firms. For example, the use of interest-increasing performance pricing is increased by 338%. As the group of firms do not raise new equity during IPO, the results suggest that the post-IPO increase in the use of performance-sensitive terms is beyond an effect of equity increase.

The sample of secondary IPO firms with DealScan loans is rather small. One may think that these firms are not representative. We thus conduct additional analyses, comparing the post-issue changes in loan contracts between IPOs and SEOs. Like IPOs, SEOs increase firm equity. Unlike IPOs, SEOs do not affect the firms' private-public status. If firms experience significantly more use of performance pricing and covenants after IPO than after SEO, we would conclude that changing from private to public results in more use of performance-sensitive terms in loan contracts. Through a propensity score matching (PSM) approach, we create a matched sample of SEOs and IPOs, and show that IPO firms experience a larger increase in the use of all types of performance-contingent terms in post-issue loans relative to SEO firms. This effect is statistically significant and economically large. The results confirm that the significant increase in bank monitoring after going public is beyond an effect of equity increase during IPO.

It follows that the increased bank monitoring after IPO is due to either reduction in monitoring costs increasing the supply of bank monitoring (i.e., *the monitoring costs channel*), or dispersed ownership increasing the demand of bank monitoring (i.e., *the ownership channel*). We conduct further tests to verify the presence of both channels. First, we show that the increase in performance pricing is mainly driven by a remarkable increase (141%) in interest-increasing performance pricing, but not in interest-decreasing performance pricing (54.83%). If reduction in monitoring costs is the only driver of our results, we should see similar increases in both types of performance pricing. Similar to financial covenants, interest-increasing performance pricing imposes a threat to the borrower to maintain certain firm performance, while interest-decreasing performance pricing saves borrowing cost based on improved performance. The latter is an option of the borrower and hence less relevant to lender's concerns. Therefore, the above result verifies the presence of the ownership channel.

Second, some firms have issued public bonds before IPO. The SEC regulations over the private

firms with public bonds, concerning financial disclosure, are the same as those over listed firms. That is, for these private firms, information asymmetry and disclosure quality do not change significantly before and after IPO, and hence the monitoring costs channel should be weaker. We then split our sample of firms into two subsamples: one with public bonds before IPO, and the other without. We do see a weaker effect of going public on bank monitoring for firms with pre-IPO bond issues, though the difference is not statistically significant. The result is consistent with the presence of the monitoring costs channel.

Our study contributes to the growing literature on the cross-sectional differences between private and public firms, for example, in terms of innovation (e.g., Bernstein, 2015; Acharya and Xu, 2017), corporate governance (e.g., Field and Lowry, 2017), investments (e.g., Asker, Farre-Mensa, and Ljungqvist, 2014; Gilje and Taillard, 2016), cash holdings (e.g., Gao, Harford, and Li, 2013), among others. Saunders and Steffen (2011) find that public firms on average have lower borrowing costs, while Zhang and Su (2018) compare loans made shortly before and after IPO and show that going public reduces borrowing costs of the IPO firm. We instead focus on bank monitoring and, as the first, identify a significant increase in bank monitoring after firm's going public, reflecting the improved information transparency and dispersed ownership after IPO.

We also add to the literature on the governance structure of IPO firms. There are mainly two strands of the literature. First, after an IPO, ownership are typically more dispersed, and previous owners are hence more likely to lose control. One strand of the literature focuses on how this change after IPO affects the board structure (e.g., Baker and Gompers, 2003; Boone, Field, Karpoff, and Raheja, 2007; Field, Lowry, and Mkrtchyan, 2013) and takeover defenses (e.g., Field and Karpoff, 2002; Johnson, Karpoff, and Yi, 2015). Second, newly listed firms and matured public firms differ in information asymmetry and market pressure to focus on short-term performance goals. These differences may cause differences in the governance structure between the two types of firms (e.g., Field and Lowry, 2017). There are other papers studying the governance structure of start-up firms, such as human resource policies and stock option plans (Hellmann and Puri, 2002). Almost all these papers focus on the governance structure related to shareholders or firm owners, as well as firm management. We instead study another type of external governance – bank monitoring and, as the first, identify a shift of monitoring from concentrated shareholders before IPO to

concentrated lenders after IPO.

We show that a reduction in enforcement costs, or state verification costs, raises bank monitoring. Theory suggests that state verification costs and enforcement costs affect the optimal contracts (e.g., Gale and Hellwig, 1985; Krasa and Villamil, 2000). Consistent with the theory, a branch of papers find evidence over debt financing and the design of debt contracts. For example, Beatty, Scott Liao, and Weber (2010) show that firms with lower information quality and hence higher state verification costs are less likely to obtain debt financing, while Francis, LaFond, Olsson, and Schipper (2005), Bharath, Sunder, and Sunder (2008), and Minnis (2011) show that improvement in information quality reduces cost of debt. Qian and Strahan (2007) and Bae and Goyal (2009) find that lower enforcement costs increase loan maturities but reduce interest rates. Complementary to the previous studies, we expand the literature to bank monitoring.

Finally, our study adds to the broad literature that studies how changes in information environment or ownership structure affect financial contracting (see, e.g., Jensen and Meckling, 1976; Kaplan and Strömberg, 2003; Armstrong, Guay, and Weber, 2010). In particular, we employ one of the most important events during a firm's life – going public or IPO. The IPO event induces substantial information and ownership changes, while there is almost no paper in particular studying how these changes affect financial contracting.

In the following of the paper, Section 2 discusses channels and develops testable hypotheses, Section 3 describes the data and sample, and provides summary statistics for key variables of interest. Section 4 shows the baseline results that going public increases bank monitoring, and exclude some plausibly alternative explanations. Section 5 provides some robustness checks. Section 6 discusses the various channels, and finally Section 7 concludes.

2 Hypothesis Development

Going public significantly changes a firm's information environment and ownership structure (e.g., Lowry, Michaely, and Volkova, 2017), which are important divers of financial contracting (e.g., Sufi, 2007; Ivashina, 2009). We in this paper examine how going public affects the design of bank loan contracts, in particular, performance-sensitive terms, such as performance pricing and loan covenants, which are the key means of bank monitoring (e.g., Rajan and Winton,

1995; Bradley and Roberts, 2004; Asquith, Beatty, and Weber, 2005; Garleanu and Zwiebel, 2008; Manso, Strulovici, and Tchistyi, 2010). There are a few possible channels, through which going public may affect bank monitoring. We in this section discuss these channels and develop testable hypotheses for our empirical analyses.

2.1 The Information Asymmetry Channel

Theoretical studies posit that greater information asymmetry between creditors and borrowers leads to more bank monitoring, for example, through state-contingent terms in loan contracts, such as performance pricing and covenants (e.g., Aghion and Bolton, 1992; Tirole, 2006; Garleanu and Zwiebel, 2008; Manso, Strulovici, and Tchistyi, 2010). These state-contingent provisions protect lenders from borrower agency problems, and could increase lenders' incentive to monitor the borrower (see, e.g., Billett, King, and Mauer, 2007; Miller and Reisel, 2011). Empirically, Asquith, Beatty, and Weber (2005) provide evidence that private debt contracts are more likely to include performance-pricing provisions when asymmetric information is high. Hollander and Verriest (2016) find that covenant intensity is positively associated with the distance between the lender and borrower – a proxy for information frictions. Moreover, Prilmeier (2017) documents that covenant tightness is relaxed over the duration of a relationship, especially for opaque borrowers.

Going public significantly affects the information environment of a firm through the following ways. First, SEC requires public firms to disclose audited financial information to the public after IPO, which before IPO is mostly confidential. This regulation change significantly improves information transparency of public firm in general. Second, going public attracts more analyst and media coverage, which significantly improves information transparency of the firm and decreases information asymmetry between the firm and outside investors. As Miller (2006) points out, the press, using public and private information, could act as the "watchdog" over public firms and provide investors with additional information and analysis that they might be not aware of. Third, the availability of the firm's stock price reveals the market value of the firm, notifying banks more timely performance of the firm, and alerting banks while firm performance deteriorates.

Overall, going public increases the supply of information, and lowers information asymmetry

between the firm and external financiers, including lenders. As such, going public decreases the demand of bank monitoring, and we should thus observe less use of performance pricing and covenants in post-IPO loan contracts, relative to pre-IPO ones.

2.2 The Monitoring Costs Channel

Theory suggests that both state verification costs and contract enforcement costs affect the design of optimal contracts (e.g., Gale and Hellwig, 1985; Krasa and Villamil, 2000). Simply put, a contract consists of various terms, specifying the rights and obligations of both contract parties, which must be enforceable. For example, a third party like the courts may compel performance of contractual obligations by the party in default or, more commonly, may award damages for breach of contract. For loan contracts, Qian and Strahan (2007) and Bae and Goyal (2009) find that lower enforcement costs affect loan contracting, such as increasing maturities and reducing interest rates. As state verification costs and contract enforcement costs are largely determined by information quality, Beatty, Scott Liao, and Weber (2010) show that firms with lower information quality are less likely to obtain debt financing, while Francis, LaFond, Olsson, and Schipper (2005), Bharath, Sunder, and Sunder (2008), and Minnis (2011) show that improvement in information quality reduces cost of debt. Similar effects should also apply to bank monitoring, although there is almost no extant study examining this issue.

In a lending relationship, banks typically exert monitoring through performance pricing and covenants, which are mostly written on specific performance measures of the borrower. For example, performance-pricing provisions adjust the loan interest rate according to borrower performance, and the majority of performance pricing is based on the borrower's debt-to-cash flow ratio. Financial covenants require borrowers to maintain certain financial ratios, while the most widely used one is the debt-to-EBITDA ratio. In Appendix V and Appendix VI, we show that a majority of these state-contingent provisions in DealScan loans are based on different sorts of accounting-based financial ratios. In order to effectively monitor the borrower, the performance measures in performance pricing and covenants must be easily verifiable and enforceable. In this sense, the quality of borrower's accounting figures is important in bank monitoring.

Going public significantly improves the firm's accounting quality (see, e.g., Armstrong, Guay,

and Weber, 2010; Bushman, Piotroski, and Smith, 2004; Hope, Thomas, and Vyas, 2013). Firms might involve in earnings management, accounting fraud or misstatements in order to avoid breaching of loan contracts or triggering interest increase provisions. After going public, the likelihood of doing these decreases significantly. Auditors, regulators, analysts, the media, and other information intermediaries could scrutinize and assimilate disclosures, and uncover distortions in various pieces of information (Miller, 2006). Without these parties involved, banks may still access borrowers' financial information, but these information are not necessarily audited. In sum, going public reduces banks' information acquisition and processing costs, as well as state verification and enforcement costs, and hence increases the supply of bank monitoring. We thus expect that going public raises bank monitoring.

2.3 The Ownership Channel

Going public allows the firm to have dispersed ownership, which affects monitoring from owners. In general, private firms suffer less from managerial agency problems, because they are often owner-managed and, even when not, typically have highly concentrated ownership, which motivates owners to monitor firm managers more closely. However, after going public, these governance and monitoring mechanism become weaker and less efficient due to the free-rider problem of dispersed owners (e.g., Bolton and Von Thadden, 1998). For example, compared with private firms, public firms invest substantially less and are less responsive to changes in investment opportunities (Asker, Farre-Mensa, and Ljungqvist, 2014), and hold about twice as much cash (Gao, Harford, and Li, 2013).

Firm managers, when not properly monitored by shareholders, may make self-maximizing decisions that may not necessarily be in the interest of either shareholders or debt holders. For example, empire building of managers can increase the default risk of the firm. A lack in efficient monitoring from owners makes lender's monitoring more desirable. As supporting evidence, Qi and Wald (2008) find that firms with anti-takeover protection are more likely to suffer from managerial agency problems, and thus are more likely to use debt covenants to minimize agency costs. Chava, Kumar, and Warga (2009) show that managerial entrenchment affects the design of bond covenants, for example, by increasing investment covenants but decreasing dividend payout and takeover related covenants.

To sum up, a lower monitoring from dispersed shareholders after firm's going public makes bank monitoring more desirable. We should thus see a shift of monitoring from concentrated owners before IPO to bank lenders after IPO. In other words, going public would increase bank monitoring.

2.4 Testable Hypotheses

The three channels discussed above give opposite predictions concerning how going public affects bank monitoring. The information asymmetry channel predicts a decrease in bank monitoring after IPO, but the monitoring costs channel and the ownership channel predict an increase. It is thus a purely empirical issue which channel dominates. To examine this issue, we in particular examine the use of performance pricing and loan covenants, which are the key means of bank monitoring directly link firm performance to the cost of loans to mitigate conflicts of interest between borrowers and lenders (e.g., Rajan and Winton, 1995; Bradley and Roberts, 2004; Asquith, Beatty, and Weber, 2005; Garleanu and Zwiebel, 2008; Manso, Strulovici, and Tchistyi, 2010). Our main hypothesis is:

Hypothesis I (Dominant channel): *Going public increases banking monitoring. That is, we observe more use of performance pricing and loan covenants after a firm goes public.*

However, even if Hypothesis I is verified, there could still be other confounding effects that induce the increased performance pricing and loan covenants in post-IPO loan contracts. One may argue that firms that file an IPO are generally in their growth stage with many investment opportunities. According to Billett, King, and Mauer (2007), debt protection using covenants is increasing in growth opportunities, when the stockholder-bondholder conflicts over the exercise of growth options are higher. In this case, the increased use of state-contingent terms in post-IPO loan contracts reflects only the firms' life cycle or large growth opportunities, rather than any of the above channels. To exclude such an effect of the firm life cycle, we compare firms that file and complete an IPO with firms that file and withdraw an IPO. Both types of firms file an initial registration statement with the SEC in an attempt to go public, indicating that they are in the same stage of the firm life cycle, but those complete an IPO become public firms while those withdraw remain private. If we see a significant difference in the post-issue changes in loan contracting

between IPO complete firms and IPO withdrawn firms, we could conclude that the increase in bank monitoring after IPO is caused by firms' going public, instead of by the effect of the firm life cycle or growth opportunities. Therefore, we propose our second hypothesis:

Hypothesis II (Excluding the effect of the firm life cycle): *The post-filing increase in the use of performance pricing and loan covenants is significantly larger for IPO complete firms than for IPO withdrawn firms.*

Furthermore, going public typically leads to an equity increase and improved credit quality of the firm. Manso, Strulovici, and Tchistyi (2010) show that performance pricing can be used by good firms to signal their quality. If this is the case, the increased performance pricing after IPO could not be an effect of going public (i.e., changing the firms' private-public status) and hence not an effect of any above channel, but be only an effect of improved credit quality of the firm, so does the increase in the use of covenants (Levine and Hughes, 2005). In order to exclude the effect of equity increase, we compare the post-issue changes of bank monitoring (i.e., performance pricing and covenants) between IPOs and SEOs. Like IPOs, SEOs increase firm equity; but unlike IPOs, SEOs do not affect the firms' private-public status. If we observe a larger increase in bank monitoring after IPOs than that after comparable SEOs, we would conclude that the increased bank monitoring after IPO is not only due to an equity increase. Hence, we form our third hypothesis:

Hypothesis III (Excluding the effect of equity increase during IPO): *The post-issue increase in the use of performance pricing and loan covenants is significantly larger for IPOs than for comparable SEOs.*

If all above three hypotheses are confirmed, we can conclude that the monitoring costs channel and the ownership channel together dominate the information asymmetry channel, but we are still not able to identify which one of the two channels is more important for our results. One step further is to distinguish the channels. In this paper, we won't completely separate these three channels, but try to verify the presence of the monitoring costs channel and the ownership channel.

Performance pricing links the loan interest spread to borrower performance measures, and it could be split into two types: interest-increasing performance pricing, which increases the interest

spread if borrower performance deteriorates, and interest-decreasing performance pricing, which decreases the interest spread if borrower performance improves. Concerning the use of the two types of performance pricing, the monitoring costs channel and the ownership channel differ in predictions: Although the monitoring costs channel predicts more use of both types of performance pricing, the ownership channel matters mainly for interest-increasing performance pricing, because interest-decreasing performance pricing is more like an option of the borrower (that will only be initiated by the borrower) rather than a form of banking monitoring. For this reason, we propose our fourth hypothesis to verify the presence of the ownership channel.

Hypothesis IV (Presence of the ownership channel): *The increasing use of performance pricing after going public is concentrated on interest-increasing performance pricing.*

3 Data, Sample, and Statistics

3.1 IPO Data and Sample Selection

Our IPO sample contains all non-utility and non-financial firms in the SDC Global New Issues Database, which complete IPO on the NYSE, AMEX and NASDAQ stock exchanges in 1997-2013. We exclude REITs, units, ADRs, and offerings with the stock price below $5. We correct for SDC errors using information provided on Jay Ritter's website, and merge records that represent one IPO. We obtain information for each IPO on the issue date, issue amount, and the VC-backed dummy from SDC. We also supplement information on venture capital (VC) funding from VentureXpert.

We select IPOs between 1997 and 2013 for two reasons. First, our loan data is from DealScan database,[1] which compile data from difference sources like SEC filings, public documents, loan syndicator as well as other internal sources. According to Roberts and Chava (2008), the majority of the data comes from SEC filings in EDGAR system. While SEC EDGAR system was not introduced until 1994, information on covenants in DealScan is fairly limited prior to that. Following their study, we focus our attention on the sample of loans with start dates between 1994 and 2016. Second, we require every firm to have at least one loan in DealScan within 3 years before IPO and

[1]The loan data are described in Section 3.2.

one loan within 3 years after IPO, resulting in our final IPO sample period of 1997-2013.

In total, we have 529 IPOs in 1997-2013 and Figure 1 shows the frequency or distribution of our IPO sample across years. Although we have only a subset of all IPOs, the distribution of our sample is quite similar to that of the universal set of IPOs (see, e.g., Lowry, Michaely, and Volkova, 2017). In the figure, we also see that in general, there are less observations over time in the sample period, reflecting the constant decline in the number of U.S. IPOs and public firms in the past three decades (see, e.g., Doidge, Karolyi, and Stulz, 2017).

3.2 Loan and Borrower Data

We obtain bank loan data from the Reuters Loan Pricing Corporation (LPC) DealScan database. DealScan collects loan contracts information from SEC filings, large loan syndicators, and a staff of reporters. It covers the majority of new loans made to U.S. firms, and contains detailed information of corporate loan contracts, such as performance pricing and loan covenants, for both public and private firms from 1987.[2] Performance-pricing provisions specify the pricing grids of how interest rates would change with borrow performance, while a loan covenant is a provision in loan contract that requires the borrower to fulfill certain condition or to forbids the borrower from undertaking certain actions. DealScan contains both financial covenant and negative covenant information for a loan package. Financial covenant, in particular, is a clause in the loan agreement that commits the borrower to operate within predefined financial constraints. For example, the borrower might be required to maintain Debt-to-EBITDA ratio below 3, breach of which would normally constitute an event of default. Negative covenant, on the other hand, requires the borrower to cease or avoid doing something. In Appendix IV, we demonstrate several examples of performance pricing and loan covenants contained in loan contracts, and in Appendix V and Appendix VI, we present a detailed description of different types of performance pricing and loan covenants.

Our analyse are conducted at the facility level for performance pricing, and at the package level for loan covenants. For facility level variables, we obtain the all-in-spread-drawn (*AIS*), *Maturity* in months, *Loan Amount* in million U.S. $, and whether the loan is secured (*Secured*). We generate a dummy variable, *PSD*, indicating whether the loan contains performance-pricing

[2]According to Carey and Nini (2007), Dealscan has information on 50-75% of all U.S. commercial loan volume into the early 1990s, with coverage increasing to 80-90% from 1992-2002.

provisions, i.e., whether the loan is a performance-sensitive debt, and we further divide them into interest-increasing PSD and interest-decreasing PSD, indicated by dummy variables *Increasing PSD* and *Decreasing PSD*. Interest-increasing PSD automatically raises loan interest rates when borrower performance weakens, while interest-decreasing PSD automatically lowers loan interest rates when borrower performance improves.

For package level variables, we obtain *Maturity* in months, and *Loan Amount* in million U.S. $. Specifically, package maturity is defined as the maturity of the longest facility in the loan package. In addition, we generate a dummy variable, *FinCov_D*, which equals to one if the loan package contains at least one financial covenant and zero otherwise, and a dummy variable, *Cov_D*, which equals to one if the loan package contains at least one financial covenant or negative covenant and zero otherwise. We calculate the number of financial covenants (*N_FinCov*) and covenants (*N_Cov*) for each loan package as well. For both facility level and package level data, we generate dummies for loan purposes, based on the four groups of primary purposes: general purposes (working capital and general corporate purpose), recapitalization (debt repayment/consolidation, recapitalization, and debtor-in-possession loans), acquisition (general or specific acquisition program and LBO loans), and others (see, e.g., Carey, Post, and Sharp, 1998). Finally, for both levels of loan data, we generate lead banks dummies to control for bank fixed effects.

We focus on bank loans made by the 529 IPO firms between 3 years before IPO and 3 years after IPO in 1994-2016. To merge the DealScan loan data with our sample of IPOs, we first merge DealScan with Compustat, using the link table initiated by Chava and Roberts (2008). We manually supplement the link table for the period between 2013 and 2016. Second, we use CUSIP and the fiscal year as the key words to combine the IPO data with the merged DealScan and Compustat data. Because Compustat records data for public firms, accounting information before IPO is typically not available. We manually collect the missing accounting data from SEC Form S-1 filings, including five important variables: *Total Assets*, *Total Debt*, *Net Income*, *Cash* and *PP&E*.

Our final sample consists of 3,315 loan facilities from 2,052 packages made by the 529 firms in 1994-2016. Figure 2 shows the distribution of the number of loans across calender years. In general, the number of loans is smaller at the beginning and at the end of the sample period. This

is because our IPO sample start in 1997 and end in 2013, indicating that the first three years (i.e., 1994-1996) only cover pre-IPO loans, and the last three years (i.e., 2014-2016) only contain post-IPO loans. Across the rest of calender years, the distribution of the number of loans is very similar to that of IPOs shown in Figure 1, and the decreasing number of loans in the last decade reflects a lower number of IPOs recently.

Figure 3 shows the distribution of loans across the 12 window quarters. Our time window covers the 3 years before IPO and the 3 years after IPO, so there are in total 6 years or 24 quarters. The figure shows that a significant proportion of loans before IPO are made close to the IPO time, especially in the last 3 quarters before IPO. There are several possible reasons. *First*, around 11.53% of the IPO firms in our sample go public within 3 years after being established and hence do not have loan records before being founded. Moreover, another 11.91% of the IPOs are made within 6 years after firm foundation, and in the first several years they might have limited ability of issuing loans. *Second*, some issuers borrow short-term loans just before IPO to avoid diluting firm ownership (e.g., bridge loans) or to restructure the firm (e.g., recapitalization loans). These two types of loans in total constitute about 6% of our sample observations. *Third*, many loans are not included in DealScan, especially those issued before the borrowers go public. We manually select a random sample of 20 U.S. IPOs in 1990-2013. We compare the loan information reported by firms in SEC S-1 filings with that recorded in DealScan. Among these 20 firms, only one has syndicated loans reported in S-1 filings but not recorded in DealScan. This means DealScan is quite complete in covering pre-IPO syndicated loan information. In Appendix I, we provide a more detailed description of our manual comparison of the two database regarding pre-IPO loans. *Finally*, many firms renegotiate and restate loans before IPO, and DealScan records them as new loans. In Appendix III, we show that some loans issued just before IPO are renegotiations of existing loans instead of new loans. Therefore, the larger amount of loans in the 3 quarters before IPO date in Figure 3 could due to a higher probability of renegotiations, rather than a higher probability of issuing new loans in this period.

3.3 Summary Statistics for Loan and Borrower Characteristics

Table 1 summarizes the key loan and borrower characteristics for our sample, and all the variables are winsorized at the 1^{st} and 99^{th} percentiles. Panel A and Panel B report loan characteristics

at the facility and package level respectively, and Panel C shows borrower characteristics. In total, we have 3,315 loan facilities in our loan sample in 1994-2016. We split them into 1,703 pre-IPO loans and 1,612 post-IPO loans. Compared to loans before IPO, loans after IPO on average have a lower interest spread of 47.09 bps, which is about 16.34% of the average pre-IPO interest spread (288.16 bps) of all firms. This is consistent with previous literature showing a reduction in borrowing cost after firm goes public due to a higher bargaining power and a lower credit risk (see, e.g., Pagano, Panetta, and Zingales, 1998; Saunders and Steffen, 2011; Schenone, 2010). The average loan size increases by U.S. $53.46 million or 26.72% after IPO. Going public expands firm size and hence firms' borrowing capacity, so public firms tend to borrow more. In addition, the loan maturity decreases significantly after IPO. Firms are more likely to use performance pricing in the loan contracts, increasing from 31% in the pre-IPO loans to 42% in the post-IPO loans. The increase is more dramatic for interest-increasing performance pricing, which is 1.5 times larger in the post-IPO loans compare to the increase for interest-decreasing performance pricing, which is only 28% larger. Indeed, the use of performance pricing is a way to effectively shorten loan maturity and to increase bank monitoring, so the statistics for maturity and performance pricing show consistent evidence that going public raises bank monitoring.

Panel B reports loan characteristics for 2,052 loan packages in our sample, among which 1,028 are made before firms go public and 1,024 are made after firms go public. Similar with statistics at the facility level, package amount increases while package maturity, defined as the maturity of the longest facility in the loan package, decreases. In addition, loans after IPO are more likely to include financial covenants, and on average include more financial covenants. This is probably because financial covenants are based on firms' financial ratios, which are more reliable and accurate after IPO, making it easier to implement financial covenants in the loan contracts. We also look at the use of both financial covenants and negative covenants, the results are consistent.

Panel C summarizes borrower characteristics at the package level. Consistent with increased equity from IPO, *Book Assets* significantly increases, while *Book Leverage* decreases. *Profitability* increases, but *Cash Ratio* and *Tangibility* have almost no difference. This lower leverage is consistent with Eckbo and Norli (2005) who show that IPO firms have lower leverage than older firms, for about two years following the IPO.

4 How Going Public Affects Bank Monitoring?

4.1 Performance-contingent Terms: Baseline Results

To study how going public affects bank monitoring through the use of performance pricing in loan contracts, we run the following Probit regression at the facility level,

$$PSD_i = \alpha + \beta \cdot \textit{Post}_i + \Theta \cdot \mathbf{X}'_{i,j,t} + \mu_t + \eta_j + \epsilon_{i,j,t}, \tag{1}$$

where the dependent variable is a dummy, *PSD*, which equals to one if the loan contains performance pricing and zero otherwise. Alternatively, we use a dummy, *Increasing PSD*, which equals to one if the loan includes interest-increasing performance pricing and a dummy, *Decreasing PSD*, which equals to one if the loan contains interest-decreasing performance pricing. *Post* is a dummy variable, which equals one if the loan is issued after firm goes public. $\mathbf{X}'$ represents a set of firm, loan and IPO characteristics. Specifically, loan controls include the natural logarithm of both loan amount and maturity, i.e., $\log$(*Loan Amount*) and $\log$(*Maturity*), and a dummy variable, *Secured*, which is equal to one if the loan is secured. Firm controls, include $\log$(*Book Assets*) defined as the natural logarithm of book assets, *Book Leverage* defined as total liabilities scaled by total assets, *Tangibility* defined as PP&E scaled by total assets, *Cash Ratio* defined as cash and short-term investments scaled by total assets, and *Profitability* defined as the ratio of net income to book assets. Finally, IPO controls include *Gross Proceeds*, and the *VC-backed* dummy representing whether the IPO is VC-backed or not. We also add year, industry fixed effects, as well as bank and loan purpose fixed effects in the regression. The coefficient of *Post*, therefore, captures the change in the use of performance pricing in post-IPO loans relative to that in pre-IPO loans. All variables are winsorized at the 1^{st} and 99^{th} percentiles to reduce outlier bias. Standard errors are clustered at the firm level and corrected for heterogeneity.

Results are reported in Table 2, where Column (1) of the table presents the most parsimonious specification, without any control but including year and industry fixed effects. Columns (2) adds loan characteristics, bank fixed effects and loan purpose fixed effects. Columns (3) further includes firm characteristics, and Column (4) also adds IPO characteristics. The dependent variable in Columns (1)-(4) is a dummy, *Increasing PSD*. Columns (5)-(6) and Columns (7)-(8) replicate the

analyses in Columns (3)-(4), but replace the dependent variable with *Decreasing PSD* and *PSD* respectively.

Across all columns or specifications, *Post* enters with a significantly positive coefficient, indicating that going public significantly increase the use of performance-pricing provisions of all types. The economical magnitude is also large, especially for interest-increasing performance pricing. Taking Column (4) for example, post-IPO loans have a 141% higher probability of including interest-increasing performance pricing provisions relative to pre-IPO loans, after considering all firm, loan and IPO characteristics. Additionally, going public increase the probability of containing interest-decreasing performance pricing by 54.83% and increase the probability of containing any type of performance-sensitive provision by 24.84%. Moreover, a few control variables show consistent signs across specifications. For example, *Book Leverage* is negatively, while *Profitability* is positively associated with the use of performance pricing, consistent with previous studies that better firms and firms with lower credit risks are more likely to include performance pricing in the loan contracts (Manso, Strulovici, and Tchistyi, 2010).

In Table 3, we replicate the regressions in Table 2, but conduct the analysis at the package level. We define a package as including performance-pricing provision if at least one of the facilities contain these provisions. In general, the results are consistent with Table 2. Across all columns, *Post* enters with a positive coefficient and the effect is strongest for interest-increasing performance pricing. Specifically, going public increase the likelihood of the loan package to contain interest-increasing performance pricing by 117%, interest-decreasing performance pricing by 11.03%, and any type of performance pricing by 23.23%.

We use the same specification in Equation (1) to study how going public affects the use of covenants in loan contracts. Results are shown in Table 4 for financial covenants, and in Table 5 for total covenants, with analyses conducted at the package level for both tables. Specifically, Table 4 examines the difference in the use of financial covenants in the pre- and post-IPO loan contracts, and the dependent variable in Columns (1)-(4) is a dummy, *FinCov_D*, that equals to one if the loan contains at least one financial covenant and zero otherwise. Column (1) includes only the *Post* dummy with industry and loan year fixed effects. Columns (2) adds loan characteristics, bank fixed effects and loan purpose fixed effects. Columns (3) further include firm characteristics,

and Column (4) also adds IPO characteristics. Across all columns, we see a significantly positive coefficient of *Post*, meaning that firms are more likely to include financial covenants in their loan contracts after they go public. According to Column (4), going public increases the probability of including financial covenants by 12.32 %. Furthermore, Columns (6)-(7) study the effect of going public on the number of financial covenants used in loan covenants. The dependent variable is the logarithm of the number of financial covenants, $\log$(*N_FinCov)*, and the model is estimated using OLS. Column (5) includes loan and firm controls, as well as firm and industry, loan year, bank and loan purpose fixed effects. Column (6) further adds IPO characteristics. The coefficient of *Post* remains significantly positive, indicating that firms use more financial covenant after they go public. According to Column (6), going public induces the lender to use 9.09% more financial covenants in post-IPO loan contracts.

In Table 5, we consider both financial and negative covenants contained in loan contracts. Except having different dependent variables, the specifications are the same as Table 4. The dependent variable in Columns (1)-(4) of the table is a dummy, *Cov_D*, that equals to one if the loan contains at least one covenant (either financial covenant or negative covenant), and in Columns (5)-(6) is the logarithm of the number of total covenants, $\log$(*N_Cov)*. Consistent with findings in Table 4, more firms use covenants and the average number of covenants in loan contracts also increases. In particular, post-IPO loans have a 9.21% higher probability of including covenants in loan contracts, and on average include 12.08% more covenants in loan contracts compare to pre-IPO loans. The results also suggest that larger firms and firms with higher leverage have less covenants, while firms with higher profitability have more covenants.

Overall, the results presented in this section confirm that going public significantly increases bank monitoring through the use of performance pricing and loan covenants, and thus confirming Hypothesis I. In other words, the monitoring costs channel and the ownership channel dominate the information asymmetry channel in predicting the changes in the use of state-contingent provisions in post-IPO loan contracts.

4.2 Are Post-IPO Changes in Loan Contracts due to the Firm Life Cycle? Complete vs. Withdrawn IPOs

So far we have shown that loan contracts after IPO have a significantly higher probability to include performance-contingent terms, confirming our Hypothesis I. We interpret this finding as supportive evidence for the dominance of the monitoring costs channel and the ownership channel. There are two caveats in giving this interpretation. One is that the firm life cycle could be the omitted variable that drives both the IPO decision and changes in bank monitoring. The other is that the increased bank monitoring following an IPO could reflect only the equity increase during the IPO, instead of the change in the private and public status. In both cases, we are not able to draw any conclusion about the dominance of the proposed three channels. We will examine the first case in the current section and the second case in the next section.

The post-IPO changes in loan contracts might due to the firm life cycle, instead of the effect of going public. Specifically, firms in their growth stage typically have more investment opportunities, higher likelihood of exercising growth options, and therefore larger stockholder-bondholder conflicts. Therefore, more credit protection is needed to mitigate these conflicts. Bradley and Roberts (2004) and Billett, King, and Mauer (2007) provide evidence that firms' growth opportunities are positively related to the use of covenants. Firms in general choose to go public in their growth stage when they have more investment opportunities and this could be the reason we see an increase in the use of state-contingent provisions in post-IPO loan contracts.

To identify whether the changes in loan contracts after IPO is caused by firms' going public rather than the firms' life cycle, we compare firms that file and complete an IPO with firms that file and withdraw an IPO. Both type of firms file an initial registration statement with the SEC in an attempt to go public, indicating that they are in the same stage of the firm life cycle, but those complete an IPO become public firms while those withdraw remain private. According to Dunbar and Foerster (2008) and Edelen and Kadlec (2005), a surprisingly large percentage of proposed IPOs are withdrawn from the market before being completed. For example in 1985 to 2000, almost one in five IPOs are withdrawn due to factors like unfavor market conditions. If we see a significant difference in the post-issue changes in loan contracting for IPO complete firms

and IPO withdrawn firms, we could conclude that the increase in bank monitoring through the use of performance pricing and loan covenants is caused by firms' changing the public-private status, instead of the effect of firms' life cycle or growth opportunities.

The sample selection for IPO withdrawn firms is the same as that for IPO complete firms. We start with all non-utility and non-financial firms in the SDC Global New Issues Database that filed an IPO in 1997-2013. We exclude REITs, units, ADRs, and offerings with the stock price below $5, and keep records with transaction status of "CANCELLED." We further require the withdrawn firms to have at least one loan within 3 years before and one loan within 3 years after filing, leaving us with 43 firms in 1997-2013. The number of withdrawn firms constitutes less than 10% of the complete IPOs in our sample period. The relatively low percentage could due to the fact that the withdrawn firms remain private after registration, and thus they have lower ability of raising capital in the loan market compare to public firms. Consequently, the percentage of firms with both pre- and post-filing loans would be lower for withdrawn firms. We manually collect withdrawn firms' financial information from Form S-1 filings from the SEC EDGAR database. In total, we have 243 loan facilities from 137 loan packages issued by these 43 withdrawn IPO firms in 1994-2016.

Table 6 compares the pre-and post-IPO loan characteristics for 3,315 loan facilities from 2,052 loan packages issued by 529 complete IPO firms, and 243 loan facilities from 137 loan packages issued by 43 withdrawn IPO firms. Panel A reports statistics for performance pricing at the facility level, and Panel B displays statistics for covenants at the package level. We split the loan sample into pre- and post-IPO loans according to the IPO issue date for IPO complete firms, and IPO filing date for IPO withdrawn firms (because they do not have issue date). In particular, we can see that for IPO complete firms the use of both performance pricing and loan covenants increase dramatically in the post-IPO loan contracts relative to pre-IPO loan contracts. On the contrary, for IPO withdrawn firms, the use of both types of state-contingent provisions decrease significantly. In addition, loan spread increases for firms that complete an IPO and become public, but decreases for firms withdraw an IPO and thus remain private. Finally, the loan amount increases and maturity decreases for both groups.

Using our complete IPOs as the treatment group and withdrawn IPOs as the control group, we run difference-in-differences (DiD) tests, specified in Equation (2), to compare bank monitoring

for the two types of firms.

$$PSD_i = \alpha + \beta \cdot \textit{Post}_i + \gamma \cdot \textit{Post}_i \times \textit{Treated}_j + \Theta \cdot \mathbf{X}'_{i,j,t} + \mu_t + \eta_j + \epsilon_{i,j,t}, \tag{2}$$

Specifically, we add an interaction term, *Post*×*Treated*, to Equation (1), where *Treated* is a dummy variable that equals to one for complete IPOs and zero for withdrawn IPOs.

One caveat in conducting the above DiD analysis is that, we might introduce some biases associated with the firm's decision to withdraw an IPO if we simply compare the whole complete IPOs with the whole withdrawn IPOs. For this reason, we employ a propensity score matching (PSM) approach to construct a matched sample, i.e., for each withdrawn IPO in our sample, we match three complete IPOs using $\log$(*Book Assets*), *Book Leverage*, *Tangibility*, *Profitability*, *Cash Ratio*, and *Gross Proceeds*, in addition to year fixed effects. The matching is done without replacement and the maximum difference in the propensity score allowed for a match is 1%. This results in a sample of 75 complete IPOs and 36 withdrawn IPOs.

The matching results are reported in Table 7. In Panel A, we present results from Logit regressions used to calculate the propensity scores for the matching procedure, where the dependent (dummy) variable is set to one for complete IPOs and zero for withdrawn IPOs. Columns (1)-(2) respectively show coefficients for the complete and withdrawn IPO sample before and after matching. Panel B displays the distribution of propensity scores from the regression in Column (2) of Panel A. After matching, all the six variables exhibit no significant difference between complete IPOs and withdrawn IPOs, suggesting that our matched sample satisfies the important validity criteria of PSM (see, e.g., Fang, Tian, and Tice, 2014).

Table 8 reports results of the DiD tests. Panel A shows results for performance pricing at the facility level, with dependent variables equal to *Increasing PSD*, *Decreasing PSD*, and *PSD* across different columns indicated by column headers. In Columns (1)-(3), we use all complete and withdrawn IPO firms as treatment and control groups, while in Columns (4)-(6) we use the matched sample to conduct the DiD analysis. Across all columns, we include a list of firm, loan and IPO controls, as well as year, industry, bank and loan purpose fixed effects. We can see that the interaction term, *Post*×*Treated*, enters with a significantly positive coefficient in all specifications, indicating that the increased probability of using of performance pricing in post-IPO loans

is significantly larger for IPO complete firms than for IPO withdrawn firms, and the economical magnitude is remarkably large. In particular, according to Column (4) with all controls and fixed effects, IPO complete firms experience an 170% larger increase in the use of interest-increasing performance pricing in post-IPO loan contracts relative to IPO withdrawn firms. Furthermore, Panel B presents results of DiD analysis for loan covenants at the package level. In general, the results are consistent with Panel A, where we see a 50.75% larger increase in the use of financial covenant, and a 37.56% larger increase in the use of total covenants for IPO complete firms relative to IPO withdrawn firms.

Withdrawn IPO firms do not complete the transition from a private to public company but have the intention of going public. In other words, they are in the same stage of the firm life cycle as the complete IPO firms. Therefore, the above results show that the post-filing increase in the use of state-contingent provisions is indeed caused by firms' going public rather than an effect of the firm life cycle, thus confirming our Hypothesis II.

4.3 Are Changes in Loan Contracts due to Equity Increase through IPO? Evidence from Secondary IPOs and comparable SEOs

According to Hypothesis III, the increased use of state-contingent provisions in post-IPO loans might not be an effect of firm going public or the changing the public-private status. Instead, it might due to the equity increase during IPO, which raises the firm's creditworthiness and hence increases the use of performance-contingent terms in the loan contracts (e.g., Manso, Strulovici, and Tchistyi, 2010). To alleviate this concern, we conduct two analysis. First, we examine loans made by for a group of IPO firms that do not raise any equity in the IPO market, also called secondary IPOs. If we see a significant increase in the use of state-contingent provision in loan contracts for these firms, we could conclude that going public affect bank monitoring, which is beyond the effect of an equity increase. Second, we compare the effects of going public on the post-issue changes in bank monitoring between IPOs and SEOs, both of which experience an equity increase, but the latter do not change the issuer's public-private status. A significant difference in the post-issue changes in performance pricing and loan covenants would confirm the role going public plays on bank monitoring.

Secondary IPOs refer to the group of firms that went public for the sole purpose of allowing existing shareholders to cash out, as opposed to raising equity or to repay debt. These firms undergo a transition from private to public status, without experiencing an equity increase. Studying this set of firms would allow us to sperate the impact of going public on loan contracting from the effect of equity increase. In total, we identify 42 secondary IPOs from 1997-2013 from Asker, Farre-Mensa, and Ljungqvist (2014) (Table IA.3). We further require the firm to have at least one loan before and one loan after IPO, which leaves us with 28 firms. In total, these firms issue 174 facilities from 122 packages between 3 years before and 3 years after IPO in 1994-2016. We collect their accounting information from Compustat and manually complete the missing information on pre-IPO data from S-1 filings in SEC EDGAR database.

Panel A and Panel B of Table 9 report pre- and post-IPO loan characteristics for our secondary IPOs at the facility and package level respectively. In general, the results are similar to that in Table 1. First, there is a decrease in borrowing cost, as well as loan maturity after firms go public, and an increase in loan amount. Additionally, we can see that there is indeed a significant increase in the use of all performance-contingent terms in post-IPO loans for secondary IPO firms. The change is especially tremendous for interest-increasing performance pricing, which increases by 338%. As this group of firms do not raise new equity during IPO, the results suggest that the post-IPO increase in the use of performance-sensitive terms is beyond an effect of equity increase.

Given that the sample of secondary IPO firms with DealScan loans is rather small, multivariate analysis is not feasible. We thus conduct additional analyses, comparing the post-issue changes in loan contracts between IPOs and SEOs. Like IPOs, SEOs increase firm equity; but unlike IPOs, SEOs do not affect the firms' private-public status. If firms experience significantly larger increase in the use of state-contingent provisions after IPO than after SEO, we could conclude that going public increases bank monitoring, which is beyond the effect of equity increase.

We start with all SEOs in the SDC Database, made by non-utility and non-financial firms in 1997-2013. We exclude those with an issue price below U.S. $5, and keep security types as "Common Shares" and "Ord/Common Shs." We further require the issuing firm to have at least one loan within 3 years before SEO and one loan within 3 years after SEO. We drop SEOs that fall within three years after IPO so that there is no intersection between loan observations for the

two samples. This leaves us with 2,646 SEOs. Given that we have only 529 IPOs in our sample, we might be picking up other firm characteristics if simply comparing the IPOs with these 2,646 SEOs. For this reason, we also employ a propensity score matching (PSM) approach to construct a matched SEO sample. Specifically, for each IPO in our sample, we match a SEO through a PSM using $\log$(*Book Assets*), *Book Leverage*, *Tangibility*, *Profitability*, *Cash Ratio,* and *Gross Proceeds*, in addition to year fixed effects. The matching is done without replacement and the maximum difference in the propensity score allowed for a match is 1%.

Using our IPOs as the treatment group and all or matched SEOs as the control group, we run the same difference-in-differences (DiD) tests specified in Equation (2), to compare the effects of IPOs and SEOs on bank monitoring. *Treated* is a dummy variable that equals to one for IPOs and zero for SEOs.

The results are reported in Table 10. In Panel A, we report results from Logit regressions used to calculate the propensity scores for the matching procedure, where the dependent (dummy) variable is set to one for IPOs and zero for SEOs. Columns (1) and (2) respectively show coefficients for the sample before matching (IPOs and SEOs) and the matched sample (IPOs and SEOs). After matching, all the six variables exhibit no significant difference between IPOs and SEOs, suggesting that our matched sample satisfies the important validity criteria of PSM (see, e.g., Fang, Tian, and Tice, 2014). Table 11 reports results of the DiD tests, where Columns (1)-(3) show results for performance pricing at the facility level, and Columns (4)-(7) displays results for loan covenants at the package level. In all specifications, the interaction, *Post*$\times$*Treated*, enters with a significantly positive coefficient, indicating that the increase use of state-contingent provisions after IPO is significantly larger than that after SEO. In particular, according to Column (1) with all controls and fixed effects, the average increase in the use of interest-increasing performance pricing for IPOs is 102% larger than that for the matched SEOs. Similarly, according to Column (4), the average increase in the use of financial covenants is 13.03% larger for IPOs than that for the matched SEOs. Both differences are statistically significant and economically large.

SEOs do not change the firms' public-private status but increase firm equity, so the above results confirm that the significant increase in bank monitoring after IPO is indeed an effect of going public and is beyond the effect of equity increase from IPO, and hence confirm our Hypothesis III.

5 Robustness Checks

5.1 Controlling for the Loan Spread

We are aware that state-contingent provisions and loan cost are determined simultaneously in loan contracts. For example, according to Asquith, Beatty, and Weber (2005), interest-increasing performance pricing typically benefits the lender, and the borrower is compensated with a lower interest to participate. While going public significantly lower loan spread, one might argue that this is the reason we see an increase in the use of state-contingent provisions in post-IPO loan contracts. In response to this, we conduct a robustness test for our baseline analysis in Section 4.1. Specifically, we add the logarithm of loan spread, $\log$(AIS), to Equation (1) and present the results in Table A.1. In general, the findings are similar to our baseline results documented in Section 4.1. *Post* enters all specifications with a positive coefficient and the economical magnitude remain remarkably large. Specifically, according to Columns (1) and (4), going public significant increase the probability of using interest-increasing performance pricing and financial covenants by 102% and 10.62% respectively, after taking account of the simultaneous effect from the loan spread. Additionally, we can see that the coefficient of $\log$(AIS) on performance pricing is significantly negative in Columns (1)-(3) , indicating that loan contracts are more likely to include performance-pricing provisions when borrowers are compensated with a lower loan spread. However, the impact of loan spread on the use of loan covenants is only significant for financial covenants, with a lower loan spread associated with higher likelihood of using financial covenants. Overall, the results show that our findings of going public significantly increasing bank monitoring are robust to controlling for the loan spread.

5.2 Alternative Sample of IPOs

In examining the effect of going public on bank monitoring, we rely on a sample of IPOs that have both pre- and post-IPO loans in 1997-2013. Concentrating on this sample allow us to focus on the within-firm changes in loan contracts rather than cross-sectional differences in loan terms. In Appendix II, we provide a detailed analysis on the percentage of IPOs with pre- and/or post-IPO loans. It turns out that firms with both pre- and post-IPO syndicated loans constitute only around

20% of IPOs in 1997-2013. These firms are in general larger in size compared to the overall IPO sample. One potential caveat is that our results might introduce some selection bias and might not generalize beyond large firms if we simply rely on these firms.

In this section, we display results using an alternative sample where we include loans issued by all non-utility and non-financial firms which complete IPO on the NYSE, AMEX and NASDAQ stock exchanges in 1997-2013. We do not require the IPO firm to have at least one pre-IPO and one post-IPO loan, and excluding this requirement gives us a broader sample of IPOs with a smaller firm size on average. Following our main sample, we focus on loans made by these firms between 3 years before IPO and 3 years after IPO. In total, we have 4,924 loan facilities from 3,175 loan packages issued by 1,252 firms in 1994-2016. We use this alternative sample to test all our hypotheses developed in Section 2.

Table A.2 displays baseline results studying the effect of going public on bank monitoring using this sample. In Columns (1)-(3), we replicate results in Table 2, where the dependent variable is *Increasing PSD*, *Decreasing PSD*, and *PSD* respectively. Moreover, in Columns (4)-(7) we replicate results in Table 4 and Table 5, with dependent variables equal to *FinCov*_D, $\log$(*N_FinCov*), *Cov*_D, $\log$(*N_Cov*) respectively. Across all columns, we add firm, loan and IPO controls, as well as year, industry, bank and loan purpose fixed effects. In general, the results are quite consistent. Firms use more performance pricing and loan covenants after going public, and the number of financial covenants and covenants also increase significantly in post-IPO loan contracts. Moreover, the economical magnitude remains at the same level. Going public increases the probability of including interest-increasing performance pricing by 121% and increases the probability of including financial covenants by 7.88%, reconfirming our Hypothesis I.

In Table A.3, we replicate the analysis in Table 8, comparing post-filing changes in the use of state-contingent terms in loan contracts for IPO complete firms and IPO withdrawn firms in 1997-2013. We do not require the withdrawn firms to have at least one loan within 3 years before and one loan within 3 years after filing. Instead, we keep loans issued by all withdrawn firms within 3 years before and after registration, leaving us with 571 loan facilities from 328 loan packages made by 174 withdrawn firms in 1994-2016. Using these IPO complete and withdrawn sample, we replicate the PSM and DiD analysis in Table 8. Columns (1)-(3) show results of DiD tests for performance

pricing at the facility level, and Columns (4)-(7) display DiD tests for loan covenants at the package level. According to Columns (1)-(3), relative to IPO withdrawn firms, the matched IPO complete firms have a larger increase in the use of performance pricing in post-IPO loan contracts. The effect is in particular strong for interest-increasing performance pricing. Similarly, Column (4)-(7) shows that firms after the transition from private to public have a significantly larger increase in the use of financial covenants and covenants, compared to firms that do not complete the transition process. Overall, these results show that our Hypothesis II is verified using this alternative loan sample as well.

Finally, we retest our Hypothesis III, examining whether the significantly larger increase in the use of state-contingent terms in post-issue loans is larger for IPOs relative to SEOs using this sample. We do not require the SEO firms to have at least one loan before and one loan after equity issue. We keep all loans issued by SEO firms within 3 years before and after equity issue in 1994-2016. We drop SEOs that fall within three years after IPO, so that there is no intersection between loans issued by IPO firms and SEO firms. Table A.4 presents results for this robustness test. We replicate the PMS and DiD analysis in Table 11 using the alternative sample of IPOs and SEOs, where Columns (1)-(3) show results for performance pricing at the facility level, and Columns (4)-(7) display results for loan covenants at the package level. In general, the results are quite similar with that in Table 11, both economically and statistically. The interaction term, *Post*$\times$*Treated*, enters with a significantly positive coefficient for performance pricing and total covenants, indicating that the increase in the use of performance pricing and total covenants is significantly larger after an IPO than that after a SEO, thereby reconfirming our Hypothesis III.

In summary, the results in this section show that our findings are not driven by sample selection bias. In other words, the conclusion that going public significantly increases bank monitoring also applies to firms with smaller size.

5.3 Alternative Time Window

Our study concentrates on loans made by firms within 3 years before and 3 years after IPO. To see that our results are not picking up some random patterns for loan contracting around IPO, we conduct a robustness analysis using different window years. We replicate our baseline results using

a window year of two in Table A.5, and using a window year of year in Table A.6. Regardless of the time window we choose, loans issued after IPO are more likely to include performance pricing and loan covenants compared to loans issued before IPO. In addition, the economical magnitude remains at a similar level. Overall, the results suggest that our finding is not sensitive to alternative window years, and therefore is not picking up some random patters around IPO.

6 Further Discussion: Separating the Channels

We have documented that going public significantly increases bank monitoring, i.e., the monitoring costs channel and the ownership channel together dominate the information asymmetry channel. However, at this stage, we are still not able to identify which one of the two channels is more important. One step further is therefore to distinguish the channels. In this paper, we won't completely separate these three channels, but we try to verify the presence of the monitoring costs channel and the ownership channel.

First, the ownership channel predicts that a dispersed ownership and free-rider problems after firms go public should increase the demand of bank monitoring. While interest-increasing performance pricing imposes a threat to the borrower to maintain certain firm performance, interest-decreasing performance pricing saves borrowing cost based on improved performance and is an option of the borrowers. This means interest-increasing performance pricing should be more relevant for lenders if demand of monitoring increases after firms go public. In other words, the ownership channel predict a larger increase in the use of interest-increasing performance pricing while the monitoring costs channel would predict a similar level of increase for both types of performance pricing. According to Table 2, we can see that the increase in performance pricing is mainly driven by a remarkable increase (141%) in interest-increasing performance pricing, but not in interest-decreasing performance pricing (54.83%). Similarly, the package level analysis in Table 3 gives consistent results. Taking together, the large difference between the increase in the use of interest-increasing performance pricing and interest-decrease performance pricing in post-IPO loan contracts verifies the presence of the ownership channel, and therefore confirm our Hypothesis IV.

Second, to verify the presence of monitoring costs channel, we study firms that have issued

public bonds before IPO. The SEC regulations over the private firms with public bonds, concerning financial disclosure, are the same as those over listed firms. That is, for these private firms, information asymmetry and disclosure quality do not change significantly before and after IPO, and hence the monitoring costs channel should has little or no impact on these firms. We therefore split our sample firms into two subsamples: one with public bonds before IPO, and the other without, and we replicate our baseline analysis for the two subsamples separately. Results are presented in Table 12. Specifically, Columns (1)-(2) examine the effect of going public on the use of interest-increasing performance pricing, and Columns (3)-(4) study the effect on the use of financial covenants for each subsample. Comparing Column (1) and Column (2), we can see the increased use of interest-increasing performance pricing after IPO is smaller for firms with pre-IPO bond issues relative to those without, though the difference is not statistically significant. Moreover, Column (3) and Column (4) show that the effect of going public on financial covenant is weaker for firms with pre-IPO bond issues than those without. Overall, the findings are consistent with the presence of the monitoring costs channel.

7 Conclusion

In this paper, we document that going public significantly influence bank monitoring through a few channels. First, going public improves information transparency of the IPO firm, and reduces lender-borrower information asymmetry, lowering the demand of bank monitoring. Second, public firms are subject to strict regulation and more analyst coverage, both of which improve the quality of disclosure, leading to lower monitoring costs and higher supply of monitoring. Third, after going public, dispersed ownership aggravates the free-rider problem, which impedes shareholders' monitoring over firm decisions. Bank monitoring is thus more desired to reduce managerial agency problems. The three channels have opposite predictions, and it is thus an empirical issue which channel dominates. In this paper, we examine how going public affects bank monitoring through the use of state-contingent terms in loan contracts, such as performance pricing and loan covenants. These terms, as the key means of bank monitoring, link firm performance to borrowing costs, and help mitigate conflicts of interest between lenders and borrowers. We provide evidence of a significant increase in bank monitoring after firms' going public. This increase is neither driven by

the firm life cycle nor by equity increase during IPO, and is robust to various model specifications and identification strategies. Overall, our results support the presence and importance of the second and third channels.

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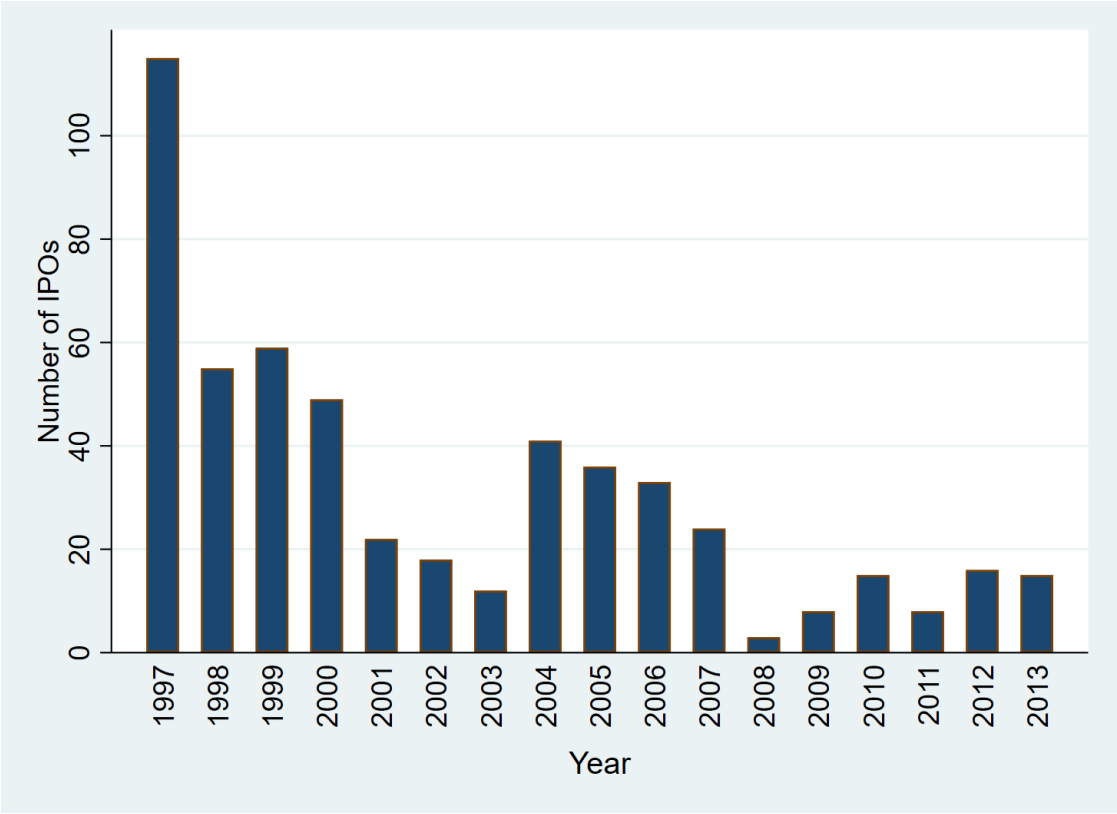

Figure 1: The Number of IPOs over Calendar Years

This figure shows the number of IPOs in our sample over years. The sample in total consists of 529 IPOs. To construct this sample, we start with non-utility and non-financial firms in the SDC Global New Issues Database, which complete IPO on the NYSE, AMEX and NASDAQ stock exchanges in 1997-2013. We exclude REITs, units, ADRs, and offerings with the stock price below $5. We choose the sample period as 1997-2013 for two reasons. First, the SEC EDGAR system was introduced in 1993. The majority of loan data in the DealScan database are collected from the SEC filing in EDGAR. We find that only after 1993, loan covenant information is relatively complete. For this reason, our loan sample starts in 1994, and ends in 2016. Second, we require every firm to have at least one loan facility in DealScan within 3 years before IPO and one loan facility within 3 years after IPO. This results in our IPO sample period as 1997-2013. The figure shows that in general, there are less IPO observations over time in the sample period, reflecting the constant decline in the number of U.S. IPOs and public firms in the past three decades (see, e.g., Doidge, Karolyi, and Stulz, 2017).

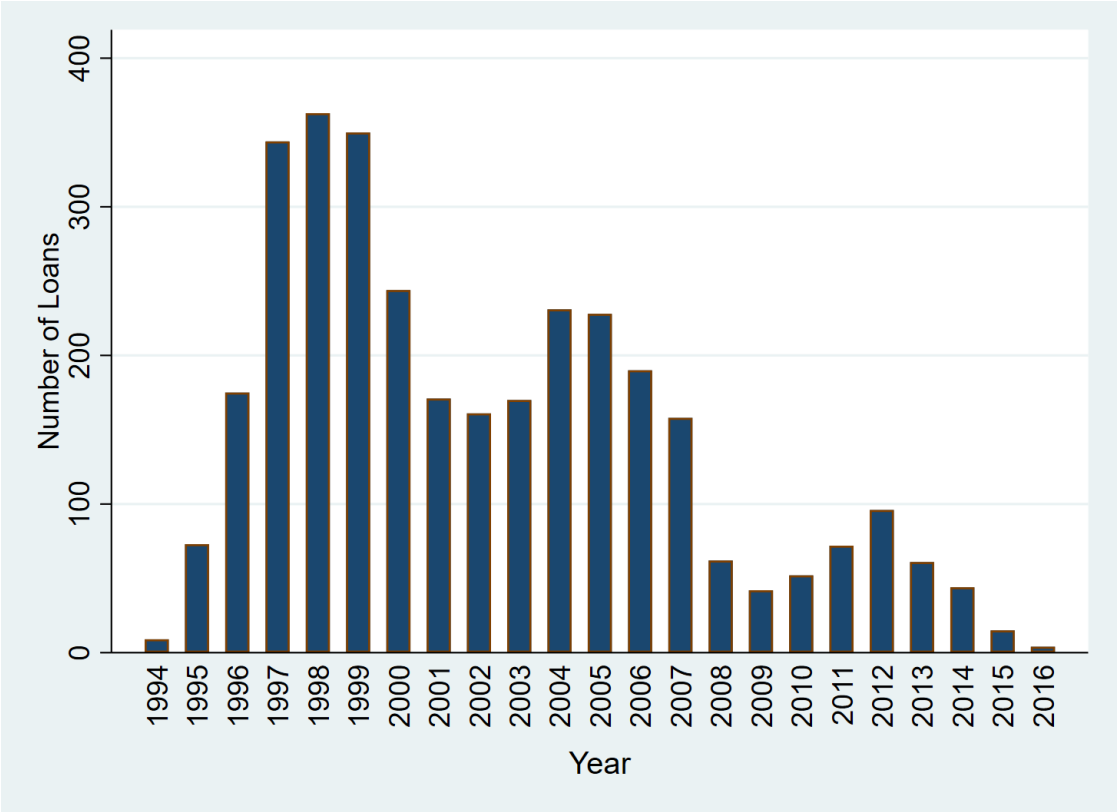

Figure 2: The Number of Loan Facilities over Calendar Years

This figure presents the distribution of the number of loan facilities in our sample from 1994-2016. The full sample consists of 3,315 bank loan facilities, each of which is made by an IPO firm between 3 years before and 3 years after IPO. From the the SDC Global New Issues Database, we require the IPO firm to be non-utility and non-financial, and complete IPO on the NYSE, AMEX and NASDAQ stock exchanges. We then exclude REITs, units, ADRs, and offerings with the stock price below $5.

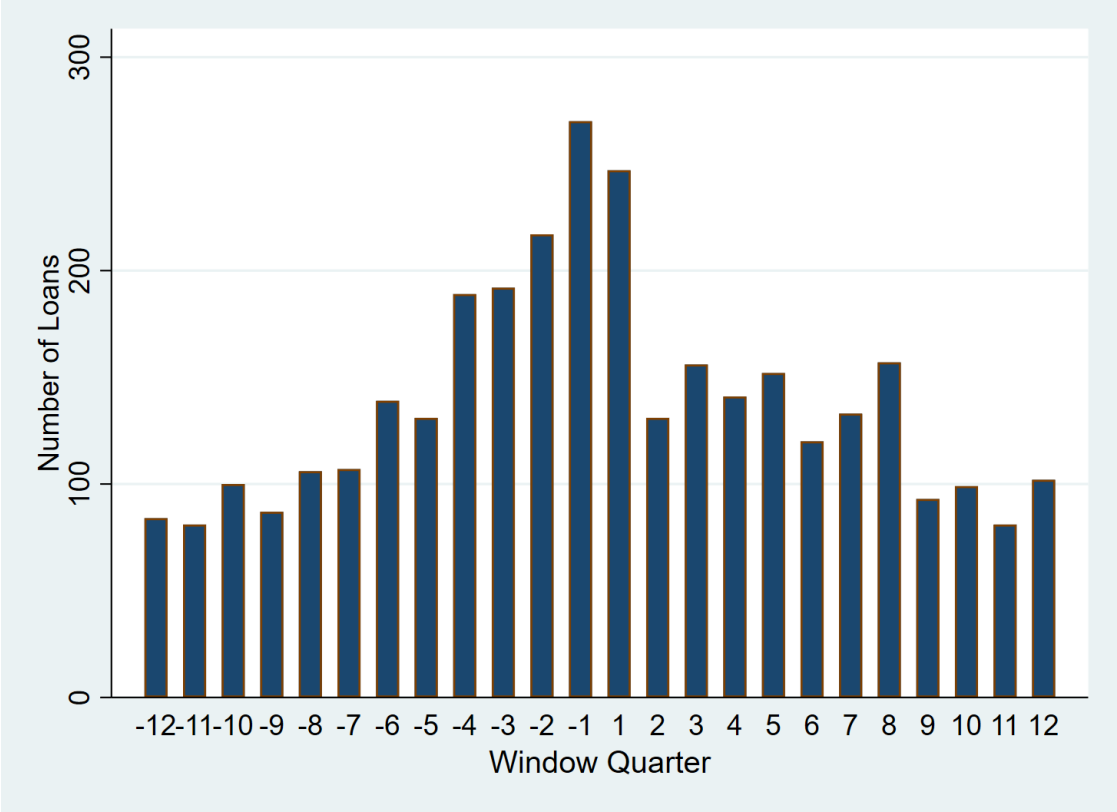

Figure 3: The Number of Loans over Window Quarters

This figure shows the distribution of the number of loan facilities in our sample across the 24 quarters between 3 years before and 3 years after IPO. The full sample consists of 3,315 bank loan facilities in 1994-2016, made by 529 IPO firms that went public in 1997-2013. From the the SDC Global New Issues Database, we require the IPO firm to be non-utility and non-financial, and complete IPO on the NYSE, AMEX and NASDAQ stock exchanges. We then exclude REITs, units, ADRs, and offerings with the stock price below $5.

Table 1: Statistics for Loan and Borrower Characteristics: Pre- vs. Post-IPO

This table compares the key loan and borrower characteristics for pre-and post-IPO loans in 1994-2016. The borrowers in our sample are IPO firms that selected through the process described in Section 3.1. In total, we have 3,315 loan facilities from 2,052 loan packages, each is borrowed by an IPO firm between 3 years before and 3 years after IPO. Panel A and Panel B reports loan characteristics at the facility and package level respectively, and Panel C shows borrower characteristics. All variables are winsorized at the 1^{st} and 99^{th} percentiles, and are summarized in Appendix I. All dollar amounts are in 2010 real dollars.

	Pre-IPO						Post-IPO						Diff.
	N	Mean	SD	p10	p50	p90	N	Mean	SD	p10	p50	p90	
Panel A: Loan Characteristics at the Facility Level: Pre- and Post-IPO (obs:3,315)													
AIS (bps)	1,486	288.16	126.72	156.00	275.00	425.00	1,435	241.07	123.10	125.00	225.00	375.00	-47.09***
Maturity (month)	1,595	56.88	28.43	13.00	60.00	95.00	1,527	53.52	24.90	16.00	60.00	84.00	-3.36***
Loan Amount ($ million)	1,703	200.08	355.94	5.95	82.53	499.92	1,612	253.54	374.57	12.64	123.61	618.05	53.46***
Secured	1,355	0.95	0.21	1.00	1.00	1.00	1,340	0.94	0.24	1.00	1.00	1.00	-0.01
PSD	1,703	0.31	0.46	0.00	0.00	1.00	1,612	0.42	0.49	0.00	0.00	1.00	0.11***
Increasing PSD	1,703	0.09	0.29	0.00	0.00	0.00	1,612	0.23	0.42	0.00	0.00	1.00	0.14***
Decreasing PSD	1,703	0.29	0.45	0.00	0.00	1.00	1,612	0.37	0.48	0.00	0.00	1.00	0.08***
Panel B: Loan Characteristics at the Package Level: Pre- and Post-IPO (obs:2,052)													
Maturity (month)	951	58.20	31.14	12.00	60.00	96.00	977	52.76	26.60	12.00	60.00	84.00	-5.44***
Loan Amount ($ million)	1,028	361.03	647.92	7.39	139.10	931.35	1,024	394.19	588.82	18.13	186.47	979.78	33.16
FinCov_D	1,028	0.56	0.50	0.00	1.00	1.00	1,024	0.65	0.48	0.00	1.00	1.00	0.09***
N_FinCov	1,028	1.67	1.73	0.00	1.00	4.00	1,024	1.87	1.69	0.00	2.00	4.00	0.20***
Cov_D	1,028	0.63	0.48	0.00	1.00	1.00	1,024	0.71	0.46	0.00	1.00	1.00	0.08***
N_Cov	1,028	3.80	3.86	0.00	3.00	10.00	1,024	4.07	3.56	0.00	4.00	9.00	0.27
Panel C: Borrower Characteristics: Pre- and Post-IPO (obs:1,556)													
Book Assets ($ million)	996	1,517	4,051	98.19	315.97	3,162	982.00	2,018	4,569	220.42	612.68	4,184	500.27**
Book Leverage	962	0.53	0.37	0.28	0.49	0.93	982.00	0.39	0.30	0.17	0.38	0.73	-0.14***
Cash Ratio	948	0.10	0.16	0.01	0.03	0.28	977.00	0.10	0.15	0.01	0.04	0.29	0.01
Profitability	973	-0.02	0.19	-0.03	0.01	0.14	978.00	-0.00	0.16	-0.02	0.03	0.12	0.02**
Tangibility	929	0.33	0.26	0.11	0.26	0.76	982.00	0.33	0.27	0.11	0.24	0.77	0.00

Table 2: Pre- and Post-IPO Loans: Performance Pricing at the Facility Level

This table presents regression results of Probit models examining the use performance pricing in firms' loan contracts before and after IPO. The analyses are conducted at the facility level, with 3,315 loan observations (there are dropped observations due to fixed effects) in 1994-2016. All the loans are issued by firms that complete an IPO in 1997-2013, and are borrowed within three window years before and after IPO. The dependent variable in Columns (1)-(4) is a dummy, *Increasing PSD*, that equals to one if the loan facility contains interest-increasing performance pricing, in Columns (5)-(6) is a dummy, *Decreasing PSD*, that equals to one if the loan facility contains interest-decreasing performance pricing, and in Columns (7)-(8) is a dummy, *PSD*, that equals to one if the loan has performance pricing. Column (1) includes only the *Post* dummy, which is equal to one for loans made after IPO, with industry and loan year fixed effects. Columns (2) adds loan characteristics, bank fixed effects and loan purpose fixed effects. Columns (3) further includes firm characteristics, and Column (4) also adds IPO characteristics. Except having different the dependent variables, Columns (5) and (7) replicate the specification in Columns (3), and Columns (6) and (8) replicate the specification in Columns (4). All variables are winsorized at the 1^{st} and 99^{th} percentiles, and are summarized in Appendix I. Standard errors are clustered at the firm level to correct for heterogeneity and t-values are presented in parentheses. *, **, and *** indicate that the coefficient is statistically significant at the 10%, 5%, and 1% levels, respectively.

Y-Variable	*Increasing PSD*				*Decreasing PSD*		*PSD*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post	**0.675*** **	**0.651*** **	**0.589*** **	**0.604*** **	**0.177** **	**0.159** **	**0.271*** **	**0.253*** **
	(7.78)	**(7.13)**	**(5.97)**	**(5.93)**	**(2.34)**	**(2.04)**	**(3.57)**	**(3.21)**
log(Loan Amount)		0.194***	0.218***	0.214***	0.092***	0.098***	0.132***	0.137***
		(6.05)	(5.34)	(5.21)	(2.65)	(2.78)	(3.70)	(3.84)
log(Maturity)		0.079	0.117*	0.116	0.219***	0.218***	0.234***	0.232***
		(1.23)	(1.65)	(1.63)	(3.36)	(3.34)	(3.57)	(3.54)
Secured		-0.115	-0.072	-0.060	0.447**	0.432**	0.363**	0.348*
		(-0.65)	(-0.38)	(-0.31)	(2.52)	(2.44)	(2.00)	(1.92)
log(Book Assets)			-0.051	-0.074	0.014	0.034	-0.011	0.010
			(-1.20)	(-1.53)	(0.38)	(0.78)	(-0.30)	(0.23)
Book Leverage			-0.583***	-0.593***	-0.153	-0.147	-0.311**	-0.306**
			(-3.82)	(-3.93)	(-1.07)	(-1.02)	(-2.10)	(-2.06)
Tangibility			0.396*	0.425*	-0.155	-0.175	0.010	-0.009
			(1.74)	(1.84)	(-0.73)	(-0.83)	(0.05)	(-0.04)
Profitability			1.077***	1.027***	1.136***	1.147***	1.265***	1.271***
			(3.38)	(3.24)	(3.67)	(3.70)	(3.99)	(4.01)
Cash Ratio			-1.250***	-1.205***	-1.271***	-1.255***	-1.131***	-1.104***
			(-3.25)	(-3.16)	(-3.92)	(-3.76)	(-3.69)	(-3.50)
VC-backed				-0.119		0.002		-0.012
				(-0.89)		(0.02)		(-0.10)
Gross Proceeds				0.039		-0.048		-0.049
				(0.61)		(-0.81)		(-0.83)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loan Purpose FE	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	3,268	3,054	2,812	2,812	2,837	2,837	2,837	2,837
pseudo R^2	0.120	0.179	0.200	0.201	0.188	0.188	0.198	0.198

Table 3: Pre- and Post-IPO Loans: Performance Pricing at the Package Level

This table presents regression results of Probit models examining the use performance pricing in firms' loan contracts before and after IPO. The analyses are conducted at the package level, with 2,052 loan observations (there are dropped observations due to fixed effects) in 1994-2016. All the loans are issued by firms that complete an IPO in 1997-2013, and are borrowed within three window years before and after IPO. The dependent variable in Columns (1)-(4) is a dummy, *Increasing PSD*, that equals to one if the loan facility contains interest-increasing performance pricing, in Columns (5)-(6) is a dummy, *Decreasing PSD*, that equals to one if the loan facility contains interest-decreasing performance pricing, and in Columns (7)-(8) is a dummy, *PSD*, that equals to one if the loan has performance pricing. Column (1) includes only the *Post* dummy, which is equal to one for loans made after IPO, with industry and loan year fixed effects. Columns (2) adds loan characteristics, bank fixed effects and loan purpose fixed effects. Columns (3) further includes firm characteristics, and Column (4) also adds IPO characteristics. Except having different the dependent variables, Columns (5) and (7) replicate the specification in Columns (3), and Columns (6) and (8) replicate the specification in Columns (4). All variables are winsorized at the 1^{st} and 99^{th} percentiles, and are summarized in Appendix I. Standard errors are clustered at the firm level to correct for heterogeneity and t-values are presented in parentheses. *, **, and *** indicate that the coefficient is statistically significant at the 10%, 5%, and 1% levels, respectively.

Y-Variable	*Increasing PSD*				*Decreasing PSD*		*PSD*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post	**0.591*** **	**0.627*** **	**0.574*** **	**0.579*** **	**0.176** **	**0.106**	**0.298*** **	**0.236*** **
	(7.17)	**(6.93)**	**(5.98)**	**(5.74)**	**(2.24)**	**(1.29)**	**(3.82)**	**(2.88)**
log(Loan Amount)		0.231***	0.349***	0.346***	0.423***	0.457***	0.451***	0.480***
		(6.73)	(6.35)	(6.13)	(7.88)	(8.58)	(8.61)	(9.19)
log(Maturity)		0.164**	0.180**	0.181**	0.261***	0.242***	0.258***	0.242***
		(2.33)	(2.34)	(2.35)	(3.77)	(3.50)	(3.72)	(3.51)
log(Book Assets)			-0.121**	-0.129**	-0.239***	-0.165***	-0.254***	-0.189***
			(-2.51)	(-2.43)	(-4.98)	(-3.02)	(-5.34)	(-3.53)
Book Leverage			-0.713***	-0.716***	-0.259**	-0.252*	-0.493***	-0.490***
			(-4.92)	(-4.97)	(-1.96)	(-1.91)	(-3.68)	(-3.65)
Tangibility			0.265	0.273	-0.436**	-0.512**	-0.253	-0.317
			(1.22)	(1.23)	(-2.09)	(-2.45)	(-1.21)	(-1.51)
Profitability			0.768**	0.751**	0.984***	1.046***	1.171***	1.224***
			(2.40)	(2.34)	(3.83)	(3.96)	(4.49)	(4.52)
Cash Ratio			-0.953***	-0.939***	-0.940***	-0.906**	-0.830**	-0.791**
			(-2.77)	(-2.72)	(-2.65)	(-2.51)	(-2.56)	(-2.37)
VC-backed				-0.045		0.102		0.082
				(-0.34)		(0.84)		(0.68)
Gross Proceeds				0.013		-0.177***		-0.153**
				(0.21)		(-2.95)		(-2.55)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loan Purpose FE	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	2,015	1,875	1,708	1,708	1,721	1,721	1,721	1,721
pseudo R^2	0.121	0.175	0.202	0.202	0.183	0.188	0.198	0.201

Table 4: Pre- and Post-IPO Loans: Financial Covenants

This table presents regression results examining the use of financial covenants in firms' loan contracts before and after IPO. Financial covenants are defined as the terms in loan contracts that obligate the borrower to maintain one or more financial ratios during each reporting period, and the most commonly used financial covenants are listed in Appendix VI. The analyses are conducted at the package level, with 2,052 loan observations (there are dropped observations due to fixed effects) in 1994-2016. The loans are issued by firms that complete an IPO in 1997-2013, and are made within three window years before and after IPO. Across all columns, we include a dummy, *Post*, which is equal to one if the loan is made after IPO. The dependent variable in Columns (1)-(4) is a dummy, *FinCov_D*, that equals to one if the loan contains at least one financial covenant, and the analysis is estimated using Probit model. Column (1) includes only the *Post* dummy with industry and loan year fixed effects. Columns (2) adds loan characteristics, bank fixed effects and loan purpose fixed effects. Columns (3) further includes firm characteristics, and Column (4) also adds IPO characteristics. In Columns (6)-(7), the dependent variable is the logarithm of the number of financial covenants, log(*N_FinCov)*, and the model is estimated using OLS. Column (5) includes loan and firm controls, as well as firm and industry, loan year, bank and loan purpose fixed effects. Column (6) further adds IPO characteristics. All variables are winsorized at the 1^{st} and 99^{th} percentiles, and are summarized in Appendix I. Standard errors are clustered at the firm level to correct for heterogeneity and t-values are presented in parentheses. *, **, and *** indicate that the coefficient is statistically significant at the 10%, 5%, and 1% levels, respectively.

Y-Variable	*FinCov_D*				log(*N_FinCov*)	
	(1)	(2)	(3)	(4)	(5)	(6)
Post	**0.334*** **	**0.340*** **	**0.271*** **	**0.218*** **	**0.129*** **	**0.091** **
	(4.91)	**(4.66)**	**(3.52)**	**(2.72)**	**(3.69)**	**(2.47)**
log(Loan Amount)		-0.046	0.082	0.106**	0.061***	0.076***
		(-1.47)	(1.63)	(2.00)	(2.76)	(3.39)
log(Maturity)		0.072	0.051	0.033	0.062**	0.052*
		(1.24)	(0.82)	(0.53)	(2.15)	(1.82)
log(Book Assets)			-0.166***	-0.111**	-0.100***	-0.062***
			(-3.65)	(-2.34)	(-5.19)	(-2.64)
Book Leverage			-0.434***	-0.428***	-0.120**	-0.118**
			(-3.44)	(-3.35)	(-2.31)	(-2.31)
Tangibility			-0.201	-0.248	-0.093	-0.125
			(-0.96)	(-1.15)	(-0.92)	(-1.22)
Profitability			1.142***	1.139***	0.575***	0.561***
			(4.67)	(4.58)	(5.45)	(5.20)
Cash Ratio			-0.276	-0.246	-0.266*	-0.221
			(-0.92)	(-0.81)	(-1.92)	(-1.63)
VC-backed				0.052		0.005
				(0.47)		(0.10)
Gross Proceeds				-0.131**		-0.091***
				(-2.22)		(-3.14)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	Yes	Yes	Yes	Yes	Yes
Loan Purpose FE	No	Yes	Yes	Yes	Yes	Yes
N	2,044	1,908	1,724	1,724	1,752	1,752
pseudo/adj. R^2	0.072	0.095	0.134	0.137	0.163	0.170

Table 5: Pre- and Post-IPO Loans: All Types of Covenants

This table presents regression results examining the use of total covenants in firms' loan contracts before and after IPO. Total covenants consist of two types: financial covenants, which obligate the borrower to maintain one or more financial ratios during each reporting period and negative covenants, which require the borrower to cease or avoid doing something. A detailed description of different types of covenants are presented in Appendix VI. The analyses are conducted at the package level, with 2,052 observations (there are dropped observations due to fixed effects) in 1994-2016. The loans are issued by firms that complete an IPO in 1997-2013, and are made within 3 window years before and after IPO. Across all columns, we include a dummy *Post*, which is equal to one if the loan is made after IPO. The dependent variable in Columns (1)-(4) is a dummy, *Cov_D*, that equals to one if the loan contains at least one covenant, and the analysis is estimated using Probit model. Column (1) includes only the *Post* dummy with industry and loan year fixed effects. Columns (2) adds loan characteristics, bank fixed effects and loan purpose fixed effects. Columns (3) further includes firm characteristics, and Column (4) also adds IPO characteristics. In Columns (6)-(7), the dependent variable is the logarithm of the number of covenants, log(*N_Cov)*, and the model is estimated using OLS. Column (5) includes loan and firm controls, as well as firm and industry, loan year, bank and loan purpose fixed effects. Column (6) further adds IPO characteristics. All variables are winsorized at the 1^{st} and 99^{th} percentiles, and are summarized in Appendix I. Standard errors are clustered at the firm level to correct for heterogeneity and t-values are presented in parentheses. *, **, and *** indicate that the coefficient is statistically significant at the 10%, 5%, and 1% levels, respectively.

Y-Variable	*Cov_D*				log(*N_Cov*)	
	(1)	(2)	(3)	(4)	(5)	(6)
Post	**0.295*** **	**0.281*** **	**0.234*** **	**0.193** **	**0.161*** **	**0.121** **
	(4.23)	**(3.69)**	**(2.92)**	**(2.34)**	**(3.37)**	**(2.36)**
log(Loan Amount)		-0.022	0.088*	0.105**	0.154***	0.170***
		(-0.66)	(1.72)	(1.98)	(5.00)	(5.52)
log(Maturity)		-0.087	-0.096	-0.110*	0.018	0.008
		(-1.47)	(-1.50)	(-1.73)	(0.48)	(0.20)
log(Book Assets)			-0.113**	-0.072	-0.125***	-0.085**
			(-2.40)	(-1.46)	(-4.46)	(-2.49)
Book Leverage			-0.362***	-0.356***	-0.096	-0.095
			(-2.91)	(-2.85)	(-1.31)	(-1.29)
Tangibility			-0.043	-0.075	-0.229*	-0.262**
			(-0.22)	(-0.38)	(-1.86)	(-2.07)
Profitability			0.816***	0.805***	0.452***	0.433***
			(3.20)	(3.10)	(3.06)	(2.81)
Cash Ratio			0.100	0.144	-0.109	-0.053
			(0.31)	(0.43)	(-0.58)	(-0.28)
VC-backed				0.017		-0.007
				(0.15)		(-0.10)
Gross Proceeds				-0.098		-0.096**
				(-1.54)		(-2.34)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	Yes	Yes	Yes	Yes	Yes
Loan Purpose FE	No	Yes	Yes	Yes	Yes	Yes
N	2,044	1,908	1,722	1,722	1,752	1,752
pseudo/adj. R^2	0.067	0.092	0.113	0.115	0.136	0.139

Table 6: Pre- and Post-IPO Loan Characteristics: Complete vs. Withdrawn IPOs

This table shows pre-and post-IPO loan characteristics for loans issued by firms that file an IPO in 1994-2016. A majority of these firms finally complete an IPO, while the rest withdraw. In total, we have 3,315 loan facilities from 2,052 loan packages issued by 529 IPO complete firms, and 243 loan facilities from 137 loan packages issued by 43 IPO withdrawn firms. The withdrawn firms are selected through the process described in Section 4.2. Panel A reports statistics for performance pricing at the facility level, and Panel B displays statistics for covenants at the package level. We split the sample into pre- and post-IPO loans according to the IPO issue date for IPO complete firms, and the IPO filing date for IPO withdrawn firms. All variables are winsorized at the 1^{st} and 99^{th} percentiles, and are summarized in Appendix I. All dollar amounts are in 2010 real dollars.

	IPO Complete Firms (529 firms)					**IPO Withdrawn Firms (43 firms)**				
	Before IPO		After IPO		Chg.	Before IPO		After IPO		Chg.
	N	Mean	N	Mean		N	Mean	N	Mean	
Panel A: Performance pricing at the Facility Level										
AIS (bps)	1,486	288.16	1,435	241.07	-16.3%	113	299.18	101	324.65	+8.5%
Maturity (month)	1,595	56.88	1,527	53.52	-5.9%	121	55.00	104	52.59	-4.4%
Loan Amount ($ million)	1,703	200.08	1,612	253.54	+26.7%	129	259.82	114	266.58	+2.6%
Secured	1,355	0.95	1,340	0.94	-1.1%	105	0.89	77	0.94	+5.6%
PSD	1,703	0.31	1,612	0.42	+35.5%	129	0.28	114	0.10	-64.3%
Increasing PSD	1,703	0.09	1,612	0.23	+155.6%	129	0.09	114	0.05	-44.4%
Decreasing PSD	1,703	0.29	1,612	0.37	+27.6%	129	0.26	114	0.10	-61.5%
Panel B: Covenants at the Package Level										
Maturity (month)	951	58.20	977	52.76	-9.3%	66	59.92	62	52.66	-12.1%
Loan Amount ($ million)	1,028	361.03	1,024	394.19	+9.2%	71	535.41	66	453.10	-15.4%
FinCov_D	1,028	0.56	1,024	0.65	+16.1%	71	0.54	66	0.32	-40.7%
N_FinCov	1,028	1.67	1,024	1.87	+12.0%	71	1.46	66	0.80	-45.2%
Cov_D	1,028	0.63	1,024	0.71	+12.7%	71	0.58	66	0.39	-32.8%
N_Cov	1,028	3.80	1,024	4.07	+7.1%	71	3.03	66	1.91	-37.0%

Table 7: Propensity Score Matching: Complete vs. Withdrawn IPOs

This table presents propensity score matching results for firms that file and then complete an IPO and firms that file and then withdraw an IPO. The selection of withdrawn IPO is the same as that of the complete IPO, and we require every withdrawn IPO firm to have in DealScan at least one loan within 3 years before and one loan within 3 years after IPO. In total, we have 43 withdrawn IPO firms from 1997-2013. For each withdrawn IPO in our sample, we match three complete IPOs through a propensity score matching approach using log(*Book Assets*), *Book Leverage*, *Tangibility*, *Profitability*, *Cash Ratio*, and *Gross Proceeds*, in addition to year fixed effects. Panel A reports results from Logit regressions used to calculate the propensity scores for the matching procedure, where the dependent (dummy) variable is set to one for complete IPOs and zero for withdrawn IPOs. Columns (1)-(2) respectively show coefficients for the complete and withdrawn IPO sample before and after matching. Panel B displays the distribution of propensity scores from the regression in Column (2) of Panel A. All variables are winsorized at the 1^{st} and 99^{th} percentiles, and are summarized in Appendix I. Standard errors are clustered at the firm level to correct for heterogeneity and t-values are presented in parentheses. *, **, and *** indicate that the coefficient is statistically significant at the 10%, 5%, and 1% levels, respectively.

Panel A: Pre- and Post-Match Logit Regressions

	(1) Pre-Match	(2) Post-Match
log(Book Assets)	-0.234	0.171
	(-1.12)	(0.52)
Book Leverage	-0.818*	-0.826
	(-1.89)	(-1.02)
Tangibility	1.704**	1.872*
	(1.99)	(1.71)
Profitability	-0.261	-0.012
	(-0.21)	(-0.01)
Cash Ratio	1.833	0.260
	(1.40)	(0.13)
Gross Proceeds	0.435	-0.585
	(1.28)	(-1.19)
Year FE	Yes	Yes
N	501	111
pseudo R^2	0.159	0.077

Panel B: Estimated Propensity Score Distributions

	Mean	SD	p1	p25	p50	p75	p99
Complete	0.131	0.109	0.013	0.055	0.094	0.157	0.452
Withdrawn	0.163	0.122	0.013	0.075	0.125	0.214	0.442
Difference	0.032	0.013	0.000	0.020	0.031	0.057	0.010

Table 8: Do Post-IPO Changes in Loan Contracts Reflect only the Firm Life Cycle? DiD Tests with Complete vs. Withdrawn IPOs

This table shows DiD results comparing post-issue changes in loan contracts between firms that file and then complete an IPO and firms that file and then withdraw an IPO. Panel A shows results for performance pricing at the facility level. Specifically, Columns (1)-(3) use all complete and withdrawn IPO firms as treatment and control groups, while Columns (4)-(6) use matched sample described in Section 4.2 to conduct the DiD analysis. We add an interaction term, *Post* $\times$ *Treated*, to Equation (1), where *Treated* is a dummy variable that equals to one for complete IPOs and zero for withdrawn IPOs. The dependent variable in Column (1) and (4) is a dummy, *Increasing PSD*, which equals to one if the loan contains interest-increasing performance pricing; in Columns (2) and (5) is a dummy, *Decreasing PSD*, that equals to one if the loan contains interest-decreasing performance pricing, and in Columns (3)-(6) is a dummy, *PSD*, that equals to one if the loan has performance pricing. Panel B presents results for loan covenants at the package level. We conduct the same analysis as Panel A, but replace the dependent variable with *FinCov_D*, $\log$(*N_FinCov*), *Cov_D* and $\log$(*N_Cov*), indicated by column headers. Columns (1)-(4) use the full sample while Columns (4)-(8) use the matched sample. Across all columns in both panels, we include a list of firm, loan and IPO controls, as well as year, industry and loan fixed effects. All variables are winsorized at the 1^{st} and 99^{th} percentiles, and are summarized in Appendix I. Standard errors are clustered at the firm level to correct for heterogeneity and t-values are presented in parentheses. *, **, and *** indicate that the coefficient is statistically significant at the 10%, 5%, and 1% levels, respectively.

Panel A: Pre- and Post-IPO Performance Pricing (Complete vs. Withdrawn IPOs)

Sample	Full Sample			Matched Sample		
Y-Variable	*Increasing PSD*	*Decreasing PSD*	*PSD*	*Increasing PSD*	*Decreasing PSD*	*PSD*
	(1)	(2)	(3)	(4)	(5)	(6)
Post$\times$ Treated	**0.881****	**0.690****	**0.889*****	**1.115****	**0.989*****	**1.125*****
	(2.35)	**(2.44)**	**(3.19)**	**(2.39)**	**(2.97)**	**(3.42)**
Post	-0.233	-0.489*	-0.588**	-0.255	-0.572*	-0.713**
	(-0.65)	(-1.80)	(-2.19)	(-0.68)	(-1.84)	(-2.41)
Treated	-0.097	0.112	0.076	-0.615*	-0.166	-0.142
	(-0.34)	(0.55)	(0.38)	(-1.75)	(-0.67)	(-0.56)
All Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	3,226	3,241	3,243	546	595	615
pseudo R^2	0.192	0.186	0.197	0.318	0.269	0.300

Panel B: Pre- and Post-IPO Loan Covenants (Complete vs. Withdrawn IPOs)

Sample	Full Sample				Matched Sample			
Y-Variable	*FinCov_D*	*N_FinCov*	*Cov_D*	*N_Cov*	*FinCov_D*	*N_FinCov*	*Cov_D*	*N_Cov*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post$\times$ Treated	**0.800*****	**0.322****	**0.671****	**0.358***	**0.883*****	**0.341****	**0.813****	**0.388***
	(2.94)	**(2.34)**	**(2.41)**	**(1.90)**	**(2.67)**	**(2.20)**	**(2.45)**	**(1.79)**
Post	-0.540**	-0.231*	-0.443	-0.248	-0.351	-0.164	-0.365	-0.150
	(-2.03)	(-1.72)	(-1.64)	(-1.34)	(-1.24)	(-1.26)	(-1.31)	(-0.78)
Treated	0.071	0.088	0.090	0.200*	-0.079	-0.053	0.130	0.118
	(0.46)	(1.08)	(0.53)	(1.86)	(-0.35)	(-0.49)	(0.61)	(0.81)
All Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	1,994	2,014	1,994	2,014	414	431	412	431
pseudo/adj. R^2	0.121	0.156	0.110	0.136	0.213	0.161	0.196	0.118

Table 9: Are Post-IPO Changes in Loan Contracts only due to Equity Increase through IPO? Evidence from Secondary IPOs

This table shows the key loan and borrower characteristics for a sample of 28 secondary IPOs from 1997-2007. These firms went public for the sole purpose of allowing existing shareholders to cash out, as opposed to raising equity or to repay debt. The sample is taken from Asker, Farre-Mensa, and Ljungqvist (2014) (Table IA.3). We concentrate on loans borrowed by the secondary IPO firms between 3 years before and 3 years after IPO, and we require the firm to have at least one pre-IPO and one post-IPO loans. This leaves us with 174 loan facilities from 112 loan packages. Panel A and Panel B report loan characteristics at the facility and package level respectively. We compare key loan and borrower characteristics for pre- and post-IPO loans, with the last column reporting the difference in means. All variables are winsorized at the 1^{st} and 99^{th} percentiles, and are summarized in Appendix I. All dollar amounts are in 2010 real dollars. *, **, and *** indicate that the coefficient is statistically significant at the 10%, 5%, and 1% levels, respectively.

	Pre-IPO				Post-IPO				Diff.
	N	Mean	Median	SD	N	Mean	Median	SD	
Panel A: Loan Characteristics at the Facility Level: Pre- and Post-IPO (obs: 174)									
AIS (bps)	88	274.26	262.50	153.98	73	177.81	175.00	114.03	-96.45***
Maturity (month)	94	65.31	70.00	27.87	77	56.45	60.00	24.81	-8.85**
Loan Amount ($ million)	97	248.89	157.55	323.86	77	324.86	192.54	333.45	75.98
Secured	74	0.88	1.00	0.33	66	0.80	1.00	0.40	-0.08
PSD	97	0.37	0.00	0.49	77	0.49	0.00	0.50	0.12
Increasing PSD	97	0.08	0.00	0.28	77	0.35	0.00	0.48	0.27***
Decreasing PSD	97	0.36	0.00	0.48	77	0.39	0.00	0.49	0.03
Panel B: Loan Characteristics at the Package Level: Pre- and Post-IPO (obs: 112)									
Maturity (month)	55	67.64	72.00	31.15	54.00	56.04	60.00	27.43	-11.60**
Loan Amount ($ million)	58	446.35	241.51	627.89	54.00	469.18	321.04	412.53	22.83
FinCov_D	58	0.60	1.00	0.49	54.00	0.63	1.00	0.49	0.03
N_FinCov	58	1.84	2.00	1.77	54.00	1.57	2.00	1.44	-0.27
Cov_D	58	0.67	1.00	0.47	54.00	0.72	1.00	0.45	0.05
N_Cov	58	4.28	3.00	4.03	54.00	3.48	3.00	3.09	-0.79

Table 10: Propensity Score Matching: IPOs vs. SEOs

This table presents propensity score matching results for IPOs and SEOs. The selection of SEOs is the same as that of the IPOs, described in Section 4.3. Additionally, we drop SEOs that fall within three years after IPO so that there is no intersection between loan observations for the two samples, which leaves us with 2,646 SEOs. For each IPO in our sample, we match a SEO through a propensity score matching approach using log(*Book Assets*), *Book Leverage*, *Tangibility*, *Profitability*, *Cash Ratio*, and *Gross Proceeds*, in addition to year fixed effects. In Panel A, we report results from Logit regressions used to calculate the propensity scores for the matching procedure, where the dependent (dummy) variable is set to one for IPOs and zero for SEOs. Columns (1) and (2) respectively show coefficients for the sample before matching (IPOs and SEOs) and the matched sample (IPOs and SEOs). Panel B displays the distribution of propensity scores from the regression in Column (2) of Panel A. All variables are winsorized at the 1^{st} and 99^{th} percentiles, and are summarized in Appendix I. Standard errors are clustered at the firm level to correct for heterogeneity and t-values are presented in parentheses. *, **, and *** indicate that the coefficient is statistically significant at the 10%, 5%, and 1% levels, respectively.

Panel A: Pre- and Post-Match Logit Regressions

	(1) Pre-Match	(2) Post-Match
log(Book Assets)	-1.295***	0.015
	(-15.35)	(0.15)
Book Leverage	3.462***	-0.201
	(9.80)	(-0.54)
Tangibility	-0.620	-0.235
	(-1.49)	(-0.50)
Profitability	0.419	-0.423
	(0.88)	(-0.90)
Cash Ratio	-1.168**	-0.182
	(-2.12)	(-0.29)
Gross Proceeds	1.528***	-0.071
	(13.96)	(-0.52)
Year FE	Yes	Yes
N	2,843	7,23
pseudo R^2	0.398	0.065

Panel B: Estimated Propensity Score Distributions

	Mean	SD	p1	p25	p50	p75	p99
IPOs	0.363	0.219	0.027	0.183	0.346	0.508	0.947
SEOs	0.365	0.222	0.027	0.183	0.345	0.512	0.954
Difference	0.002	0.003	0.000	0.000	0.001	0.004	0.007

Table 11: Are Changes in Loan Contracts only due to Equity Increase through IPO? Evidence from Differences between IPOs and SEOs

This table compares post-issue changes in loan contracts between IPOs and matched SEOs described in Section 4.3. Columns (1)-(3) show results of DiD tests for performance pricing at the facility level, and Columns (4)-(7) displays results for loan covenants at the package level. Across all columns, where we add an interaction term, *Post* $\times$ *Treated*, to Equation (1), where *Treated* is a dummy variable that equals to one for IPOs and zero for SEOs. The dependent variable in Column (1) is a dummy, *Increasing PSD*, which equals to one if the loan contains interest-increasing performance pricing, in Columns (2) is a dummy, *Decreasing PSD*, that equals to one if the loan contains interest-decreasing performance pricing, and in Columns (3) is a dummy, *PSD*, that equals to one if the loan has performance pricing. In Columns (4)-(7) we replicate the DiD analyses as in Columns (1)-(3), but replace the dependent variable with covenant measures. Specifically, the dependent variable in Columns (4) is a dummy, *FinCov_D*, that equals to one if the loan contains at least one financial covenant, in Columns (5) is the logarithm of the number of financial covenants, $\log$(*N_FinCov*), in Columns (6) is a dummy, *Cov_D*, that equals to one if the loan contains at least one covenant, and in Columns (7) is the logarithm of the number of covenants, $\log$(*N_Cov*). All variables are winsorized at the 1^{st} and 99^{th} percentiles, and are summarized in Appendix I. Standard errors are clustered at the firm level to correct for heterogeneity and t-values are presented in parentheses. *, **, and *** indicate that the coefficient is statistically significant at the 10%, 5%, and 1% levels, respectively.

	PSD			Covenant			
Y-Variable	*Increasing PSD*	*Decreasing PSD*	*PSD*	*FinCov_D*	$\log$(*N_FinCov*)	*Cov_D*	$\log$(*N_Cov*)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Post$\times$ Treated	**0.616*** **	**0.254** **	**0.357*** **	**0.239** **	**0.076**	**0.344*** **	**0.204*** **
	(4.58)	**(2.39)**	**(3.28)**	**(2.10)**	**(1.43)**	**(3.01)**	**(3.01)**
Post	-0.043	-0.037	-0.037	0.035	0.058	-0.069	-0.027
	(-0.46)	(-0.44)	(-0.45)	(0.40)	(1.40)	(-0.81)	(-0.51)
Treated	-0.581***	-0.297***	-0.363***	-0.186**	-0.086**	-0.182**	-0.127**
	(-5.42)	(-3.33)	(-4.00)	(-2.09)	(-1.99)	(-2.08)	(-2.37)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loan Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	3,915	3,959	3,959	2,486	2,500	2,486	2,500
pseudo R^2	0.167	0.181	0.194	0.122	0.163	0.108	0.147

Table 12: The Presence of the Monitoring Costs Channel: Firms with Pre-IPO Bond(s)

This table presents cross-sectional analysis examining the effect of going public on bank monitoring. Specifically, we split our sample firms into two subsamples: one with public bonds before IPO, and the other without, and we replicate our baseline analysis for the two subsamples. The analyses are conducted at the facility level for interest-increasing performance pricing in Columns (1)-(2), and at the package level for financial covenant in Columns (3)-(4). In Columns (1)-(2), we replicate results in Table 2, where the dependent variable is *Increasing PSD*, that equals to one if the loan contains interest-increasing performance pricing. In Columns (3)-(4) we replicate results in Table 5, with dependent variables equal to *FinCov*_D, a dummy that equals to one if the loan contains at least one financial covenant. In Columns (1) and (3), we study the effect of going public on bank monitoring for firms with public bonds before IPO, and in Columns (2) and (4) we examine the effect of going public on bank monitoring for firms without public bonds before IPO. Across all columns, we include the *Post* dummy, which is equal to one for loans made after IPO, and we add a list of firm, loan and IPO controls, as well as year, industry, bank and loan purpose fixed effects. All variables are winsorized at the 1^{st} and 99^{th} percentiles, and are summarized in Appendix I. Standard errors are clustered at the firm level to correct for heterogeneity and t-values are presented in parentheses. *, **, and *** indicate that the coefficient is statistically significant at the 10%, 5%, and 1% levels, respectively.

Y-Variable	*Increasing PSD*		*FinCov_D*	
Sample	With Bond	Without Bond	With Bond	Without Bond
	(1)	(2)	(3)	(4)
Post	**0.460****	**0.575*****	**0.015**	**0.174***
	(2.15)	**(4.49)**	**(0.09)**	**(1.85)**
log(Loan Amount)	0.223**	0.218***	0.259**	0.120*
	(2.42)	(4.54)	(2.11)	(1.91)
log(Maturity)	-0.282*	0.214***	-0.272	0.149**
	(-1.69)	(2.77)	(-1.30)	(2.08)
log(Book Assets)	0.081	-0.053	0.040	-0.123**
	(0.49)	(-0.89)	(0.35)	(-2.31)
Book Leverage	-0.294	-0.483***	0.143	-0.500***
	(-0.61)	(-2.90)	(0.50)	(-3.30)
Tangibility	0.038	0.609**	-0.542	-0.273
	(0.05)	(2.34)	(-0.86)	(-1.16)
Profitability	3.204*	1.017***	1.405*	1.362***
	(1.90)	(3.05)	(1.81)	(4.60)
Cash Ratio	-1.133	-1.070**	-0.235	-0.004
	(-1.01)	(-2.45)	(-0.36)	(-0.01)
VC-Backed	-0.768	-0.111	0.053	0.183
	(-1.25)	(-0.77)	(0.19)	(1.48)
Gross Proceeds	-0.174	0.033	-0.305**	-0.182***
	(-0.88)	(0.45)	(-2.20)	(-2.89)
All FEs	Yes	Yes	Yes	Yes
N	644	2,042	396	1,288
pseudo R^2	0.294	0.233	0.220	0.157

Appendix I: Variable Definitions

Book Assets: Total book assets in millions of 2010 U.S. dollars. Data source: *Compustat* plus manually collected from *SEC Form S-1*.

Book Leverage: Total liabilities scaled by total assets, i.e., (dlc + dltt)/at. Data source: *Compustat* plus manually collected from *SEC Form S-1*.

Cash Ratio: Cash and short-term investments scaled by total assets, i.e., che/at. Data source: *Compustat* plus manually collected from *SEC Form S-1*.

Cov_D: Dummy variable that equals one if a loan has covenants, and zero otherwise. Data source: *DealScan*.

Decreasing PSD: Dummy variable equal to one if the loan facility has interest-decreasing performance pricing,and zero otherwise. Data source: *DealScan*.

Facility Amount: Loan facility amount in millions of 2010 U.S. dollars. Data source: *DealScan*.

Facility Maturity: Loan facility maturity measured in month. Data source: *DealScan*.

FinCov_D: Dummy variable that equals one if a loan has financial covenants, and zero otherwise. Data source: *DealScan*.

Gross Proceeds: Principle amount raised in IPO in millions of 2010 U.S. dollars.. Data source: *SDC*.

Increasing PSD: Dummy variable equal to one if the loan facility includes interest-increasing performance pricing, and zero otherwise. Data source: *DealScan*.

log(*AIS*): The natural logarithm of all-in-spread-drawn, which is the interest spread above LIBOR plus annualized upfront fees in terms of basis points. Data source: *DealScan*.

N_Cov: Number of covenants that a loan has. Data source: *DealScan*.

N_FinCov: Number of financial covenants that a loan has Data source: *DealScan*.

Package Amount: Loan package amount in millions of 2010 U.S. dollars. Data source: *DealScan*.

Package Maturity: The maturity of the longest facility in the loan package measured in month. Data source: *DealScan*.

Post: Dummy variable that equals one if a loan is issued after firm goes public.

Profitability: The ratio of net income to book value of assets, i.e., ni/at. Data source: *Compustat* plus manually collected from *SEC Form S-1*.

PSD: Dummy variable equal to one if the loan facility includes performance pricing, and zero otherwise. Data source: *DealScan*.

Secured: Dummy variable equal to one if loan is secured with collateral. Data source: *DealScan*.

Tangibility: PP&E (property, plant, and equipment) scaled by total assets, i.e., ppent/at. Data source: *Compustat* plus manually collected from *SEC Form S-1*.

VC-backed: An indicator equal to one if the firm was funded by a venture capital firm at the time of the IPO filing. Data source: *SDC* plus *VentureXpert*.

Appendix II: IPOs with Pre- and/or Post-IPO DealScan Loans

This Appendix examines the percentage of IPOs with pre-and/or post-IPO loans. Our sample starts with all non-utility and non-financial firms in the SDC Global New Issues Database, which filed an IPO on the NYSE, AMEX and NASDAQ stock exchanges. We exclude REITs, units, ADRs, and offerings with the stock price below $5. Panel A shows the number of IPOs. In total, there are 7,779 IPOs in 1980-2016, among which 6,481 complete and 1,298 withdraw. We concentrate our analysis on IPOs between 1997 and 2013 because we require the firm to have detailed performance pricing and loan covenants data in DealScan. This results in 3,396 IPOs, where 2,534 (74.62%) are complete and 862 (25.38%) are withdrawn. The proportion of withdrawn IPOs is higher than that for the whole sample, probably due to the fact that a large proportion of IPOs in our sample are made around financial crisis, but the figure is in line with the evidence documented in other paper. For example, Dunbar and Foerster (2008) and Edelen and Kadlec (2005) report that one in five IPOs are withdrawn between 1985 and 2000.

Panel B reports the percentage of firms with pre- and/or post-IPO loans. Among the 2,534 complete IPOs in 1997-2013, 866 (34.18%) firms have pre-IPO bank loans and 1,284 (50.67%) firms have post-IPO bank loans. The number of firms with both pre- and post-IPO loans is 666, meaning that most (76.90%=666/866) of the firms with pre-IPO loans keep issuing loans after they go public. In addition, among firms with pre-IPO loans, around half (51.87%=666/1,284) of the them do not have pre-IPO loans. Going public decreases firm leverage and increases firm size, allowing firm to have lower credit risk and therefore higher ability to borrow. As expected, the number of firms with only pre-IPO loans is quite low, with only 200 out of 2,534 (7.89%) firms fall in this group. There are three reasons why firms with pre-IPO loans do not continue to issue loans after IPO. First, some firms go bankrupt after IPO and therefore do not issue any post-IPO loans. Second, firms have more options in raising capital after going public. For example, they could issue equity and bond, instead of only relying on bank loans and therefore decreases their demand of bank loans. Third, firms that go public at the end of our sample period might have not start issuing loans, given that our loan sample ends in 2016.

Panel C replicates the statistics in Panel B but requires the loan to be issued within 3 years before and after IPO. In general, we could see that the distribution is quite similar to that of Panel B. The number of firms with pre-IPO loans within 3 years before IPO is 819 and the number of firms with post-IPO loans within 3 years after IPO is 962. Comparing statistics in Panel B and Panel C, we can see that pre-IPO loans are mostly made within three years before IPO, while post-IPO loans are issued more dispersedly across years. In addition, the number of firms with both pre- and post-IPO loans within 3 years before and after IPO is 529, i.e., 20.88% of the total IPOs

in 1997-2013. This 529 IPOs is the final sample in our study.

In general, the percentage of firms with either pre- or post-IPO loans is lower than one would expect. One possibility is that DealScan misses information for certain loans, especially for pre-IPO loans. We therefore, manually select a random sample of 20 U.S. IPOs in 1990-2013. We compare the loan information reported by firms in SEC S-1 Filings with that recorded in DealScan. While 16 out of 20 (80%) firms have pre-IPO loans according to S-1, only 8 (40%) of them have pre-IPO loans recoded in DealScan. For the other 8 firms that S-1 has loan information while DealScan misses pre-IPO loan recordes, almost all of the missing loans are non-syndicated loans. For our random sample, DealScan only misses syndicated loan information for one out of twenty firms, and we can thus conclude that DealScan is quite complete in covering pre- and post-IPO syndicated loan information.

	Number of Firms	**Frequency**
Panel A: IPO sample		
Total IPOs in 1980-2016	**7,779**	**100%**
–Complete IPOs	6,481	83.31%
–Withdrawn IPOs	1,298	16.69%
Total IPOs in 1997-2013	**3,396**	**100%**
–Complete IPOs	2,534	74.62%
–Withdrawn IPOs	862	25.38%
Panel B: IPOs with pre-and/or post-IPO loans (all loans)		
Complete IPOs in 1997-2013	**2,534**	**100%**
-Firms with pre-IPO loans	866	34.18%
-Firms with post-IPO loans	1,284	50,67%
-Firms with only pre-IPO loans	200	7.89%
-Firms with only post-IPO loans	618	24.39%
-Firms with both pre- and post-IPO loans	666	26.28%
Panel C: IPOs with pre-and/or post-IPO loans (loans within three years before and after IPO)		
Complete IPOs in 1997-2013	**2,534**	**100%**
-Firms with pre-IPO loans	819	32.32%
-Firms with post-IPO loans	962	37.96%
-Firms with only pre-IPO loans	432	17.05%
-Firms with only post-IPO loans	289	11.40%
-Firms with both pre- and post-IPO loan	529	20.88%

Appendix III: Renegotiation of Loans before IPO

Renegotiation is an important feature of bank loans, which enables the borrowers and lenders to dynamically complete the loan contract and to allocate control rights ex post (see, e.g., Grossman and Hart, 1986; Hart and Moore, 1988). There are three types of renegotiations: amendments, amended and restated agreements, and rollovers. Amendments spell out only the modifications to the loan, while amended and restated agreements result in a new, stand-alone contract. Rollovers are similar to amended and restated agreements in that they results in a new credit agreement with existing lenders. Both amendment and restated agreements and rollovers are recorded in DealScan as new loans, while amendments are not necessarily treated as a new loan, depending on the importance of the modifications.

According to Roberts (2015), a typical bank loan is on average renegotiated five times, and the timing depends on the financial health of the contracting parties and uncertainty regarding the borrowers' credit quality. Going public, as an important milestone for a firm, dramatically changes the borrowers ownership structure, financial health and credit risk. The typical IPO process starts with drafting and filing with SEC a registration statement, and once approved, the firm will start being traded on the stock market. The time between the filing date and the issue date is called the registration period, during which existing lenders might be informed and notified about the IPO event. For our IPO sample, the average registration period is 132 days with a median of 85 days. It is thus reasonable to believe that firms and banks might renegotiate loans in anticipation, especially during the registration period, or after the IPO event.

We download and manually check loan contracts signed during the registration period for a random sample of 20 IPOs in 1997-2013. A loan contract contains information about whether the loan is an original loan, an amendment, or an amended and restated agreement. We find that as many as 80% of the loans are either amendments or amended and restated credit agreements. Moreover, the majority of these pre-IPO loan contracts already include information regarding the coming IPO. The amendments include but are not limit to:

- Modify "Change of Control" definition for the purpose of the coming IPO;
- Incorporate IPO proceeds when defining some ratios, e.g., cash available;
- Mention that the firm is going to repay the debt using proceeds from the IPO;
- Change covenants in anticipation of the IPO.

Appendix IV: Examples of Performance-contingent Terms

A. Interest-decreasing Performance Pricing and Covenants

Below is an example of pure interest-decreasing performance pricing provision contained in the loan agreement between Diversified Restaurant Holdings, Inc. and RBS Citizens, National Association, entered into as of September 25, 2013. It is a term loan facility with amount of U.S. $ 37,000,000 and maturity of 5 years. At initiation the interest rate of the loan is LIBOR + 370 basis points, and the pricing grid allows for reduction in the interest rate with improvements in financial performance as follows:

Level	**Total Debt to Cash Flow**	**LIBOR Plus**
1[a]	≥ 5.5	370
2	$\geq 5 < 5.5$	340
3	$\geq 4.5 < 5$	310
4	$\geq 4 < 4.5$	275
5	< 4	250

[a] Initial interest rate at this level.

At the same time, the loan package contains the following covenants:

- Maintain a Debt-to-EBITDA ratio < 5.
- Maintain a Debt Service Coverage ratio < 1.2.

B. Interest-increasing Performance Pricing and Covenants

Below is an example of pure interest-increasing performance pricing provision contained in the loan agreement between Shamrock Logistics LP, and J.P. Morgan Chase Bank, as Administrative Agent, Royal Bank of Canada, as Syndication agent, and Suntrust Bank and Mizuho Corporate Bank Ltd., as Co-Documentation agents. It is entered into as of March 06, 2003 as an amended and restated credit agreement dated as of December 15, 2000. The principle amount of the revolving credit facility is U.S. $175,000,000 with maturity of 34 months. At initiation the interest rate of the loan is LIBOR + 95 basis points, and the pricing grid allows for increases in the interest rate with deteriorations in financial performance as follows:

Level	**Senior Debt Rating**	**LIBOR Plus**
1[a]	$\geq$ BBB/Baa2	95
2	$\geq$ BBB- /Baa3 < BBB	112.5
3	< BBB-/Baa3	125

[a] Initial interest rate at this level.

At the same time, the loan package contains the following covenants:

- Maintain a Debt-to-EBITDA ratio < 4.
- Maintain a Interest Coverage ratio < 3.5.
- Restrict payment of dividend.

C. Both Interest-increasing and interest-decreasing Performance Pricing and Covenants

Below is an example of both interest-increasing and interest-decreasing performance pricing provision contained in the loan agreement between Nexstar Broadcasting Group Inc. and Bank of America, as Administrative Agent, UBS Securities LLC and Merrill Lynch, Pierce, Fenner & Smith Incorporated, as the Co-Syndication agents. It is entered into as of April 01, 2005 as a forth amended and restated credit agreement. The principle amount of the revolving credit facility is U.S. $ 50,000,000 and maturity of 50 months. At initiation the interest rate of the loan is LIBOR + 125 basis points, and the pricing grid allows for reduction in the interest rate with improvements in financial performance and increases in the interest rate with deteriorations in financial performance as follows:

Level	**Senior Debt to Cash Flow**	**LIBOR Plus**
1	≥ 5	200
2	$\geq 4.75 < 5$	175
3	$\geq 4.25 < 4.75$	150
4[a]	$\geq 3.5 < 4.25$	125
5	$\geq 2.75 < 3.5$	100
6	< 2.75	75

[a] Initial interest rate at this level.

At the same time, the loan package contains the following covenants:

- Maintain a Debt-to-EBITDA ratio < 7.5.
- Maintain a Senior Debt-to-EBITDA ratio < 5.25.
- Maintain a Fixed Charge Coverage ratio < 1.15.
- Maintain a Interest Coverage ratio < 1.5.
- 75% of the excess cash flow shall be applied to repay outstanding debt.
- 100% of the proceedings from asset sales shall be applied to repay outstanding debt.
- 100% of the gross cash proceeds received in connection with the incurrence or issuance of any indebtedness shall be applied to repay outstanding debt.

- 50% of the gross cash proceeds received in connection with the sale or issuance of equity shall be applied to repay outstanding debt.
- 100% of the gross cash proceeds received in connection with the sale or issuance of capital stock shall be applied to repay outstanding debt.
- Restrict payment of dividend.

Appendix V: Performance Pricing in the DealScan Database

This Appendix describes different types of performance pricing, and the frequency of their inclusion in the whole DealScan loan sample and in our loan sample. Performance pricing links bank debt interest rate spreads to a pre-specified grid of some measure of credit risk. DealScan records it at the facility level in "PerofrmancePricing" dataset, which in total identifies 17 sperate types of performance pricing.[3] The measure of credit risk could be based on some accounting ratios, such as Total Debt to Cash Flow, Leverage, and Fixed Charge Coverage, or certain debt ratings, such as Senior Debt Rating, Commercial Paper Rating and Moodys Rating, or some rare forms of measure like Maturity, Availability and EBITDA. For all loans with performance pricing in the DealScan database, the majority (95.92%) are based on only one type of performance measure, with less than 5% on two or three types of performance measures. In addition, performance pricing could be split into two categories: interest-increasing performance pricing, which increases spread if credit quality deteriorates, and interest-decreasing performance pricing, which decreases interest rates if credit quality improves. Firms can also include both interest-increasing and interest-decreasing performance pricing in one loan.

In total, there are 104,249 loan facilities incurred by 25,311 non-financial and non-utility U.S. borrowers from 1994-2016 in DealScan. In comparison, we have 3,315 loan facilities made by 529 IPO firms within 3 years before and after IPO in 1994-2016. Panel A presents the types of performance pricing measures, and the frequency of their inclusion in these two loan sample. Total Debt to Cash Flow, defined as the ratio of total debt to EBITDA (Debt/EBITDA), is by far the most prevalent performance pricing measure, used by 11.34% loans in the full DealScan sample and by 29.11% loans in our sample. The second and third most common used performance measure is borrowers' condition and credit rating, which combined used by around 5% loan in the DealScan sample and in our sample. In Panel B, we show the distribution of different types of performance pricing separated by whether the loan interest rate will increase or decrease according to the firm performance. In general, firms are more likely to include interest-decreasing performance pricing relative to interest-increasing performance pricing. Additionally, among all loans with performance pricing, about 47.79% loans in DealScan sample include both types of performance pricing. This is consistent with the result of Asquith, Beatty, and Weber (2005), showing that interest-decreasing performance pricing provisions are more likely to be included when interest-increasing performance pricing provisions are included in the contract, and vice versa.

[3]DealScan also includes the following performance pricing: Senior Leverage, Liquidity, Loan to Value, Subordinated Debt Rating, Debt to Equity, Debt to Borrowing Base Rating, Net Income and Quick Ratio. However, all of them appear in an immaterial percent (i.e., < 0.05%), and we therefore omit them from the description here.

	DS Frequency	Sample Frequency
Panel A: Performance Pricing Measure		
1. Total Debt to Cash Flow	11.34%	29.11%
2. User Condition 1	1.04%	2.59%
3. Senior Debt Rating	3.60%	2.50%
4. Senior Debt to Cash Flow	0.72%	1.69%
5. Leverage	0.64%	0.60%
6. Debt to Tangible Net Worth	0.30%	0.57%
7. Fixed Charge Coverage	0.49%	0.48%
8. Outstandings	0.29%	0.33%
9. Borrowing Base	0.09%	0.24%
10. Interest Coverage	0.42%	0.21%
11. Debt Service Coverage	0.12%	0.15%
12. Maturity	0.08%	0.12%
13. Availability	0.24%	0.09%
14. User Condition 2	0.01%	0.06%
15. Commercial Paper Rating	0.02%	0.03%
16. EBITDA	0.01%	0.03%
17. Moodys Rating	0.02%	0.03%
Panel B: Performance Pricing Type		
Any Performance Pricing	**19.48%**	**36.29%**
Pure Interest-increasing	1.96%	3.41%
Pure Interest-decreasing	8.21%	20.09%
Both Interest-increasing-and-decreasing	9.31%	12.79%
Interest-increasing	11.27%	16.20%
Interest-decreasing	17.52%	32.88%
Loan Observations	**104,249**	**3,315**

Appendix VI: Covenants in the DealScan Database

This Appendix describes different types of covenants included in loan contracts. In general, there are three groups of covenants: affirmative covenants, negative covenants, and financial covenants. Affirmative covenant requires the borrower to adhere to certain terms. For example, firms may be required to deliver audited financial statement quarterly. Additional examples of affirmative covenants include obligating the issuer to maintain its underlying assets or specific collateral, such as real estate or equipment and to repay the principal at maturity. Negative (or restrictive) covenant, on the other hand, require the borrower to cease or avoid doing something, such as selling certain assets or issue additional debt. The last group of covenant is financial (or maintenance) covenant, which obligate the borrower to maintain one or more financial ratios during each reporting period. DealScan includes detailed information of negative and financial covenants, while affirmative covenants are described as boilerplates in loan contracts and are not recorded in DealScan.

Table A2 shows the types of loan covenants, and the frequency of their inclusion in the whole DealScan loan sample and in our loan sample. In total, there are 67,524 loan packages incurred by 25,311 non-financial and non-utility U.S. borrowers from 1994-2016 in DealScan. In comparison, we have 2,052 loan packages made by 529 IPO firms within 3 years before and after IPO in the same period. The average number of loans issued by firm in the full sample is 2.67, while in our sample is 3.88. This higher number is probability due to the difference in the sample composition. While most firms in the full DealScan sample is private firm, firms in our sample all become public ultimately.

Financial covenant data is recorded in package level, and is contained in the "FinancialCovenant" and "NetWorthCovenant" datasets in DealScan database. These two datasets combined report 16 distinct classes of financial covenants. Panel A shows the distribution of these financial covenants, which we divide into 6 categories: Debt to Cash Flow Covenant, Debt to Balance Sheet Covenant, Coverage Covenant, Liquidity Covenant, Net Worth Covenant, and EBITDA and CAPEX Covenant.[4] Both in the whole DealScan loan sample and in our loan sample, the most broadly used covenants are Coverage Covenant, Debt to Cash Flow Covenant, and CAPEX Covenant. For example, 46.73% of the loans contain Covenant Covenant in the whole DealScan loan sample in 1994-2016, and 23.41% of the loans contain this type of covenant in our loan sample. Panel B reports non-financial covenants or negative covenants in loan contract. They are contained in the "Package" dataset in DealScan database, and could be split into Sweep Covenant and Dividend Restriction

[4]DealScan also includes the following 5 covenant classes: Max. Loan to Value, Min. Equity to Asset Ratio, Max. Net Debt to Assets, Min. Net Worth to Total Assets, and Other Ratio. However, each of these covenants appears in an immaterial percent (i.e., < 0.1%), and we therefore omit them from the description here.

Covenant. Sweep Covenant require the borrower to repay certain percent of a loan using proceeds from asset sales, excess cash flow, debt issuance, equity issuance and insurance issuance, while Dividend Covenant restricts firm's ability to pay dividend. Both of them are widely used in bank loan contracts.

	Definition	DS Frequency	Sample Frequency
Panel A: Financial Covenants			
1. Debt to Cash Flow Covenant		**18.66%**	**40.84%**
Max. Debt to EBITDA	Debt/EBITDA	17.86%	38.94%
Max. Senior Debt to EBITDA	Senior Debt/EBITDA	3.10%	9.99%
2. Debt to Balance Sheet Covenant		**7.47%**	**12.18%**
Max. Debt to Tangible Net Worth	Debt/Tangible Net Worth	3.59%	7.65%
Max. Leverage ratio	Debt/Assets	3.65%	3.95%
Max. Debt to Equity	Debt/Equity	0.27%	0.63%
Max. Senior Leverage	Senior Debt/Assets	0.04%	0.10%
3. Coverage Covenant		**23.41%**	**46.73%**
Min. Interest Coverage	EBITDA/Interest Expense	12.17%	25.97%
Min. Fixed Charge Coverage	EBITDA/(Interest Expense +Principal+Rent Expense)	11.13%	23.20%
Min. Debt Service Coverage	EBITDA/(Interest Expense+Principal)	2.98%	9.02%
Min. Cash Interest Coverage	EBITDA/Interest Paid	0.42%	0.78%
4. Liquidity Covenant		**4.58%**	**12.23%**
Min. Current Ratio	Current Assets/Current Liabilities	3.54%	8.77%
Min. Quick Ratio	A/R+Cash&Equivalent/Current Liabilities	1.08%	3.46%
5. EBITDA and CAPEX Covenant		**8.17%**	**20.81%**
Max. Capex	Capital Expenditure	7.15%	18.32%
Min. EBITDA	EBITDA	2.89%	5.99%
6. Net Worth Covenant		**11.00%**	**19.93%**
Min. Net Worth	Total Assets-Total Liabilities	5.05%	9.75%
Min. Tangible Net Worth	Total Assets-Intangible Assets-Total Liabilities	5.95%	10.67%
Panel B: Non-Financial Covenants			
1. Sweep Covenant	The amount (or % amount of) a loan must be repaid from:	**14.05%**	**35.33%**
Asset Sales Sweep	Asset sales	12.19%	32.16%
Excess Cash Flow Sweep	Excess cash flow	6.28%	19.83%
Debt Issuance Sweep	Debt issuance	8.89%	24.81%
Equity Issuance Sweep	Equity issuance	7.43%	21.64%
Insurance Proceeds Sweep	Insurance proceeds	7.56%	21.98%
2. Dividend Covenant			
Dividend Restriction	Restrictions of payments of dividends	**26.08%**	**91.18%**
Loan Observations		**67,524**	**2,052**

Additional Table A.1: Robustness Check: Controlling for the Loan Spread

This table presents robustness tests examining the effect of going public on bank monitoring controlling for the loan spread. We replicate our baseline analyses in Section 4.1, but further add the logarithm of loan spread, log(AIS), to the regression specified in Equation (1). The analyses are conducted at the facility level for performance pricing in Columns (1)-(3), and at the Package level for loan covenant in Columns (4)-(7). In Columns (1)-(3), we replicate results in Table 2, where the dependent variable in Columns (1) is a dummy, *Increasing PSD*, that equals to one if the loan contains interest-increasing performance pricing, in Columns (2) is a dummy, *Decreasing PSD*, that equals to one if the loan contains interest-decreasing performance pricing, and in Columns (3) is a dummy, *PSD*, that equals to one if the loan has performance pricing. Similarly, in Columns (4)-(5) we replicate results in Table 5, with dependent variables equal to *FinCov_*D, log(*N_FinCov*) respectively. *FinCov_D* is a dummy that equals to one if the loan contains at least one financial covenant, and log(*N_FinCov)* is the logarithm of the number of financial covenants. Columns (6)-(7) conduct the same analysis as Columns (4)-(5) but substitute *FinCov_D* and log(*N_FinCov)* by *Cov_D* and log(*N_Cov)*. Across all columns, we include the *Post* dummy, which is equal to one for loans made after IPO, and we add a list of firm, loan and IPO controls, as well as year, industry, bank and loan purpose fixed effects. All variables are winsorized at the 1^{st} and 99^{th} percentiles, and are summarized in Appendix I. Standard errors are clustered at the firm level to correct for heterogeneity and t-values are presented in parentheses. *, **, and *** indicate that the coefficient is statistically significant at the 10%, 5%, and 1% levels, respectively.

	PSD			Covenant			
Y-Variable	*Increasing PSD*	*Decreasing PSD*	*PSD*	*FinCov_D*	log(*N_FinCov*)	*Cov_D*	log(*N_Cov*)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Post	**0.453*** **	**0.091**	**0.142***	**0.206****	**0.085****	**0.206****	**0.118****
	(4.13)	**(1.09)**	**(1.65)**	**(2.27)**	**(2.20)**	**(2.11)**	**(2.21)**
log(AIS)	-1.199***	-0.403***	-0.694***	-0.250***	-0.038	-0.077	0.026
	(-9.84)	(-4.34)	(-6.88)	(-2.84)	(-1.06)	(-0.88)	(0.56)
log(Loan Amount)	0.127***	0.051	0.078**	0.094	0.063***	0.136**	0.173***
	(2.92)	(1.43)	(2.12)	(1.57)	(2.68)	(2.18)	(5.50)
log(Maturity)	0.259***	0.316***	0.371***	0.248***	0.154***	0.096	0.159***
	(2.97)	(4.44)	(5.06)	(3.37)	(4.82)	(1.37)	(4.25)
log(Book Assets)	-0.070	0.038	0.012	-0.077	-0.044	-0.050	-0.067*
	(-1.28)	(0.81)	(0.25)	(-1.35)	(-1.65)	(-0.85)	(-1.88)
Book Leverage	-0.131	0.032	-0.039	-0.210	-0.037	-0.285*	-0.046
	(-0.83)	(0.22)	(-0.26)	(-1.34)	(-0.59)	(-1.94)	(-0.55)
Tangibility	0.289	-0.251	-0.102	-0.335	-0.124	-0.142	-0.292**
	(1.12)	(-1.13)	(-0.46)	(-1.37)	(-1.19)	(-0.60)	(-2.27)
Profitability	0.547*	1.116***	1.129***	1.098***	0.533***	0.809**	0.435**
	(1.66)	(3.67)	(3.64)	(3.71)	(4.36)	(2.49)	(2.48)
Cash Ratio	-1.312***	-1.242***	-1.073***	0.008	-0.117	0.697*	0.215
	(-2.76)	(-3.51)	(-3.11)	(0.02)	(-0.88)	(1.79)	(1.25)
VC-backed	-0.101	0.035	0.034	0.248*	0.069	0.188	0.067
	(-0.71)	(0.28)	(0.27)	(1.82)	(1.24)	(1.31)	(0.93)
Gross Proceeds	-0.102	-0.106*	-0.148**	-0.174**	-0.090***	-0.124	-0.089**
	(-1.38)	(-1.65)	(-2.29)	(-2.51)	(-2.77)	(-1.64)	(-2.10)
All FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	2,539	2,562	2,562	1,518	1,555	1,509	1,555
pseudo R^2/adj. R^2	0.272	0.195	0.221	0.177	0.233	0.165	0.224

Table A.2: Robustness Check: Alternative Sample for Pre- and Post-IPO Bank Monitoring

This table presents robustness tests examining the effect of going public on bank monitoring using a broader sample of IPOs in 1997-2013. We do not require the IPO firm to have at least one pre-IPO and one post-IPO loan and we concentrate on loans made by these firms between 3 years before IPO and 3 years after IPO. In total, we have 4,924 loan facilities from 3,175 loan packages issued by 1,252 firms in 1994-2016. The analyses are conducted at the facility level for performance pricing in Columns (1)-(3), and at the Package level for loan covenant in Columns (4)-(7). In Columns (1)-(3), we replicate results in Table 2, where the dependent variable in Columns (1) is a dummy, *Increasing PSD*, that equals to one if the loan contains interest-increasing performance pricing, in Columns (2) is a dummy, *Decreasing PSD*, that equals to one if the loan contains interest-decreasing performance pricing, and in Columns (3) is a dummy, *PSD*, that equals to one if the loan has performance pricing. Similarly, in Columns (4)-(5) we replicate results in Table 5, with dependent variables equal to *FinCov*_D, log(*N_FinCov*) respectively. *FinCov_D* is a dummy that equals to one if the loan contains at least one financial covenant, and log(*N_FinCov)* is the logarithm of the number of financial covenants. Columns (6)-(7) conduct the same analysis as Columns (4)-(5) but substitute *FinCov_D* and log(*N_FinCov)* by *Cov_D* and log(*N_Cov)*. Across all columns, we include the *Post* dummy, which is equal to one for loans made after IPO, and we add a list of firm, loan and IPO controls, as well as year, industry, bank and loan purpose fixed effects. All variables are winsorized at the 1^{st} and 99^{th} percentiles, and are summarized in Appendix I. Standard errors are clustered at the firm level to correct for heterogeneity and t-values are presented in parentheses. *, **, and *** indicate that the coefficient is statistically significant at the 10%, 5%, and 1% levels, respectively.

	PSD			Covenant			
Y-Variable	*Increasing PSD*	*Decreasing PSD*	*PSD*	*FinCov_D*	log(*N_FinCov*)	*Cov_D*	log(*N_Cov*)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Post	**0.523*** **	**0.195*** **	**0.287*** **	**0.142** **	**0.071** **	**0.140** **	**0.094** **
	(6.28)	**(2.95)**	**(4.33)**	**(2.25)**	**(2.41)**	**(2.13)**	**(2.38)**
log(Loan Amount)	0.195***	0.121***	0.159***	0.096**	0.070***	0.091**	0.150***
	(5.68)	(4.13)	(5.35)	(2.40)	(3.92)	(2.21)	(6.39)
log(Maturity)	0.213***	0.267***	0.299***	-0.003	0.042*	-0.144***	0.017
	(3.83)	(5.14)	(5.76)	(-0.07)	(1.86)	(-2.79)	(0.60)
log(Book Assets)	-0.107***	0.003	-0.033	-0.187***	-0.092***	-0.162***	-0.121***
	(-2.64)	(0.09)	(-0.94)	(-4.82)	(-4.94)	(-4.04)	(-4.73)
Book Leverage	-0.496***	-0.066	-0.262**	-0.521***	-0.183***	-0.453***	-0.181***
	(-3.85)	(-0.55)	(-2.07)	(-5.02)	(-4.01)	(-4.52)	(-2.96)
Tangibility	0.119	-0.104	0.011	-0.124	-0.086	-0.045	-0.190*
	(0.62)	(-0.60)	(0.06)	(-0.74)	(-1.06)	(-0.28)	(-1.90)
Profitability	1.178***	1.319***	1.410***	0.765***	0.407***	0.416***	0.327***
	(4.41)	(6.13)	(6.46)	(6.13)	(7.41)	(3.23)	(4.63)
Cash Ratio	-1.040***	-1.393***	-1.188***	-0.659***	-0.348***	-0.494**	-0.319***
	(-3.89)	(-6.19)	(-5.55)	(-3.44)	(-3.90)	(-2.42)	(-2.76)
VC-backed	0.018	-0.003	-0.001	0.044	0.006	0.072	0.011
	(0.17)	(-0.03)	(-0.01)	(0.54)	(0.15)	(0.83)	(0.23)
Gross Proceeds	0.041	-0.021	-0.028	-0.059	-0.060***	-0.041	-0.052*
	(0.79)	(-0.45)	(-0.60)	(-1.34)	(-2.73)	(-0.85)	(-1.80)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loan Purpose FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	4,176	4,196	4,198	2,669	2,687	2,667	2,687
pseudo R^2/adj. R^2	0.193	0.204	0.213	0.115	0.150	0.101	0.132

Table A.3: Robustness Check: Alternative Sample for DiD Analyses with Complete and Withdrawn IPOs

This table shows robustness checks comparing post-filing changes in bank monitoring for IPO complete firms and IPO withdrawn firms using sample described in Section 5.2. Specifically, we do not require the withdrawn firms to have at least one loan within 3 years before and one loan within 3 years after filing. Instead, we keep loans issued by all withdrawn firms within 3 years before and after registration, leaving us with 571 loan facilities from 328 loan packages made by 174 withdrawn firms in 1994-2016. Using these IPO complete and withdrawn sample, we replicate the PSM and DiD analysis in Table 8. Across all columns, we add an interaction term, *Post* $\times$ *Treated*, where *Treated* is a dummy variable that equals to one for complete IPOs and zero for withdrawn IPOs. Columns (1)-(3) show results of DiD tests for performance pricing at the facility level using a matched sample described in Section 4.2. The dependent variable in Column (1) is a dummy, *Increasing PSD*, which equals to one if the loan contains interest-increasing performance pricing; in Columns (2) is a dummy, *Decreasing PSD*, that equals to one if the loan contains interest-decreasing performance pricing, and in Columns (3) is a dummy, *PSD*, that equals to one if the loan has performance pricing. Panel B presents results of DiD analysis for loan covenants at the package level using the matched sample. We conduct the same analysis as Columns (1)-(3), but replace the dependent variable with *FinCov_D*, log(*N_FinCov*), *Cov_D* and log(*N_Cov*), indicated by column headers. Across all columns, we include a list of firm, loan and IPO controls, as well as year, industry and loan fixed effects. All variables are winsorized at the 1^{st} and 99^{th} percentiles, and are summarized in Appendix I. Standard errors are clustered at the firm level to correct for heterogeneity and t-values are presented in parentheses. *, **, and *** indicate that the coefficient is statistically significant at the 10%, 5%, and 1% levels, respectively.

	PSD			Covenant			
Y-Variable	*Increasing PSD*	*Decreasing PSD*	*PSD*	*FinCov_D*	log(*N_FinCov*)	*Cov_D*	log(*N_Cov*)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Post$\times$ Treated	**0.948*** **	**0.407**	**0.679** **	**0.758*** **	**0.288** **	**0.659** **	**0.319***
	(2.61)	**(1.37)**	**(2.44)**	**(2.79)**	**(2.11)**	**(2.26)**	**(1.66)**
Post	-0.076	-0.334	-0.434*	-0.484*	-0.207	-0.408	-0.213
	(-0.25)	(-1.31)	(-1.76)	(-1.92)	(-1.59)	(-1.52)	(-1.16)
Treated	0.054	0.189	0.148	-0.106	0.027	0.041	0.157
	(0.19)	(0.89)	(0.71)	(-0.59)	(0.30)	(0.23)	(1.29)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loan Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	759	839	839	477	505	472	505
pseudo R^2/adj. R^2	0.261	0.225	0.243	0.147	0.119	0.161	0.119

Table A.4: Robustness Check: Alternative Sample for DiD Analysis between IPOs and SEOs

This table displays robustness checks comparing post-issue changes in bank monitoring between IPOs and matched SEOs using sample described in Section 5.2. We do not require the SEO firms to have at least one loan before and one loan after equity issue. We keep all loans issued by SEO firms within 3 years before and after equity issue in 1994-2016. Columns (1)-(3) show results of DiD tests for performance pricing at the facility level, and Columns (4)-(7) displays results for loan covenants at the package level. Across all columns, where we add an interaction term, *Post* $\times$ *Treated*, to Equation (1), where *Treated* is a dummy variable that equals to one for IPOs and zero for SEOs. The dependent variable in Column (1) is a dummy, *Increasing PSD*, which equals to one if the loan contains interest-increasing performance pricing, in Columns (2) is a dummy, *Decreasing PSD*, that equals to one if the loan contains interest-decreasing performance pricing, and in Columns (3) is a dummy, *PSD*, that equals to one if the loan has performance pricing. In Columns (4)-(7) we conduct the same DiD analysis as in Columns (1)-(3), but replace the dependent variable with covenant measures. Specifically, the dependent variable in Columns (4) is a dummy, *FinCov_D*, that equals to one if the loan contains at least one financial covenant, in Columns (5) is the logarithm of the number of financial covenants, $\log$(*N_FinCov*), in Columns (6) is a dummy, *Cov_D*, that equals to one if the loan contains at least one covenant, and in Columns (7) is the logarithm of the number of covenants, $\log$(*N_Cov*). All variables are winsorized at the 1^{st} and 99^{th} percentiles, and are summarized in Appendix I. Standard errors are clustered at the firm level to correct for heterogeneity and t-values are presented in parentheses. *, **, and *** indicate that the coefficient is statistically significant at the 10%, 5%, and 1% levels, respectively.

	PSD			Covenant			
Y-Variable	*Increasing PSD*	*Decreasing PSD*	*PSD*	*FinCov_D*	log(*N_FinCov*)	*Cov_D*	log(*N_Cov*)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Post$\times$ Treated	**0.558*** **	**0.313*** **	**0.403*** **	**0.129**	**0.040**	**0.245** **	**0.143** **
	(4.77)	(3.11)	(3.94)	(1.27)	(0.86)	(2.44)	(2.35)
Post	0.040	-0.014	-0.000	0.069	0.065*	-0.023	0.005
	(0.51)	(-0.19)	(-0.00)	(0.96)	(1.91)	(-0.31)	(0.12)
Treated	-0.613***	-0.361***	-0.436***	-0.146*	-0.063*	-0.220***	-0.153***
	(-6.36)	(-4.48)	(-5.34)	(-1.77)	(-1.65)	(-2.72)	(-3.06)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loan Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	5,411	5,448	5,448	3,532	3,545	3,529	3,545
pseudo R^2	0.178	0.188	0.203	0.123	0.173	0.101	0.152

Table A.5: Robustness Checks using [-2,+2] Window

This table presents robustness tests examining the effect of going public on bank monitoring using a shorter window year. To begin with, we require the firm to have at least one loan within 3 years before and 3 years after IPO. We then focus on loans made by these firms within 2 years before and 2 years after IPO. The analyses are conducted at the facility level for performance pricing in Columns (1)-(3), and at the Package level for loan covenant in Columns (4)-(7). In Columns (1)-(3), we replicate results in Table 2, where the dependent variable in Columns (1) is a dummy, *Increasing PSD*, that equals to one if the loan contains interest-increasing performance pricing, in Columns (2) is a dummy, *Decreasing PSD*, that equals to one if the loan contains interest-decreasing performance pricing, and in Columns (3) is a dummy, *PSD*, that equals to one if the loan has performance pricing. Similarly, in Columns (4)-(5) we replicate results in Table 5, with dependent variables equal to *FinCov*_D, log(*N_FinCov*) respectively. *FinCov_D* is a dummy that equals to one if the loan contains at least one financial covenant, and log*(N_FinCov)* is the logarithm of the number of financial covenants. Columns (6)-(7) conduct the same analysis as Columns (4)-(5) but substitute *FinCov_D* and log(*N_FinCov)* by *Cov_D* and log(*N_Cov).* Across all columns, we include the *Post* dummy, which is equal to one for loans made after IPO, and we add a list of firm, loan and IPO controls, as well as year, industry, bank and loan purpose fixed effects. All variables are winsorized at the 1^{st} and 99^{th} percentiles, and are summarized in Appendix I. Standard errors are clustered at the firm level to correct for heterogeneity and t-values are presented in parentheses. *, **, and *** indicate that the coefficient is statistically significant at the 10%, 5%, and 1% levels, respectively.

	PSD			Covenant			
Y-Variable	*Increasing PSD*	*Decreasing PSD*	*PSD*	*FinCov_D*	log(*N_FinCov*)	*Cov_D*	log(*N_Cov*)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Post	**0.566*** **	**0.198** **	**0.285*** **	**0.230** **	**0.095** **	**0.196** **	**0.126** **
	(5.13)	**(2.38)**	**(3.41)**	**(2.52)**	**(2.41)**	**(2.10)**	**(2.25)**
log(Loan Amount)	0.206***	0.115***	0.158***	0.171***	0.101***	0.160***	0.205***
	(4.58)	(3.00)	(4.04)	(3.04)	(4.09)	(2.86)	(6.32)
log(Maturity)	0.177**	0.248***	0.264***	0.022	0.049	-0.132*	-0.004
	(2.34)	(3.73)	(3.94)	(0.31)	(1.52)	(-1.77)	(-0.09)
log(Book Assets)	-0.074	0.024	-0.007	-0.197***	-0.094***	-0.161***	-0.137***
	(-1.26)	(0.47)	(-0.14)	(-3.41)	(-3.69)	(-2.74)	(-3.77)
Book Leverage	-0.472***	-0.096	-0.265	-0.444***	-0.108**	-0.390***	-0.093
	(-2.89)	(-0.61)	(-1.60)	(-3.26)	(-2.00)	(-2.83)	(-1.17)
Tangibility	0.499*	-0.253	-0.080	-0.322	-0.183*	-0.176	-0.317**
	(1.92)	(-1.07)	(-0.34)	(-1.41)	(-1.71)	(-0.84)	(-2.35)
Profitability	1.122***	1.012***	1.224***	1.269***	0.593***	0.877***	0.440**
	(2.94)	(2.85)	(3.25)	(4.46)	(4.92)	(2.91)	(2.51)
Cash Ratio	-1.223***	-1.455***	-1.297***	-0.385	-0.268*	-0.009	-0.095
	(-3.09)	(-4.03)	(-3.78)	(-1.19)	(-1.89)	(-0.02)	(-0.47)
VC-backed	-0.105	0.086	0.072	0.118	0.043	0.048	0.011
	(-0.70)	(0.70)	(0.57)	(0.95)	(0.82)	(0.37)	(0.15)
Gross Proceeds	0.017	-0.057	-0.055	-0.137**	-0.092***	-0.075	-0.084*
	(0.25)	(-0.85)	(-0.83)	(-2.02)	(-3.10)	(-1.00)	(-1.91)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loan Purpose FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	2,275	2,326	2,333	1,412	1,434	1,405	1,434
pseudo R^2/adj. R^2	0.213	0.197	0.211	0.164	0.183	0.131	0.147

Table A.6: Robustness Checks using [-5,+5] Window

This table presents robustness tests examining the effect of going public on bank monitoring using a longer window year. To begin with, we require the firm to have at least one loan within 3 years before and 3 years after IPO. We then focus on loans made by these firms within 5 years before and 5 years after IPO. The analyses are conducted at the facility level for performance pricing in Columns (1)-(3), and at the Package level for loan covenant in Columns (4)-(7). In Columns (1)-(3), we replicate results in Table 2, where the dependent variable in Columns (1) is a dummy, *Increasing PSD*, that equals to one if the loan contains interest-increasing performance pricing, in Columns (2) is a dummy, *Decreasing PSD*, that equals to one if the loan contains interest-decreasing performance pricing, and in Columns (3) is a dummy, *PSD*, that equals to one if the loan has performance pricing. Similarly, in Columns (4)-(5) we replicate results in Table 5, with dependent variables equal to *FinCov*_D, log(*N_FinCov*) respectively. *FinCov_D* is a dummy that equals to one if the loan contains at least one financial covenant, and log(*N_FinCov)* is the logarithm of the number of financial covenants. Columns (6)-(7) conduct the same analysis as Columns (4)-(5) but substitute *FinCov_D* and log(*N_FinCov)* by *Cov_D* and log(*N_Cov).* Across all columns, we include the *Post* dummy, which is equal to one for loans made after IPO, and we add a list of firm, loan and IPO controls, as well as year, industry, bank and loan purpose fixed effects. All variables are winsorized at the 1^{st} and 99^{th} percentiles, and are summarized in Appendix I. Standard errors are clustered at the firm level to correct for heterogeneity and t-values are presented in parentheses. *, **, and *** indicate that the coefficient is statistically significant at the 10%, 5%, and 1% levels, respectively.

	PSD			Covenant			
Y-Variable	*Increasing PSD*	*Decreasing PSD*	*PSD*	*FinCov_D*	log(*N_FinCov*)	*Cov_D*	log(*N_Cov*)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Post	**0.544*** **	**0.211*** **	**0.272*** **	**0.327*** **	**0.126*** **	**0.296*** **	**0.169*** **
	(6.21)	**(3.19)**	**(4.01)**	**(4.70)**	**(3.85)**	**(4.14)**	**(3.73)**
log(Loan Amount)	0.217***	0.096***	0.136***	0.118***	0.079***	0.117***	0.171***
	(6.36)	(3.07)	(4.24)	(2.65)	(4.06)	(2.61)	(6.72)
log(Maturity)	0.171***	0.281***	0.288***	0.052	0.061**	-0.065	0.047
	(2.74)	(5.05)	(5.02)	(1.04)	(2.56)	(-1.17)	(1.47)
log(Book Assets)	-0.082*	0.026	0.003	-0.135***	-0.073***	-0.101**	-0.104***
	(-1.87)	(0.69)	(0.07)	(-3.14)	(-3.51)	(-2.25)	(-3.55)
Book Leverage	-0.553***	-0.126	-0.297**	-0.420***	-0.131***	-0.372***	-0.118*
	(-4.11)	(-0.95)	(-2.14)	(-3.70)	(-2.64)	(-3.32)	(-1.75)
Tangibility	0.223	-0.120	-0.032	-0.193	-0.066	-0.136	-0.213*
	(1.15)	(-0.64)	(-0.17)	(-1.02)	(-0.72)	(-0.76)	(-1.88)
Profitability	1.210***	1.264***	1.400***	0.941***	0.509***	0.654***	0.368***
	(4.33)	(4.80)	(5.22)	(4.79)	(5.96)	(3.15)	(3.17)
Cash Ratio	-0.903***	-1.021***	-0.892***	-0.133	-0.171	0.284	-0.011
	(-2.97)	(-3.60)	(-3.27)	(-0.51)	(-1.43)	(0.99)	(-0.07)
VC-backed	-0.071	-0.064	-0.060	0.073	0.010	0.031	-0.002
	(-0.63)	(-0.64)	(-0.58)	(0.72)	(0.21)	(0.29)	(-0.04)
Gross Proceeds	0.019	-0.048	-0.049	-0.099**	-0.071***	-0.089*	-0.068**
	(0.35)	(-1.01)	(-1.03)	(-1.98)	(-2.92)	(-1.74)	(-2.12)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loan Purpose FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	3,750	3,748	3,752	2,306	2,336	2,304	2,336
pseudo R^2/adj. R^2	0.178	0.173	0.183	0.118	0.162	0.107	0.139

The Benefit of Going Public and IPO Underpricing: Evidence from the Loan Market*

Xiaoyu Zhang Xunhua Su†

Abstract

This paper links IPO underpricing with the benefit of going public from the loan market. We show that IPO underpricing is associated with significantly lower borrowing costs of the issuer after going public. The average reduction in the loan interest spread for firms with above-median IPO underpricing is about 23.7% of their pre-IPO loan spreads, which almost doubles the 12.6% reduction for firms with below-median underpricing, after control for firm and loan characteristics, and important factors that affect IPO underpricing. This larger reduction in borrowing costs amounts to about U.S. $0.79 billion per year for our sample firms, which is substantial relative to the total amount of money left on the table due to higher underpricing (U.S. $21.06 billion). Our findings provide a new explanation for why issuers don't get upset about IPO underpricing.

Keywords: *IPO, Underpricing, Loans, Borrowing costs, Marketing, Signaling*

*For helpful comments and suggestions, we thank Reena Aggarwal, Carsten Bienz, Espen Eckbo, Jack Jie He, Christoph Herpfer, Jerry Hoberg, Tore Leite, Michelle Lowry, Greg Nini, Ralph Walkling, An Yan, and seminar participants at CICF (2018 Tianjin), FMA (2018 San Diego), AsianFA (2018 Tokyo), Drexel University, and Norwegian School of Economics. All errors are our own. This paper was partly finished during my visit at Fordham University, sponsored by Prof. An Yan, and at Drexel University, sponsored by Prof. Michelle Lowry.

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1 Introduction

The majority of U.S. initial public offerings (IPOs) have been underpriced in the past decades. Despite leaving substantial amounts of money on the table, issuers rarely get upset (Krigman, Shaw, and Womack, 1999; Loughran and Ritter, 2002), and high-underpricing underwriters constantly gain market share (Hoberg, 2007). Why don't issuers get upset about IPO underpricing? For an explanation, extant literature focuses on studying three main players in the IPO market: the IPO firm (entrepreneurs and managers), the underwriter(s), and stock investors (see, e.g., reviews by Ritter and Welch, 2002; Ljungqvist, 2007; Lowry, Michaely, and Volkova, 2017). In this paper, we instead look out of the IPO market, and link underpricing with the benefit of going public from the loan market.

In brief, we find that firms with higher IPO underpricing experience larger reduction in post-IPO (vs. pre-IPO) borrowing costs. The average reduction in the loan interest spread for firms with above-median IPO underpricing is about 23.7% of their pre-IPO loan spreads, which almost doubles the 12.6% average reduction for firms with below-median underpricing, after controlling for firm and loan characteristics, and firm and year fixed effects. This larger reduction (11.1%) in borrowing costs amounts to over U.S. $0.79 billion *per year* for our sample firms, and is substantial relative to the total amount of money left on the table due to higher underpricing (U.S. $21.06 billion).[1] That is, the loss of issuers due to underpricing, to a large extent, can be compensated by the benefit of going public from the loan market.

The results are not driven by factors that, documented in the literature, affect IPO underpricing. For example, price revision (i.e. the difference between the offer price and the mid-point of the filing price range) is well documented as one of the most important factors to affect underpricing (e.g., Hanley, 1993), but it has almost zero explanatory power over the change in post-IPO loan spreads. The results are also robust to employing exogenous variations of underpricing (the pre-IPO market returns), supporting a causal effect. The conclusion is that underpricing plays a unique role in reducing issuers' borrowing costs, and provides a new rationale why issuers don't get upset about IPO underpricing.

[1] All dollar amounts in this paper are in 2010 real dollars.

Why does IPO underpricing lead to lower borrowing costs of the issuing firm? The literature documents various marketing benefits of underpricing. Underpricing attracts media attention, generates great publicity, and hence raises investor and customer recognition of the issuer. First, higher investor recognition increases the firm's investor base, stock liquidity and stock price (e.g., Merton, 1987; Aggarwal, Krigman, and Womack, 2002; Grullon, Kanatas, and Weston, 2004; Ellul and Pagano, 2006), and enhances the firm's bargaining power when dealing with lenders (e.g., Pagano, Panetta, and Zingales, 1998; Abreu and Gul, 2000). Second, greater customer recognition saves advertising expenses and enhance competitive advantages of the IPO firm in product markets (e.g., Demers and Lewellen, 2003; Chemmanur and Yan, 2009). Third, underpricing promotes post-IPO information production and improves transparency, for example, by attracting more analyst coverage that improves disclosure quality and corporate governance (e.g., Loughran and Ritter, 2004; Cliff and Denis, 2004; Brown, 2016). This moderates lenders' monitoring costs and reduces cost of external financing.

We start by documenting a substantial reduction in issuers' borrowing costs after going public, based on a sample of 4,948 DealScan bank loans by 1,010 firms that complete an IPO between 1990 and 2013. Compared to loans made within 3 years before IPO, loans made within 3 years after IPO on average have a lower interest spread of 57.74 bps, which is 21.0% of the average pre-IPO interest spread (276.79 bps). Even after controlling for firm and loan characteristics, as well as year and firm fixed effects, the average post-IPO reduction in the loan interest spread is still 17.6% of the average pre-IPO interest spread. The findings are consistent with the conventional wisdom that firms go public with an aim to access cheaper financial capital.

There are two caveats in interpreting the post-IPO reduction in the loan spread as a benefit of going public. First, issuers may borrow short-term loans just before IPO to avoid diluting ownership from using other funding sources. These loans have higher spreads than usual, resulting in seemingly higher borrowing costs before IPO and hence a reduction in borrowing costs after IPO. However, we show that this reduction remains at the same significance level after excluding loans made within one quarter before IPO, or loans with maturity below two years.

Second, going public changes a firm's private-public status and, at the same time, raises firm equity. One may think that the reduction in the post-IPO loan spread is only due to increased

equity from IPO improving creditworthiness of the firm. Such a reduction presents even for firms that do not change the private-public status, and is hence not a unique benefit of going public. To alleviate this concern, we compare, between IPOs and seasoned equity offerings (SEOs), the post-offering change in borrowing costs. Like IPOs, SEOs increase firm equity. Unlike IPOs, SEOs do not affect the firms' private-public status. If firms experience a significantly larger reduction in borrowing costs after IPO than after SEO, we would conclude that changing from private to public results in lower borrowing costs. Through a propensity score matching (PSM) approach, we create a matched sample of SEOs, and show that the average reduction in borrowing costs after IPOs is more than 100% higher than that after SEOs. Therefore, the reduction in post-IPO borrowing costs is beyond what caused only by an equity increase.

In the literature, Pagano, Panetta, and Zingales (1998) study the decision to go public using a sample of Italy IPOs, and show a significant drop in the cost of credit after going public. In a recent study on lending relationship, Schenone (2010) reports a univariate reduction in the average loan interest spread after going public for a sample of U.S. IPOs in 1998-2003. Neither of the studies identifies whether the effect of an IPO on issuers' cost of borrowing is beyond the increased equity in the offering. A few other papers also document that relative to private firms, public firms have a lower cost of financing (e.g., Brav, 2009; Saunders and Steffen, 2011; Gilje and Taillard, 2016), but they mainly focus on the difference in borrowing costs across private and public firms, not in particular the effect of the IPO event.

After documenting a substantial reduction in issuers' borrowing costs after IPO, we show that this benefit of going public is neither random nor uniform. Using a difference-in-differences (DiD) approach, we compare the post- and pre-IPO loan interest spreads between firms with high and low IPO underpricing, and find that underpricing is associated with significantly larger reduction in the post-IPO loan spreads. The average reduction in the loan interest spread for firms with above-median IPO underpricing is about 23.7% of their pre-IPO loan spreads, which nearly doubles the 12.6% average reduction for firms with below-median underpricing, after controlling for firm and loan characteristics, and firm and year fixed effects. The economic magnitude is remarkably large. For our sample of firms with high underpricing, the larger reduction in borrowing costs amounts to U.S. $0.79 billion per year. As these firms leave U.S. $21.06 billion more money on the table,

their loss in the IPO market due to higher underpricing can be recovered within 26.5 years by the benefit of lower borrowing costs in the loan market.

The positive association between underpricing and the post-IPO reduction in borrowing costs (henceforth the positive association) is quite robust. In addition to comparing IPOs with above- and below-median underpricing, we compare IPOs with positive (or top tercile) and negative (or bottom tercile) underpricing. The association remains positive and highly significant. Furthermore, when replacing the underpricing dummy in the DiD tests by the continuous variable of underpricing, we still find a significantly positive association.

One may think that the positive association reflects some coincidences. First, IPO underpricing is typically larger in hot markets (e.g., Lowry and Schwert, 2002; Lowry, 2003), which happen during economy booms and hence credit booms with lower borrowing costs, resulting in the positive association. This hot-markets effect, however, does not drive our results. Our sample consists of loans made within 3 years before IPO and 3 years after IPO. The majority of the loans are not made immediately after the issue date. The reduction in loan spreads for underpriced firms is larger not only during hot-market periods, but also in all the three years after IPO. Even if we exclude IPOs in hot markets, such as those in 1998-2000, the positive association maintains.

Second, certain omitted variables may drive both underpricing and the post-IPO reduction in borrowing costs, resulting in the positive association. For example, underpricing is larger for firms with greater pre-IPO information asymmetry or uncertainty (e.g., Rock, 1986; Benveniste and Spindt, 1989), while these firms benefit more from the information creation of going public and hence experience a larger reduction in post-IPO financing costs. In this case, the positive association may only reflect ex-ante information asymmetry of the issuer. Largely alleviating this concern, we show that the positive association is not affected by underwriter quality, VC-backed or not, firm size, firm age, and issue size, which in the literature are important proxies for information asymmetry or uncertainty (e.g., Beatty and Ritter, 1986; Ljungqvist and Wilhelm, 2003; Loughran and McDonald, 2013).

Finally, to further establish a causal relationship, we employ exogenous variations of underpricing in an instrumental variable (IV) approach. Previous research documents that underpricing is positively related to recent market movements (e.g., Loughran and Ritter, 2002), while there is

little reason to believe that short-term market movements affect the IPO firm's borrowing costs in the next three years without through the channel of underpricing. We thus use the 3-week (15 trading days) Nasdaq return prior to IPO as an instrument for underpricing and conduct 2-stage Least Squares (2SLS) analyses. The IV tests confirm a causal effect of underpricing on the post-IPO reduction in the loan spread.

Our findings highlight an important trade-off in IPO pricing and provide a rationale for why issuers don't get upset about underpricing. Underpricing incurs a direct loss to the issuer by leaving money on the table, but it brings substantial gains, for example, from the loan market. As we show, the money saved from lower post-IPO borrowing costs for firms with high underpricing can largely recover their loss due to underpricing, not to mention that there are other benefits of underpricing such as those from product markets. With these benefits compensating the loss, it is not difficult to understand why issuers don't get upset about underpricing.

The literature has documented various benefits of IPO underpricing. In particular, underpricing raises investor recognition and promotes information production (e.g., Demers and Lewellen, 2003; Loughran and Ritter, 2004; Grullon, Kanatas, and Weston, 2004; Cliff and Denis, 2004; Ellul and Pagano, 2006; Chemmanur and Yan, 2009; Brown, 2016). These benefits may potentially affect the issuer's cost of financing, according to extant theory of finance (e.g., Merton, 1987; Jensen and Meckling, 1976; Stiglitz and Weiss, 1981). However, there is little direct evidence showing the existence of such an effect. For example, even if underpricing raises the website visit of Internet firms and attracts media coverage (Demers and Lewellen, 2003), it is still unclear whether and how these benefits are reflected in the firm's balance sheet. Our paper fill this gap by showing that IPO underpricing is followed by lower borrowing costs of the issuer. This effect is largely consistent with the marketing role of IPO underpricing.

An alternative explanation of our findings is that IPO underpricing could be a positive surprise to bank lenders, concerning the issuer's market value, inducing banks to lower the price of loans. In this case, the post-IPO reduction in the loan spread is larger with higher underpricing, but this larger reduction reflects only higher-than-expected firm value, instead of the marketing benefits of underpricing. However, if underpricing is a surprise to bank lenders, so should be price revision. After all, both of them show unexpected market demand, and lenders get to know these two pieces

of information almost at the same time (within one day around the issue date). Based on the underwriting theory (Benveniste and Spindt, 1989), it is well established in the literature that price revision can largely explain underpricing (e.g., Hanley, 1993; Cornelli and Goldreich, 2003; Lowry and Schwert, 2004). To check whether this is the case, we replace underpricing by price revision in our DiD tests. Surprisingly, price revision has almost zero explanatory power over the post-IPO reduction in borrowing costs, so do the stock returns in one week or one month following the IPO day. Even after controlling for price revision, as well as these stock returns, the effect of underpricing maintains with the same level of significance. The results suggest that the price jump in the first day, not in the earlier day or in the latter days, plays a unique role in driving issuers' post-IPO borrowing costs. This role of underpricing is beyond a positive surprise to lenders concerning the IPO firm's market value.

Our findings that underpricing is followed by lower borrowing costs seem to be consistent with the signaling theory of underpricing (e.g., Allen and Faulhaber, 1989; Welch, 1989), in that underpricing signals good firm quality to lenders and hence reduces borrowing costs.[2] However, unlike the marketing role of underpricing that creates value directly, signaling does not create value by itself and hence requires certain post-IPO benefits to recover the issuer's loss. For the signal to generate sufficient benefits, information asymmetry is assumed to be persistent over a long period. As going public significantly reduces information asymmetry no matter whether there is underpricing, we do not think such an argument is convincing. In addition, for banks as informed investors, it is probably more efficient to screen borrowers using the design of loan contracts than using underpricing.

The rest of the paper proceeds as follows. Section 2 develops hypotheses. Section 3 describes data and sample, and summarizes the key variables used in our analyses. Section 4 documents a significant reduction in post-IPO borrowing costs from loan markets. Section 5 presents the positive association between the post-IPO reduction in borrowing costs and IPO underpricing, and Section 6 discusses alternative explanations for our findings. Finally, Section 7 concludes.

[2]The traditional signaling theory states that underpricing signals firm quality to stock investors. This signal is costly for the issuer, but if successful, it allows the firm to issue equity (i.e. SEOs) on better terms at a later date. Empirical evidence from follow-up SEOs is however mixed (e.g., Jegadeesh, Weinstein, and Welch, 1993; Michaely and Shaw, 1994; Welch, 1996).

2 Hypothesis Development

2.1 Going Public and the Cost of Borrowing

The conventional wisdom of going public is to access cheaper capital, in particular, from the public equity market. Going public may also reduce the issuer's cost of borrowing through several channels.

First, going public raises substantial amount of new equity, which for example is on average 26.33% of the issuer's book assets for our sample of firms. This equity issuance significantly decreases issuers' leverage and improves their credit quality, and hence lowers the cost of borrowing. We henceforth call this the *equity issuance* channel. It is worth emphasizing that such an effect of equity increase exists no matter whether the borrower goes public. A private firm with new equity issuance can also experience lower leverage and hence lower borrowing costs. This is thus not an effect of changing the private-to-public status, or a benefit of going public.

Second, going public is associated with significant information creation. In addition to having an informative stock market price, the issuer is required to meet strict regulatory requirements by the Securities and Exchange Commission (SEC) that improve firm transparency. Going public also attracts media and analyst coverage, further improving the firm's disclosure quality. A better information environment moderates lenders' screening and monitoring costs, and hence reduces cost of borrowing (e.g., Sengupta, 1998). We henceforth call this the *information creation and monitoring* channel.

Third, going public can be an effective device of marketing, and generates great publicity for the issuer, raising its visibility and reputation in both the financial and product markets . According to the Merton (1987) effect, investor recognition raises the investor base, stock liquidity and firm value. As supporting evidence, Grullon, Kanatas, and Weston (2004) show that firms with greater visibility have better stock liquidity, while Fang, Noe, and Tice (2009) report that firms with liquid stocks have higher market-to-book ratio. A recent study by Francis, Hasan, Mani, and Yan (2016) indeed finds that firms with higher liquidity in the capital market pay lower spreads for the loans they obtain. Furthermore, with great publicity, the issuer becomes more well-known among investors and have more financing options, enhancing its bargaining power when dealing

with bank lenders and hence reducing the cost of borrowing (e.g., Rajan, 1992; Abreu and Gul, 2000). Finally, great publicity raises customer recognition, increasing the issuer's customer base and customer loyalty, and thus improving firm performance in the product market. In sum, going public lowers the issuer's cost of debt through raising investor and customer recognition. We henceforth call this the *investor and customer recognition* channel.

All above three channels point to the same conclusion that going public reduces the issuer's borrowing costs. However, as said earlier, the equity issuance channel is not unique for firms going public, so it is not an effect of changing the private-to-public status. In order to investigate the benefit of going public from the loan market, we need separate the first channel from other two. Our first hypothesis is as follows.

Hypothesis I: *There is a significant reduction in the issuer's borrowing costs after going public, which is beyond the effect of an equity increase in IPOs.*

2.2 The Marketing Role of Underpricing and the Cost of Borrowing

Going public reduces the issuer's borrowing costs through three possible channels. The effect is not uniform for different IPO firms, as the channels may vary much across firms. In particular, we are interested in the role of IPO underpricing. As one of the biggest puzzles around the IPO event, underpricing may affect the issuer's borrowing costs by enhancing or weakening the above three channels. The literature documents a marketing role of IPO underpricing in the sense that underpricing attracts market attention and media coverage, and hence generates marketing benefits for the issuer (e.g., Aggarwal, Krigman, and Womack, 2002; Demers and Lewellen, 2003; Chemmanur and Yan, 2009). Especially in the Internet world, media attention could quickly generate a network effect and promote instant "online celebrities." Therefore, underpricing may significantly enhance the second and third channels and affect the issuer's borrowing costs.

First, underpricing attracts more media attention and analyst coverage, and thus enhances the *information creation and monitoring* channel. Cliff and Denis (2004) and Brown (2016) show that underpricing raises post-IPO analyst coverage, while Billett, Garfinkel, and Yu (2017) show that an increase in asymmetric information due to reductions in analyst coverage worsens firm

performance. Collectively, underpricing promotes information creation and hence transparency of the issuing firm, which in turn reduces its cost of external finance.

Second, underpricing generates great publicity and increases both investor and customer recognition, thus enhancing the third channel. Demers and Lewellen (2003) find that greater IPO underpricing of internet firms is associated with a post-IPO increase in website traffic and media exposure, which benefits the company in product markets. Chemmanur and Yan (2009) show that advertising and underpricing are indeed substitutes.

In sum, the marketing role of underpricing predicts a positive association between IPO underpricing and the reduction in the issuer's borrowing costs after going public. Based on this prediction, we form our second hypothesis.

Hypothesis II: *The reduction in borrowing costs after going public is larger for firms with higher IPO underpricing.*

Underpricing enhances the second and third channels, but it may weaken the *equity issuance* channel. For the same firm issuing the same amount of shares in an IPO, underpricing is followed by less equity increase and hence less reduction in borrowing costs after going public. Given the economical significance of underpricing, this effect could be substantial and causes rejection of Hypothesis II. Even if the firm keeps rasing the same amount of capital, underpricing as a wealth transfer from old to new shareholders does not affect the firm's capital structure. In this case, it has no effect on the issuer's borrowing costs through the *equity issuance* channel. Therefore, if we confirm Hypothesis II and show empirically a positive association between underpricing and the post-IPO reduction in borrowing costs of the issuer, we can conclude that the marketing benefits of underpricing in enhancing the first two channels outweigh the effect of underpricing in weakening the *equity issuance* channel.

3 Data, Variables and Statistics

3.1 IPO Data and Sample Selection

We start with all non-utility and non-financial firms in the SDC Global New Issues Database that completed an IPO on the NYSE, AMEX and NASDAQ stock exchanges between 1990 and 2013. Following the IPO literature, we exclude closed-end funds (including REITs), unit of offers, American Depositary Receipts (ADRs), and offerings with the stock price below U.S. $5. We further correct for SDC errors using information provided on Jay Ritter's website, and merge records that represent one IPO. We select IPOs between 1990 and 2013, because our loan data start in 1987 and end in 2016, while we require every IPO firm to have at least one loan within 3 years before IPO and one loan within 3 years after IPO.[3] The final sample consists of 1,010 IPOs.

Figure 1 shows the frequency or distribution of our IPO sample across years. Although we have only a subset of all IPOs, the distribution of our sample IPOs is quite like that of the universal set of IPOs (see, e.g., Lowry, Michaely, and Volkova, 2017). In the figure, we also see that the proportion of IPOs with high (above-median) and low (below-median) underpricing is relatively stable across all years. Figure 2 present the average underpricing for our IPO sample. Many issuers with extremely high underpricing, especially during the internet bubble period (i.e. 1998-2000), have no pre-IPO loans, so they are not included in our sample. We thus see less extremely high values of underpricing over time in the figure.

We collect the following information for each IPO: the issue date, offer price, filing prices (low, middle, and high), gross proceedings, underwriter ranking, firm age in the IPO year, and whether the IPO is VC-backed. In particular, we obtain information on the issue date, offer price, filing prices, issue amount, and the VC-backed dummy from SDC. We supplement information on venture capital (VC) funding from VentureXpert. Underwriter name are also provided in SDC, and we manually complete the missing data from the Internet (Scoop.com) or SEC Form S-1, which is the initial registration statement filed for an IPO. Underwriter ranking and the firm founding year (to compute firm age) are downloaded from Jay Ritter's website.[4]

[3]The loan data are described in Section 3.3.

[4]Underwriter ranking is on a scale of zero to nine, where nine is the highest underwriter prestige. If the ranking

We measure IPO underpricing as the percentage return from the offer price to the first-day closing price. The offer price is available in SDC and we supplement missing information from Scoop.com. The first-day closing price, from the Center for Research in Securities Prices (CRSP), is required to be within 5 days of the offer date in SDC; otherwise, we replace it with information in SDC or Scoop.com. For remaining missing data on the offer price and first-day closing price, we hand-collect them from the Internet (e.g., Google). Alternatively, we define IPO underpricing as the dollar amount left on the table by the issuer.

3.2 Summary Statistics for IPO Characteristics

Table 1 summarizes the key characteristics of our sample of IPOs. We winsorize all variables at the 1^{st} and 99^{th} percentiles to mitigate outlier bias. Panel A of the table includes all 1,010 IPOs in our full sample. On average, firms choose to go public 25.25 years after they were founded. This high average firm age is mainly due to two reasons: First, we include IPO firms that have at least one loan before IPO in DealScan, excluding a large proportion of very young firms; second, our sample also includes a few exceptionally old firms with age above 100 years. The median firm age is only 14 years, and one-fourth IPOs are made within 6 years after the firm was established. The IPO firms have a mean *Book Assets* of U.S. $642.21 million. This variable is also highly right-skewed, with a few large exceptions. The median *Book Assets* is only U.S. $152.46 million. The mean *Gross Proceedings* is U.S. $169.12 million, about 26.33% of the mean of book assets. The median *Gross Proceedings* is U.S. $90.36 million, more than half of the median *Book Assets*. That is, relative to current book assets, smaller firms issue more equity.

Underwriter Ranking or rating takes values 1 to 9 with an average of 8.04. The majority of lead underwriters for our sample IPOs are rated at 8 or 9. These figures are similar to Loughran and Ritter (2004). In addition, only 24% of the firms are funded by a venture capital. This proportion is low, compared to that of the universe of all U.S. IPOs (e.g., Lowry, Michaely, and Volkova, 2017), because we require every IPO firm to have at least one loan within 3 years before IPO, retaining relatively large firms.

In terms of underpricing, the mean first-day return or *Underpricing* (%) is 13.52%. The mean

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or rating for that period is not available, we employ the rating in the most proximate period. If there is more than one lead underwriter, we use the rank of the bookrunner (in the SEC S-1 Filing) or the highest ranking underwriter.

underpricing in terms of dollar amount, i.e. *Underpricing* ($), is U.S. $22.46 million. *Price Revision*, defined as the percentage change in the final offer price from the midpoint of the initial filing price range, has an average of -0.82% and a median of zero. Among the 1,007 IPOs with non-missing data on *Price Revision*, 431 (42.80%) have positive revision, 179 (17.78%) have no revision, and the rest (39.42%) have negative revision. All above figures have similar magnitudes, compared to previo studies (e.g., Lowry, Michaely, and Volkova, 2017).

Panel B splits our sample of IPOs to two subsamples by the median underpricing. In general, there are no remarkable differences between the two subsamples. On average, firms with high underpricing are more likely to be younger and VC-backed, and issue similar amount of equity in the IPO with higher offer prices. The two subsamples are similar in terms of firm size, profitability, tangibility and underwriter ranking.

3.3 Loan and Borrower Data

We obtain bank loan data from the Reuters Loan Pricing Corporation (LPC) DealScan database. DealScan collects loan contracts information from SEC filings, large loan syndicators, and a staff of reporters. It covers the majority of new loans made to U.S. firms, and contains detailed information of corporate loan contracts for both public and private firms from 1987.[5] Our analyse are conducted at the facility level. We obtain the loan variables, including the all-in-spread-drawn (*AIS*), *Maturity* in months, *Loan Amount* in million U.S. $, loan purposes, and whether the loan has financial covenant (*Fin_Covenant*). We generate dummies for loan purposes, based on the four groups of primary purposes: general purposes (working capital and general corporate purpose), recapitalization (debt repayment/consolidation, recapitalization, and debtor-in-possession loans), acquisition (general or specific acquisition program and LBO loans), and others (see, e.g., Carey, Post, and Sharp, 1998).

We focus bank loan facilities with non-missing AIS made by the 1,010 IPO firms between 3 years before IPO and 3 years after IPO. To merge the DealScan loan data with our sample of IPOs, we first merge DealScan and Comptat, ing the link table initiated by Chava and Roberts (2008). We manually supplement the link table for the period between 2013 and 2016. Second, we e

[5]According to Carey and Nini (2007), Dealscan has information on 50-75% of all U.S. commercial loan volume into the early 1990s, with coverage increasing to 80-90% from 1992-2002.

CUSIP and the fiscal year as the key words to combine the IPO data with the merged DealScan and Compustat data. Because Compustat records data for public firms, accounting data before IPO are typically not available. We manually collect the missing accounting data from SEC Form S-1 filings, including four important variables: *Total Assets*, *Total Debt*, *Net Income*, *Cash* and *PP&E*.

Our final sample consists of 4,948 loan observations in 1987-2016. There are 2,405 loans made by the 505 firms with high IPO underpricing and 2,543 loans made by the 505 firms with low IPO underpricing. Figure 3 shows the distribution of the number of loans across calender years. In general, the distribution of loans over time is very similar to that of IPOs shown in Figure 1.

Figure 4 shows the distribution of loans across the 12 window quarters. Our time window covers the 3 years before IPO and the 3 years after IPO, so there are in total 6 years or 24 quarters. The figure shows that a significant proportion of loans before IPO are made close to the IPO time, especially in the last 3 quarters before IPO. There are four possible reasons. *First*, some IPO firms go public within 3 years after being established and hence do not have loan records before being founded. In our sample, among the 1,010 IPOs, 132 IPOs are made within 3 years after firm foundation, while 85 (49) are made within 2 (1) years after the firm's foundation. *Second*, some issuers borrow short-term loans just before IPO to avoid diluting firm ownership (e.g., bridge loans) or to restructure the firm (e.g., recapitalization loans). In our sample, both bridge loans and recapitalization loans are of low proportions (below 10% in total). *Third*, many loans are not included in DealScan, especially those issued before the borrowers go public. We manually select a random sample of 20 U.S. IPOs in 1990-2013. We compare the loan information reported by firms in SEC S-1 Filings with that recorded in DealScan. Among these 20 firms, only one has syndicated loans reported in S-1 filings but not recorded in DealScan. This means DealScan is quite complete in covering pre-IPO syndicated loans. *Finally*, many firms renegotiate and restate loans before IPO, and DealScan records them as new loans. As we will show later, this last case can only reduce the significance of our results, and hence it does not matter for the current study.

3.4 Summary Statistics for Loan and Borrower Characteristics

Table 2 summarizes the key loan and borrower characteristics. All the variables are winsorized at the 1^{st} and 99^{th} percentiles. Panel A includes all 4,948 loan observations in our full sample.

The reduction in borrowing costs after going public is substantial. Compared to loans before IPO, loans after IPO on average have a lower interest spread of 57.74 bps, which is about 21.0% of the average pre-IPO interest spread (276.79 bps) of all firms. The average loan size increases by U.S. $49.23 million or 28.96% after IPO. Going public expands firm size and hence firms' borrowing capacity, so public firms tend to borrow more. The loan maturity, however, shows no difference before and after IPO; and loans after IPO are more likely to include financial covenants. This is probably because financial covenants are based on firms' financial ratios, which are more reliable and accurate after IPO, making it easier to implement financial covenants in the loan contract.

Panel A also summarizes borrower characteristics of the 4,948 loan observations. Consistent with increased equity from IPO, *Book Assets* significantly increases, while *Book Leverage* decreases. *Profitability* increases, but *Cash* and *Tangibility* have almost no difference. This lower leverage is consistent with Eckbo and Norli (2005) who show that IPO firms have lower leverage than older firms, for about two years following the IPO. One may wonder, if firms have lower cost of debt after IPO, why they do not increase leverage. There are two possible reasons. First, both cost of debt and cost of equity decrease after going public, so it is not clear what the post-IPO optimal leverage should be. Second, the lower leverage immediately after IPO could be non-optimal, but adjustments towards the optimal leverage ratio take time.

Panel B and C of Table 2 respectively summarize loan and borrower characteristics for the subsamples with high (i.e. above-median) and low (i.e. below-median) underpricing. In general, the loan and firm characteristics of the two subsamples are generally similar before IPO, but they show significant differences after IPO. In particular, loans for firms with high IPO underpricing have significantly lower interest spreads and larger loan amount after IPO. Remarkably, the drop in the loan spread for firms with high IPO underpricing is 67.86 bps, while this figure is 48.27 bps for firms with low IPO underpricing. The difference (19.59 bps) is significant at the 1% level and economically large. Moreover, there is a significant increase in the loan amount and book assets for firms with high underpricing, but not for firms with low underpricing.[6] This may indicate that the

[6]It seems that there is an inconsistency between statistics for book assets in Table 1 and 2. In Panel A of Table 1, the mean of book assets for IPO firms is 642.21 in the year prior to IPO, while mean of book assets for loan borrowing firms in the loan issue year is 1,396 in Table 2. How come the two figures differ so much. The reason is that the first figure is from the IPO sample with 951 observations, while the second figure is from the loan sample with 2,129 observations. Larger firms issue more loans and hence appear more often in the loan sample, resulting in a much larger

increase in book assets could be largely supported by debt, consistent with Arikan and Stulz (2016) that underpricing, followed by more acquisitions, may reflect greater investment opportunities of the IPO firm.

Figure 5 shows the average loan interest spreads and their 90% confidence intervals of the two subsamples across the six years before and after IPO. First, there is no significant difference between the two subsamples in the three years before IPO. Second, there is a significant drop of the average interest spread after IPO for both subsamples. Before IPO, the average spread is above 270 bps, but it is about 220 bps after IPO. One year prior to IPO, the average loan spread starts dropping. As said earlier, firms and lenders anticipating the coming IPO often renegotiate and restate their loans, probably agreeing on lower loan spreads. Third, the post-IPO loan spreads exhibit significant differences across the two subsamples. Specifically, firms with high underpricing have a lower borrowing cost compared to firms with low underpricing. The difference is about 20 bps on average in the three years following IPO.

4 The Benefit of Going Public from the Loan Market

Extant literature suggests that firms, following an IPO, tend to receive reduction in borrowing costs. Pagano, Panetta, and Zingales (1998), using a sample of Italy IPOs in 1982-1992, show that there is a significant drop in the cost of credit after going public. This drop could be because the lower financial leverage after IPO improves the creditworthiness of the firm, information creation reduces lenders' cost of monitoring, and the firm's more financing options curtail bank's bargaining power. Pagano, Panetta, and Zingales (1998) do not separate these possible channels. As we will argue later, the reduction in borrowing costs due to leverage decrease is not a benefit of going public, but presents even for firms remaining private. In a study of lending relationship, Schenone (2010) compares firms' borrowing costs before and after IPO, and reports a significant reduction in loan interest spreads after going public for a sample of U.S. IPOs in 1998-2003. Schenone (2010) shows the drop in a univariate test, but does not distinguish the channels either. A few other papers document that public firms have a lower cost of financing than private firms (e.g., Brav, 2009; Saunders and Steffen, 2011; Gilje and Taillard, 2016). These studies focus on the cross-sectional

figure.

difference between private and public firms, not the effect of the IPO event on borrowing costs.

So far, there has been no comprehensive study that identifies the benefit of going public in reducing borrowing costs. In this section, we fill the gap using a large sample of U.S. IPOs between 1990 and 2013.

4.1 The Post-IPO Reduction in Borrowing Costs: Baseline Results

To identify the benefit of going public from bank loan markets, we run the following OLS regression at the loan facility level,

$$\log AIS_i = \alpha + \beta \cdot \textit{Post}_i + \Theta \cdot \mathbf{X}'_{i,j,t} + \mu_t + \eta_j + \epsilon_{i,j,t}, \tag{1}$$

In Equation (1), the dependent variable is the logarithm of *AIS* ($\log$*AIS*). *Post* is a dummy variable, which equals one if the loan is issued after firm goes public. $\mathbf{X}'$ represents a set of firm and loan characteristics. Specifically, firm controls include $\log$(*Book Assets*) that is the natural logarithm of book assets, *Book Leverage* defined as total liabilities scaled by total assets, *Tangibility* as PP&E scaled by total assets, *Cash Ratio* as cash and short-term investments scaled by total assets, *Profitability* as the ratio of net income to book assets, and $\log$(*Firm Age*) that is the natural logarithm of firm age in the loan issue year. Loan controls include the natural logarithm of both loan amount and maturity, i.e. $\log$(*Loan Amount*) and $\log$(*Maturity*), and a dummy variable, *Fin_Covenant*, which is equal to one for loans with at least one financial covenant. These non-price features of loans are usually fixed before the syndication process, and hence commonly used as control variables (e.g., Ivashina, 2009). We also include year, firm and loan purpose fixed effects in the regression, but not IPO controls, because IPO controls are absorbed in firm fixed effects. The coefficient of *Post* captures the within-firm change in borrowing costs after IPO. By expectation, β is negative. All variables are winsorized at the 1^{st} and 99^{th} percentiles to reduce outlier bias. Standard errors are clustered at the firm level and corrected for heterogeneity.

Results are reported in Table 3. Column (1) of the table presents the most parsimonious specification, without any control but including year and firm fixed effects. Column (2) adds firm controls, and Columns (3) and (4) further include both loan controls and loan purpose fixed effects. In Columns (1) to (3), the dependent variable is $\log$*AIS*, while we use *AIS* in Column (4) to

facilitate interpretation of the results. Across all four columns or specifications, *Post* enters with a significantly negative coefficient, with t-values above 6.50. The economical magnitude is remarkably large. According to Column (3), the within-firm reduction in the loan spread is 17.6%, after considering firm, loan and year heterogeneity. According to Column (4), the average reduction in the loan spread is 41.05 bps for our sample of loans. A few control variables show consistent signs across specifications. For example, *Book Leverage* is positively, while *Profitability* is negatively associated with $\log$*AIS*, possibly because these firms have lower credit risk and therefore could negotiate a lower loan spread. In addition, consistent with previous studies (e.g., Ivashina, 2009), larger loans and loans with financial covenants have lower borrowing cost.

The results in Columns (1) to (4) are consistent with the first part of Hypothesis I that there is a significant reduction in the issuer's borrowing costs after going public. However, this drop may not be a benefit of going public. For example, some issuers may borrow short-term loans just before IPO to avoid diluting ownership (e.g., bridge loans) or to restructure the firm (e.g., recapitalization loans), while these loans have higher spreads than usual, resulting in a higher average loan spread before IPO and thus a seemingly reduction in the loan spread following IPO.[7] Moreover, many firms went public during hot market periods, which might coincide with credit booms and hence be followed by lower borrowing costs, resulting in a reduction in borrowing cost after IPO. These reductions are, however, clearly not a benefit of going public. To address this concern, in Columns (5) to (7) of Table 3, we respectively exclude loans issued within one quarter before IPO, loans with maturity less than two years,[8] and loans issued by firms going public during the hot market period (1998-2000). The reduction in the loan spread after going public remains with similar levels of statistical significance, and even shows larger economical magnitude, indicating that the post-IPO reduction in borrowing costs is not caused by short-term loans issued just before going public or the hot market effect.

[7]For example, mezzanine financing, also known as bridge financing, finances the growth of expanding companies prior to an IPO. Such funding is usually made up of convertible debt or preferred shares, which are more costly than common and provide investors certain rights over the holders of common equity. For more information, see http://fundingsage.com.

[8]We also exclude recapitalization loans, and our results remain the same.

4.2 Does the Post-IPO Reduction in Borrowing Costs Reflect only Increased Equity from IPO? IPOs vs. SEOs

IPO increases a firm's equity, and raises the firm's creditworthiness and hence reduces its borrowing costs. Having this in mind, one may argue that the reduction in borrowing costs after IPO may mainly reflect the effect of increased equity, instead of the effect of going public or changing the public-private status. Such a reduction in borrowing costs can be present for any equity issuance, not necessarily through an IPO. In this case, it is not a benefit of going public. This concern is alleviated as we have already controlled for key firm characteristics, such as book assets, leverage and cash holdings, which are directly linked to increased equity from an IPO.

To further identify the reduction in the loan spread as a benefit of going public, we compare the effects between IPOs and SEOs. Both IPOs and SEOs are associated with an equity increase, but SEOs do not change the issuer's public-private status. Therefore, a significant difference of the post-issue change in the loan spread between IPOs and SEOs captures the effect of going public or of changing the public-private status, which is beyond the effect of increased equity.

We start with all SEOs in the SDC Database, made by non-utility and non-financial firms in 1990-2013. We exclude those with an issue price below U.S. $5, and keep security types as "Common Shares" and "Ord/Common Shs." We further require the issuing firm to have at least one loan with non-missing AIS within 3 years before SEO and one loan with non-missing AIS within 3 years after SEO, which results in 3,849 SEOs. Since we have only 1,010 IPOs in our sample, we might be picking up other firm characteristics if simply comparing the IPOs with these 3,849 SEOs. For this reason, we also employ a propensity score matching (PSM) approach to construct a matched SEO sample. By doing so, we first estimate the propensity score of a firm having an IPO (vs. a SEO) by regressing an indicator variable for IPOs on *Issue Ratio*, $\log$*(Book Assets)*, *Book Leverage*, *Profitability*, *Cash Ratio* and *Tangibility*, as well as industry and year fixed effects. We then match, for each IPO, a SEO based on the propensity score. The matching is done without replacement and the maximum difference in the propensity score allowed for a match is 1%. This results in a sample of 569 IPOs and 569 SEOs.

Using our IPOs as the treatment group and all or matched SEOs as the control group, we run

difference-in-differences (DiD) tests, specified in Equation (2), to compare the effects of IPOs and SEOs on borrowing costs.

$$\log AIS_i = \alpha + \beta \cdot \textit{Post}_i + \gamma \cdot \textit{Post}_i \times \textit{Treated}_j + \Theta \cdot \mathbf{X}'_{i,j,t} + \mu_t + \eta_j + \epsilon_{i,j,t}, \tag{2}$$

We add an interaction term, *Post*×*Treated*, to Equation (1), where *Treated* is a dummy variable that equals to one for IPOs and zero for SEOs.

The results are reported in Table 4. In Panel A of the table, we compare between IPOs and matched SEOs the variables that are used to compute the propensity scores. After matching, all the six variables exhibit no significant difference between IPOs and SEOs, suggesting that our matched sample satisfies the important validity criteria of PSM (see, e.g., Fang, Tian, and Tice, 2014). Panel B reports results of the DiD tests. We use all IPOs and SEOs in Columns (1) to (3), but only the matched IPOs and SEOs in Columns (4) to (6). In all specifications, the reduction in the loan spread after IPO is significantly higher than that after SEO. In particular, according to Column (6) with all controls and fixed effects, the average reduction in borrowing costs for IPOs (15.7%=8.6%+7.1%) more than doubles that for the matched SEOs (7.1%). This difference is statistically significant and economically large.

SEOs do not affect the firms' public-private status but increase firm equity, so the above results confirm that the post-IPO reduction in borrowing costs is indeed a benefit of going public and is beyond the effect of increased equity from IPO, confirming our Hypothesis I.

5 The Benefit of Going Public from the Loan Market and IPO Underpricing

After documenting a significant benefit of going public from the loan market, i.e. the post-IPO reduction in borrowing costs, we will further show that this benefit is related to IPO underpricing. As argued in Section 2, going public reduces the issuer's borrowing costs through three possible channels: the *equity issuance* channel, the *information creation and monitoring* channel and the *investor and customer recognition* channel. IPO underpricing, by playing a marketing role, may enhance the second and third channels, resulting in a positive association between underpricing

and the post-IPO reduction in borrowing costs. However, IPO underpricing may weaken the first channel, implying a negative or no association between the two. It is thus purely an empirical issue whether underpricing is positively or negatively related to the post-IPO reduction in borrowing costs. Our Hypothesis II emphasizes the marketing role of underpricing and hence the positive association. If Hypothesis II is confirmed, we can conclude that the marketing role of underpricing in enhancing the second and third channels dominates its role in weakening the *equity issuance* channel.

5.1 The Post-IPO Reduction in Borrowing Costs and IPO Underpricing: Difference-in-Differences Tests

To test Hypothesis II, we construct a DiD test, using loans made by firms with high underpricing as the treated group and loans made by firms with low underpricing as the control group. The specification is

$$\begin{aligned} \log AIS_i = \alpha + \beta \cdot \textit{Post}_i + \gamma \cdot \textit{Post}_i \times \textit{High Underpricing}_j \\ + \Theta \cdot \mathbf{X}'_{i,j,t} + \mu_t + \eta_j + \epsilon_{i,j,t}, \end{aligned} \tag{3}$$

Equation (3) adds to (1) an interaction term between *Post* and *High Underpricing*. In this way, we contrast two layers of differences. The first layer of difference is loan spreads before and after IPO, and the second is loan spreads for firms with high and low underpricing. Note that we control firm fixed effects, so the coefficient of the interaction term (γ) captures the difference in the within-firm reduction in borrowing costs between firms with high and low underpricing. By expectation, γ is negative.

Results of the above DiD test are reported in Table 5. In all columns, we include firm, loan controls, and firm and year fixed effects. Columns (1) to (3), the dummy variable, *High Underpricing*, equals one if underpricing of the IPO is above the sample median and zero otherwise. In Columns (4) and (5), we replace *Higher Underpricing* by *Top Underpricing*, which equals one if underpricing is in the top tercile, and zero if it is in the bottom tercile. In Column (6), we instead use a continuous variable of underpricing, *Underpricing*. Moreover, underpricing can be defined in two different ways, either as the percentage change from the offer price to the first-day closing

price or as the dollar amount of money left on the table. Among the six columns of the table, we use the first way to define underpricing in Columns (1), (2), (4) and (6), indicated by the column header, "%." In other columns, we define underpricing using dollar amount indicated by "$."

In all six columns, the negative coefficient of the interaction term are highly significant. In Column (1), for example, with $logAIS$ as the dependent variable, the interaction term *Post* $\times$ *High Underpricing* enters the regression with a t-value of 3.40. In terms of economical significance, the post-IPO reduction in borrowing costs for firms with above-median underpricing (23.7%$=$ 11.1%+12.6%) almost doubles that for firms with below-median underpricing. The result confirms the positive association between the post-IPO reduction in borrowing costs and IPO underpricing, supporting Hypothesis II. In Column (2), we use *AIS* as the dependent variable to facilitate interpretation. The interaction term keeps consistently significant and negative. The average reduction of the loan interest spread for firms with high IPO underpricing is 23.20 bps larger than that for firms with low IPO underpricing. The remaining columns, (3)-(6), further confirm the positive association.[9] In particular, according to Column (6), a one standard deviation increase in underpricing raises the post-IPO reduction in the loan spread by 4.1%.

Using the estimated coefficient in Column (1), we are able to estimate the aggregate cost savings due to the larger reduction in loan spreads after going public for our sample firms. In our sample, the total amount of new loans made after IPO by the firms with high underpricing is about U.S. $258.32 billion.[10] Almost all these loans mature after 3 years and hence are not closed in our sample period. As firms with high underpricing experience a larger reduction in the average loan spread by 11.1 percentage points, this larger reduction amounts to U.S. $258.32 $\times$ 11.1%$\times$ 276.79 $\times$ 10^{-4} $=$0.79 billion per year. On the other hand, firms with high underpricing leave about U.S. $21.06 billion more money on the table than firms with low underpricing.[11] That is, the loss due to underpricing can be recovered within 26.5 years from lower borrowing costs in the loan market. The findings highlight an important trade-off in IPO pricing and provide a rationale for why issuers

[9] Alternatively, we compare loans made by firms with and without underpricing, and obtain similar results.

[10] As a comparison, the total amount of money raised from IPO by high underpricing firms is about 92.58 billion.

[11] The amount of money left on the table by each firm is defined as the first-day price increase (i.e. the first-day closing price minus the offer price) multiplied by the number of shares sold. In aggregate, the total amount of money left on the table by the IPOs with high underpricing is about U.S. $22.73 billion, while by the IPOs with low underpricing is about U.S. $1.67 billion.

do not get upset about leaving money on the table in IPOs. Underpricing incurs a direct loss to the issuer in the equity market, but it brings indirect gains from other markets. The money saved from lower post-IPO borrowing costs can largely compensate the loss due to underpricing.

Overall, our results from the DiD tests confirm a significantly positive association between IPO underpricing and the benefit of going public from the loan market. This association confirms Hypothesis II and supports the presence of certain marketing benefits of underpricing. These benefits enhance the *information creation and monitoring* channel and the *investor and customer recognition* channel, through which going public reduces the issuer's borrowing costs. Such effects of underpricing dominate its negative effect on the issuer's borrowing costs through weakening the *equity issuance* channel. In untabulated analyses, we show that our results in Table 5 does not change if we exclude the years of hot markets (i.e. 1998-2000), suggesting that our results are not driven by the hot-market effect. Arikan and Stulz (2016) report that underpricing is followed by more acquisitions, reflecting greater investment opportunities of the IPO firm. The larger reduction in borrowing costs associated with underpricing may indicate that the funding source of these acquisitions could be cheaper loans.

5.2 Effects on the Post-IPO Reduction in Borrowing Costs: Underpricing vs. Price Revision and Following Stock Returns

We document a positive association between underpricing and the post-IPO reduction in borrowing costs. There is little reason to believe that an IPO firm's post-IPO borrowing costs have impact on underpricing, so we interpret the larger reduction in borrowing costs as a result of underpricing. For this interpretation, however, we need to establish causality. As the first step, we would like to check whether underpricing plays a unique role in predicting within-firm reduction in borrowing costs after IPO.

Figure 6 shows the timeline of pricing information updates for an IPO. At the beginning of the filing period, the issuer and underwriter determine the filing price range, which together with other key information about the firm and IPO will be submitted to SEC for approval. After that, the marketing of the offering begins, and the company and the the underwriter promote the IPO and collect demand from institutional investors through the road show. On the day prior to the IPO day,

the final offer price is determined, and it is normally released on the IPO day before the market opens. At the end of the first trading day, the first-day closing price is finalized, and underpricing becomes public information, less than one day after price revision is observable. After the IPO day, the firm starts trading on the stock exchange, and we could further observe following stock returns, such as the first-week return and first-month return following IPO.

To examine whether underpricing plays a unique role in predicting post-IPO reduction in borrowing costs, we run the same DiD tests as Equation (3) but replace underpricing with price revision and following stock returns. Results are shown in Table 6. Column (1) of the table replicates Column (1) of Table 5, with the *High Underpricing* dummy replaced by *High Price Revision*, which is equal to one for above-median price revision. The interaction term, *Post*×*High Price Revision*, is not significant both statistically and economically, indicating that price revision has no explanatory power over the post-IPO reduction in borrowing costs. In Column (2), we add *Post*×*High Underpricing* to Column (1). That is, we run a horse race of underpricing and price revision. *Post*×*High Price Revision* remains insignificant, while *Post*×*High Underpricing* is even more significant. In Column (3), we further include two more stock returns in the regression, the first-week stock return and the first-month stock return, both excluding the first-day return. Again, *Post*×*High Underpricing* keeps highly significant, but none of the other interaction terms is significant. Finally, in Columns (4) to (6), we replicate Columns (1) to (3) respectively but replace the dummy variables of underpricing, price revision and stock returns by their continuous variables. The results are completely consistent with the first three columns.

In sum, we find that price revision has almost zero explanatory power over the post-IPO reduction in borrowing costs, so do the two stock returns following the IPO day. Even after controlling for price revision, as well as the stock returns, the effect of underpricing maintains with the same level of significance. The results suggest that the first-day price jump, neither the earlier day nor the latter days, plays a unique role in driving issuers' post-IPO borrowing costs.

5.3 Controlling for Other Important Factors That Affect IPO Underpricing

In addition to price revision, the empirical literature has identified a long list of other factors that affect IPO underpricing, such as underwriter quality (e.g., Beatty and Welch, 1996; Loughran

and Ritter, 2004), VC-backed or not (e.g., Lee and Wahal, 2004), firm age (e.g., Ritter, 1984; Ljungqvist and Wilhelm, 2003), firm size (e.g., Ritter, 1984), and issue size or gross proceedings (e.g., Beatty and Ritter, 1986).[12] The positive association between the benefit of going public and IPO underpricing, which we document in Section 5.1, could be driven by these other factors. To examine this possibility, we further control these factors in our tests. Specifically, we add to Equation (3) an interaction term between *Post* and one of the above factors, *Post*×*Other Factor*. If one factor affects the post-IPO loan interest spread, we should see that it enters the regression significantly. The coefficient of *Post*×*Underpricing* still captures the difference in the post-IPO reduction in borrowing costs between firms with high and low underpricing. We expect that this coefficient remains significantly negative even if these other factors are controlled.

Results are reported in Table 7. In Columns (1) to (6), we add to Equation (3) the interaction term between *Post* and respectively *Underwriter Ranking*, *VC-backed IPO*, log(*Gross Proceedings*), log(*Book Assets*), log(*Sales*) and *IPO Age*. Definitions of these variables are summarized in Appendix I. Column (7) has all the interaction terms in the same regression. In all seven columns, we include *Post*×*Price Revision* as a control, and the dependent variable is log*AIS*. The coefficient of *Post*×*Underpricing* keeps significantly negative at the 1% level, suggesting that controlling for the factors does not affect the positive association between IPO underpricing and the benefit of going public from the loan market. The economical magnitude remains at the same level except that it is slightly smaller when all factors are included in Column (7).

It is interesting that the coefficients of the interaction terms between the *Post* dummy and the above factors show little significance. In an unreported Probit regression using our sample of IPOs, we regress the *High Underpricing* dummy on price revision and the above factors, and industry and year fixed effects. We obtain a Pseudo R^2 of 0.283 and a Wald χ^2 of 275.23. Price revision is highly significant and itself has an R^2 of 0.192. Although the factors have significant explanatory power over IPO underpricing, they have little explanatory power over the post-IPO reduction in borrowing costs.

The results confirm that the positive association between the benefit of going public and IPO

[12]Many of these factors are proxies for ex-ante uncertainty or information asymmetry, which are important drivers of IPO underpricing especially in information-based theory of IPO underpricing (e.g., Rock, 1986; Beatty and Ritter, 1986; Allen and Faulhaber, 1989; Welch, 1989; Benveniste and Spindt, 1989, etc.).

underpricing is not driven by the important factors that, documented in the literature, affect underpricing. This mitigates the concern that the positive association is driven by some omitted variables.

5.4 Evidence from Exogenous Variations of IPO Underpricing

In Section 5.1 to 5.3, we show that the post-IPO reduction in borrowing costs is larger for firms with high IPO underpricing. We interpret this larger reduction as a result of underpricing. To establish causality, we show that our results are not affected by the important factors that, documented in the literature, affect underpricing. However, there could still be some unobserved variables that drive both IPO underpricing and the benefit of going public from the loan market, resulting in their positive association. To further address the omitted variable concern, we employ exogenous variations in IPO underpricing. The idea is that we try to identify the part of variations in IPO underpricing that is exogenous to the long-term post-IPO borrowing costs.

The literature documents that an IPO firm's first-day return (i.e. underpricing) is positively related to recent market movements, such as the Nasdaq returns prior to IPO (e.g., Loughran and Ritter, 2002; Hanley and Hoberg, 2012; Loughran and McDonald, 2013). However, there is little reason to believe that such short-term market movements affect the IPO firm's borrowing costs in the next three years without through the channel of underpricing. After all, the stock market movements in the following years after IPO can be quite different from the short-term movements. Therefore, the Nasdaq return, as an instrumental variable (IV) for underpricing, fulfills both the relevance and exclusion restriction conditions. We thus conduct standard 2-stage Least Squares (2SLS) analyses, employing IPO underpricing caused by exogenous changes in short-term market returns to predict post-IPO borrowing costs. In the first stage, we estimate the impact of Nasdaq return on IPO underpricing:

$$\begin{aligned} \textit{High Underpricing}_j = \alpha + \beta \cdot \textit{Post}_i + \gamma \cdot \textit{Post}_i \times HighNasdaqReturn_j \\ + \lambda \cdot HighNasdaqReturn_j + \Theta \cdot \mathbf{X}'_{i,j,t} + \textit{FEs} + \epsilon_{i,j,t}, \end{aligned} \tag{4}$$

$$\begin{aligned} \textit{Post}_i \times \textit{High Underpricing}_j = \alpha + \beta \cdot \textit{Post}_i + \gamma \cdot \textit{Post}_i \times HighNasdaqReturn_j \\ + \lambda \cdot HighNasdaqReturn_j + \Theta \cdot \mathbf{X}'_{i,j,t} + \textit{FEs} + \epsilon_{i,j,t}, \end{aligned} \tag{5}$$

High Nasdaq Return is a dummy equal to one if the 3-week Nasdaq return prior to IPO is above median and zero otherwise. We use industry fixed effects, instead of firm fixed effects, because the dependent variable of the above two equations has no variation within a firm. We also include IPO, loan, and firm characteristics, and IPO issue year and loan year fixed effects.

In the second stage, we estimate the relationship between underpricing and post-IPO reduction in borrowing costs using the following specification:

$$\begin{aligned}\log AIS_i = \alpha + \beta \cdot \textit{Post}_i + \gamma \cdot \textit{Post}_i \times \widehat{\textit{High Underpricing}}_j \\ + \lambda \cdot \widehat{\textit{High Underpricing}}_j + \Theta \cdot \mathbf{X}'_{i,j,t} + \textit{FEs} + \epsilon_{i,j,t},\end{aligned} \tag{6}$$

where $\widehat{\textit{High Underpricing}}$ and $\textit{Post} \times \widehat{\textit{High Underpricing}}$ are the predicted values from our first-stage estimation. A negative coefficient of the interaction term $\textit{Post} \times \widehat{\textit{High Underpricing}}$ would verify the causal effect of underpricing on the reduction in borrowing costs after going public.

Results for the 2SLS analyses are shown in Table 8. Columns (1) to (2) demonstrate our first-stage estimation, where the dependent variable is *High Underpricing* and *Post* $\times$ *High Underpricing* respectively, as specified in Equation (4) and Equation (5). We can see that the coefficients of the instrumental variables are both highly significant with an F-statistics of 23.37, suggesting that the instruments are strong and unlikely to be biased toward the OLS estimates (Bound, Jaeger, and Baker, 1995). Column (3) shows results of the second-stage estimation, where the dependent variable is $\log$*AIS*. We see a significantly negative coefficient of $\textit{Post} \times \widehat{\textit{High Underpricing}}$, confirming the positive effect of IPO underpricing on the benefit of going public from the loan market. Finally, Columns (4) to (6) respectively replicate the regressions in Columns (1) to (3), but replace the dummy variable *High Underpricing* with a continuous variable *Underpricing*. Results are still significant, although the significance level is some kind lower.

Both Column (3) and (6) show economically large effects of underpricing over the post-IPO reduction in borrowing cost. To sum up, our 2SLS analyses using exogenous variations of IPO underpricing verify the causal effect of underpricing on the post-IPO reduction in loan spreads.

6 Alternative Explanations and Discussions

So far, we have documented a positive association between IPO underpricing and the post-IPO reduction in borrowing costs. This association supports the marketing role of underpricing, and provides a new rationale for why issuers' do not get upset about underpricing. In the literature, there are various explanations for underpricing, which could provide alternative explanations of our findings. First to say, our findings have nothing to do with the behavioural explanations of underpricing, which entail certain irrationality of the issuers or investors (e.g., Loughran and Ritter, 2002). The findings are not directly linked to either the agency-related explanations that rely mostly on the presence of agency issues of underwriters (e.g., Reuter, 2006; Ritter and Zhang, 2007), or the control-based theory that emphasizes ownership change after going public (e.g., Brennan and Franks, 1997; Stoughton and Zechner, 1998). The most possible alternative explanations are information-based. In this section, we will discuss some of the information-based explanations and, in particular, show that our results cannot be mainly driven by these alternative explanations.

6.1 The Traditional Signaling Theory

The traditional signaling theory takes underpricing as a signal of firm quality (e.g., Allen and Faulhaber, 1989; Grinblatt and Hwang, 1989; Welch, 1989; Chemmanur, 1993). Specifically, underpricing sorts good and bad firms in the following way. Good firms choose costly underpricing while recover the cost by selling additional equity in subsequent SEOs. Bad firms, however, cannot mimic, because there is sizeable probability that the market detects firm quality after IPO, preventing bad firms from recovering the loss from underpricing. Signaling through underpricing is costly for the issuer, but if successful, it may allow the firm to issue equity on better terms at a later date (i.e. SEOs). Empirical research has explored the benefit of going public from follow-up SEOs, but fails in finding consistent evidence (e.g., Jegadeesh, Weinstein, and Welch, 1993; Michaely and Shaw, 1994; Welch, 1996).

Our evidence from the loan market seems to be consistent with the signaling theory, but there is one important question to be answered: Why would firms use underpricing as a signal of firm quality to lenders to lower cost of debt, but not to external equity investors to obtain higher valuation in follow-up SEOs? One conjecture is that the signal could be sent to both debt and equity

markets, but the evidence from SEOs is not as significant as that from loans. First, many IPO firms have loans both before and after IPO, making it easy to identify the effect of going public on the cost of loans. However, the price of equity is available only after IPO. Second, debt financing is the dominating source of external financing for business firms (e.g., Myers, 1984; Allen, Chui, and Maddaloni, 2004). In terms of both frequency and volume, SEOs are made not as large as debt issuance. For example, within 3 years after IPO, the 1,010 IPO firms in our sample issue 2,650 new loans with a total amount of U.S. $581 billion. As a comparison, these firms conduct 765 SEOs with a total amount of U.S. $158 billion in the same period. The lower frequency and volume of SEOs, relative to debt issuance, could make it difficult to find supporting evidence of the signaling benefits only from SEOs.[13]

However, it is difficult for the traditional signaling theory to fully explain our results. In the theory, underpricing is only a signal of firm value and, by itself, does not create direct value (such as saving costs or raising performance). To compensate the issuer's loss due to underpricing, information asymmetry between the IPO firm and investors should be persistent after IPO for the signaling to generate sufficient benefits. That is, without underpricing as a signal, firm types are largely undetected by the stock market even in a long period after firms go public. As going public significantly reduces information asymmetry no matter whether there is underpricing, we do not think such an argument is convincing. In addition, banks as informed investors can access internal information of the firm even before IPO. For them, it is probably more efficient to screen borrowers using the design of loan contracts than using the signal through borrower's underpricing. As Ritter and Welch (2002) point out, "On theoretical grounds, it is unclear why underpricing is a more efficient signal than, say, advertising."

Therefore, to be consistent with our findings, underpricing should by itself create value, not only being a signal of unobserved value. One such value could come from the marketing role of

[13]Our sample of IPOs is constrained by loans in DealScan - each IPO firm has at least one loan within 3 years before IPO and one loan within 3 years after IPO. It is possible that the sample reflects certain self-selection of IPO firms and is hence not representative. To address this concern, we consider the universe of IPOs in 1990-2013. For all these 6,008 IPO firms, the total amount of loans made within 3 years after IPO is U.S. $1,103 billion (6,421 loans), while the total amount of equity issuance through SEOs is U.S. $459 billion (3,083 SEOs). If we consider 10 years after IPO, the two figures are U.S. $3,134 billion and U.S. $702 billion respectively. Although DealScan does not include all loans made by these firms (while SDC does include almost all SEOs), we still see a significantly larger loan issuance than equity issuance.

underpricing. Different from signaling, in playing a marketing role, underpricing saves advertisement costs and enhances investor and customer recognition of the issuer. The direct value created reduces firms' borrowing costs, even if underpricing does not signal firm quality.

6.2 Other Information-based Explanation of Underpricing

Our finding could also be consistent with other information-based explanations of IPO underpricing. First, IPO underpricing could be a positive surprise to bank lenders (possibly, as well as to the issuer) concerning the issuer's market value, no matter what are the reasons for underpricing. This surprise induces banks to lower the price of loans after IPO. The wisdom of crowds argues that statistical aggregates of the judgments of crowds are more accurate than those of the average individual by exploiting the benefit of error cancellation (e.g., Surowiecki, 2004). It suggests that, although the bank can access the borrower's information before IPO, the bank may not have an accurate valuation over the firm. On the first trading day, the bank updates the firm's valuation after observing the market return or underpricing. In this case, the post-IPO reduction in loan spreads is larger for firms with high underpricing, but this larger reduction reflects only higher-than-expected firm value, instead of the marketing role of underpricing.

If underpricing is a positive surprise to bank lenders, so should be price revision. After all, both of them show unexpected demand of investors, and their information arrives almost at the same time (within one day around the issue date). We then in our DiD tests replace underpricing by price revision, or the stock return in the first week (or first month) after the IPO day. As shown in Table 6, price revision has almost zero explanatory power over the post-IPO reduction in borrowing costs, so do the other stock returns. Even after controlling for price revision and these stock returns in the same regression, the effect of underpricing maintains with the same level of significance. The results suggest that the first-day price jump, not earlier price revision or latter stock returns, plays a unique role in driving issuers' post-IPO borrowing costs, and this role is beyond a positive surprise to lenders concerning the IPO firm's market value.

Second, the above arguments also applies to the bookbuilding theory (Benveniste and Spindt, 1989) as an explanation for our findings. According to the theory, underpricing compensates institutional investors for revealing their private information concerning the issuer's firm value. A

larger difference between the valuations of institutional investors and the issuer before bookbuilding is followed by higher price revision after the bookbuilding process and higher underpricing in the first trading day. This is called the partial adjustment phenomenon. Supporting evidence for the bookbuilding theory, in particular, a positive association between price revision and underpricing, is well established in the literature (e.g., Hanley, 1993; Cornelli and Goldreich, 2001, 2003; Lowry and Schwert, 2004). Note that a larger valuation difference could also be a larger positive surprise to lenders and hence induces a larger reduction in post-IPO borrowing costs. Therefore, the bookbuilding theory may imply the positive association that we document. However, if the theory drives our findings, price revision should affect borrowing costs. This is not what we see in the data.

Finally, according to the winner's curse theory (Rock, 1986), higher information asymmetry among investors concerning the valuation of the IPO firm raises IPO underpricing. This information asymmetry should, arguably, be higher for more information-opaque firms, which obtain higher benefit of going public in terms of information creation and hence higher reduction in post-IPO borrowing costs. The winner's curse theory could thus also imply the positive association we document. However, Our results barely change after controlling for proxies for ex-ante uncertainty or information asymmetry, such as underwriter quality, VC-backed or not, firm size and firm age, which are widely considered as important drivers of underpricing in favor of the winner's curse theory (e.g., Beatty and Welch, 1996; Loughran and Ritter, 2004; Lee and Wahal, 2004; Ljungqvist and Wilhelm, 2003; Ritter, 1984; Beatty and Ritter, 1986). This makes it unlikely that the winner's curse theory is the main driver of our results.

7 Conclusion

In this paper, we link IPO underpricing to the benefit of going public from the bank loan market. We show that IPO underpricing is associated with larger reduction in loan interest spreads of the IPO firm after going public. This association holds after controlling for firm and loan characteristics, year and firm fixed effects, and a list of factors (price revision, underwriter quality, VC-backed or not, firm age, firm size and issue size) that, documented in the literature, are important drivers of IPO underpricing.

Our findings are consistent with the marketing role of underpricing. In playing such a role, underpricing attracts market attention and media coverage, and hence benefits the IPO firm through creating advertising benefits, reducing information asymmetry and boosting the issuer's stock liquidity. The value created directly by underpricing reduces the the issuer's post-IPO borrowing costs. That is, the loss in the IPO market due to underpricing is compensated by the benefit of lower borrowing costs in the bank loan market after IPO. As the first study linking IPO underpricing to bank loan markets, we shed new light on the underpricing puzzle as complementary to extant studies.

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Appendix I: Variable Definitions

AIS: All-in-spread-drawn, which is the interest spread above LIBOR plus annualized upfront fees, in terms of basis points. Data source: *DealScan*.

Book Assets: Total book assets in millions of 2010 U.S. dollars. Data source: *Compustat* plus manually collected from *SEC Form S-1*.

Book Leverage: Total liabilities scaled by total assets, i.e. (dlc + dltt)/at. Data source: *Compustat* plus manually collected from *SEC Form S-1*.

Cash Ratio: Cash and short-term investments scaled by total assets, i.e. che/at. Data source: *Compustat* plus manually collected from *SEC Form S-1*.

Fin_Covenant: Dummy variable that equals one if a loan has financial covenants, and zero otherwise. Data source: *DealScan*.

High Underpricing: Dummy variable that equals one if underpricing meets one of the following two criteria: (1) first-day return in percentage is above median; (2) first-day return in dollar amount (first-day return $\times$ IPO proceedings) is above median. When the variable is reported in the tables, the column headers indicate how it is created. Data source: *SDC*, *CRSP* plus manually collected.

IPO Age: Firm age in the IPO issue year. Data source: *Jay Ritter's website*.

Gross Proceedings: Principle amount raised in IPO in millions of 2010 U.S. dollars, also called issue size. Data source: *SDC*.

Issue Size: Principle amount raised in IPO in millions of 2010 U.S. dollars, also called Gross Proceedings. Data source: *SDC*.

Loan Amount: Loan facility amount in millions of 2010 U.S. dollars. Data source: *DealScan*.

log(*Book Assets*): The natural logarithm of total book assets in millions of 2010 U.S. dollars. Data source: *Compustat* plus manually collected from *SEC Form S-1*.

log(*Firm Age*): The natural logarithm of one plus firm age in the current year, which is defined as the years elapsed since the founding year. Data source: *Jay Ritter's website*.

log(*Loan Amount*): The natural logarithm of the loan facility amount in millions of 2010 U.S. dollars. Data source: *DealScan*.

log(*Maturity*): The natural logarithm of the loan maturity measured in months. Data source: *DealScan*.

log(*Gross Proceedings*): The natural logarithm of principle amount raised in IPO in millions of 2010 U.S. dollars. Data source: *SDC*.

Maturity: Loan maturity measured in months. Data source: *DealScan*.

Offer Price: The price at which the IPO is first sold to the public. Data source: *SDC* plus manually collected.

First-week Return: Percentage return from first-day closing price to first week closing price. Data source: *CRSP*.

High First-week Return: Dummy variable that equals to one if *First-week Return* is above median. Data source: *CRSP*.

First-month Return: Percentage return from first-day closing price to first month closing price. Data source: *CRSP*.

High First-month Return: Dummy variable that equals to one if *First-month Return* is above median. Data source: *CRSP*.

Post: Dummy variable that equals one if a loan is issued after firm goes public.

Price Revision: Percentage difference between offer price and midpoint of filing price. Data source: *SDC* plus manually collected.

High Nasdaq Return: Dummy variable that equals one if the 3-week Nasdaq return prior to IPO day is above median. Data source: *CRSP*.

High Price Revision: Dummy variable that equals one if the *Price Revision* of the IPO is above median. Data source: *SDC* plus manually collected.

Profitability: The ratio of net income to book value of assets, i.e. ni/at. Data source: *Compustat* plus manually collected from *SEC Form S-1*.

Tangibility: PP&E (property, plant, and equipment) scaled by total assets, i.e. ppent/at. Data source: *Compustat* plus manually collected from *SEC Form S-1*.

Top Underpricing: Dummy variable that equals one if IPO underpricing in percentage is in the top tercile. Data source: *SDC, CRSP* plus manually collected.

Underpricing (%): Percentage return from offer price to first-day closing price. Data source: *SDC, CRSP* plus manually collected.

Underpricing ($): Dollar amount left on the table in an IPO, i.e. (first-day closing price $-$ offer price) $\times$ the number of shares offered. Data source: *SDC, CRSP* plus manually collected.

Underwriter Ranking: A ranking of the lead underwriter on a scale of zero to nine, where nine is the highest underwriter prestige. If the rating for specific period is not available, we employ the rating in the most proximate period. Data source: *Jay Ritter's website* plus manually collected.

VC-backed IPO: An indicator equal to one if the firm was funded by a venture capital firm at the time of the IPO filing. Data source: *SDC* plus *VentureXpert*.

With Underpricing: Dummy variable that equals one for positive IPO underpricing. Data source: *SDC, CRSP* plus manually collected.

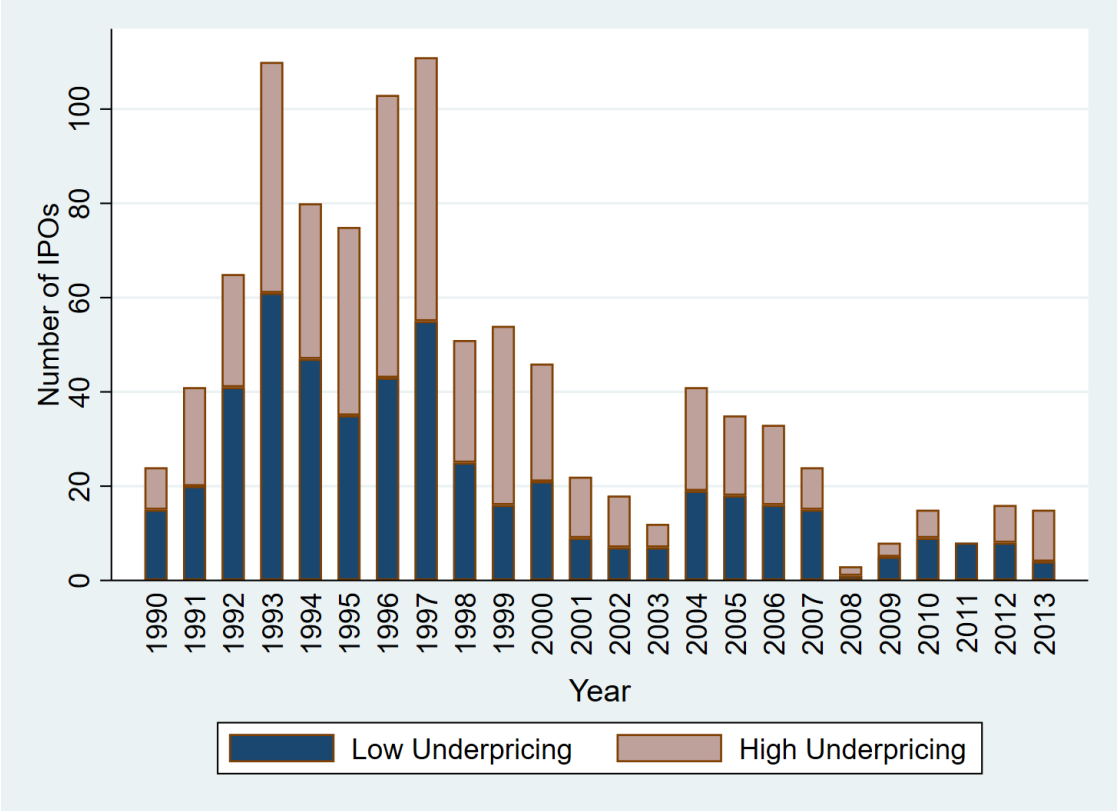

Figure 1: The Number of IPOs over Years

This figure shows the number of IPOs in our sample over years from 1990-2013. The total sample consists of 1,010 IPOs, and we divide them into firms with high (i.e. above-median) underpricing and low (i.e. below-median) underpricing. To construct the sample, we start with all non-utility and non-financial firms in the SDC Global New Issues Database, which complete IPO on the NYSE, AMEX and NASDAQ stock exchanges between 1990 and 2013. We then exclude REITs, units, ADRs, and offerings with the stock price below U.S. $5, and further require every firm to have at least one loan (with non-missing all-in-spread-drawn in DealScan) within 3 years before IPO and one loan (with non-missing all-in-spread-drawn in DealScan) within 3 years after IPO.

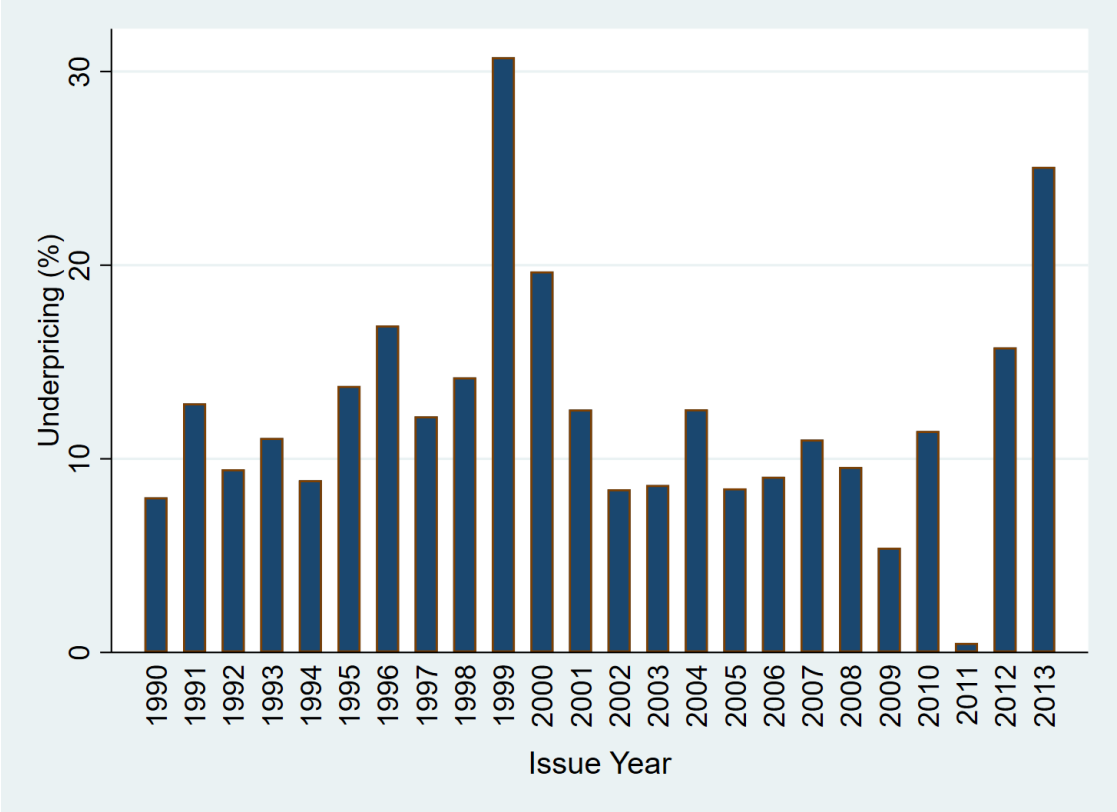

Figure 2: Average Underpricing Over IPO Issue Years

This figure shows the average underpricing of our IPO sample over years. There are in total 1,010 IPOs in 1990-2013. To construct the sample, we start with all non-utility and non-financial firms in the SDC Global New Issues Database, which complete IPO on the NYSE, AMEX and NASDAQ stock exchanges between 1990 and 2013. We then exclude REITs, units, ADRs, and offerings with the stock price below U.S. $5, and further require every firm to have at least one loan (with non-missing all-in-spread-drawn in DealScan) within 3 years before IPO and one loan (with non-missing all-in-spread-drawn in DealScan) within 3 years after IPO.

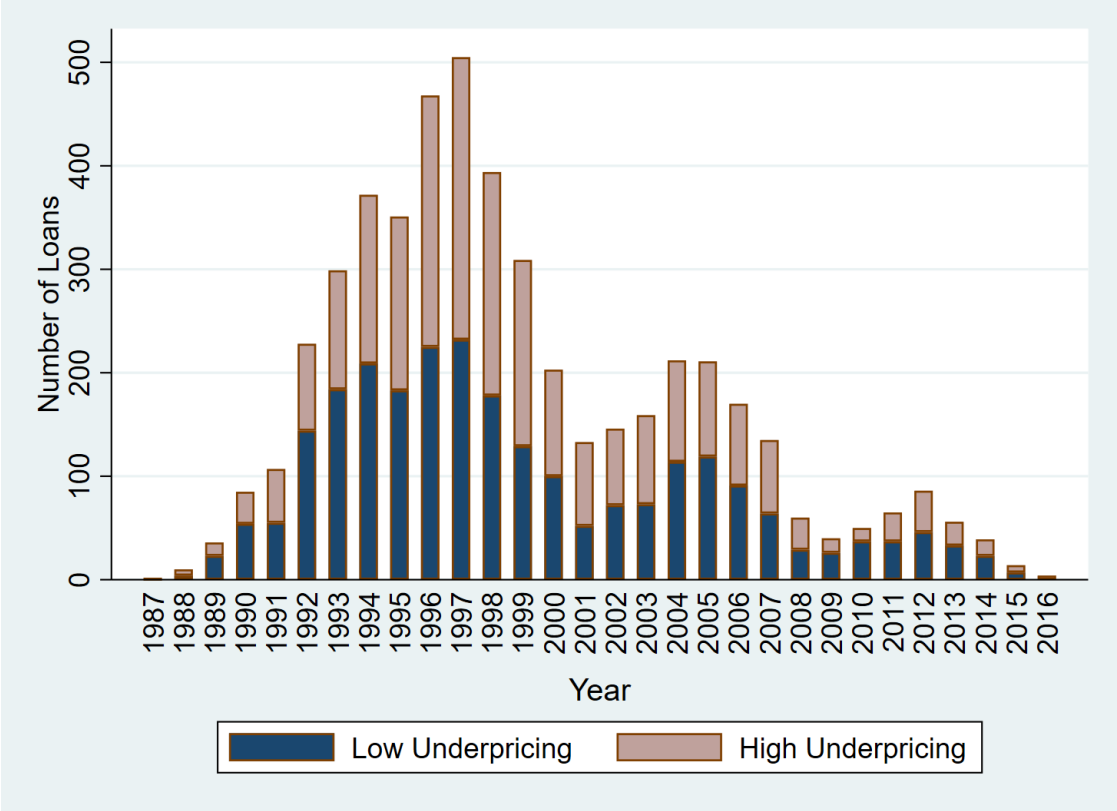

Figure 3: The Number of Loans over Loan Issue Years

This figure presents the distribution of the number of loans in our sample form 1987 to 2016. The full sample consists of 4,948 unique bank loan facilities, each of which is made by an IPO firm between 3 years before IPO and 3 years after IPO. We require the firms to be non-utility and non-financial firms, which complete IPO on the NYSE, AMEX and NASDAQ stock exchanges between 1990 and 2013. We also exclude REITs, units, ADRs, and offerings with the stock price below U.S. $5, and require every firm to have at least one loan (with non-missing all-in-spread-drawn in DealScan) within 3 years before IPO and one loan (with non-missing all-in-spread-drawn in DealScan) within 3 years after IPO. We show the distribution of loans for two subsamples: loans issued by IPO firms with high (i.e. above-median) underpricing and loans issued by IPO firms with low (i.e. below-median) underpricing.

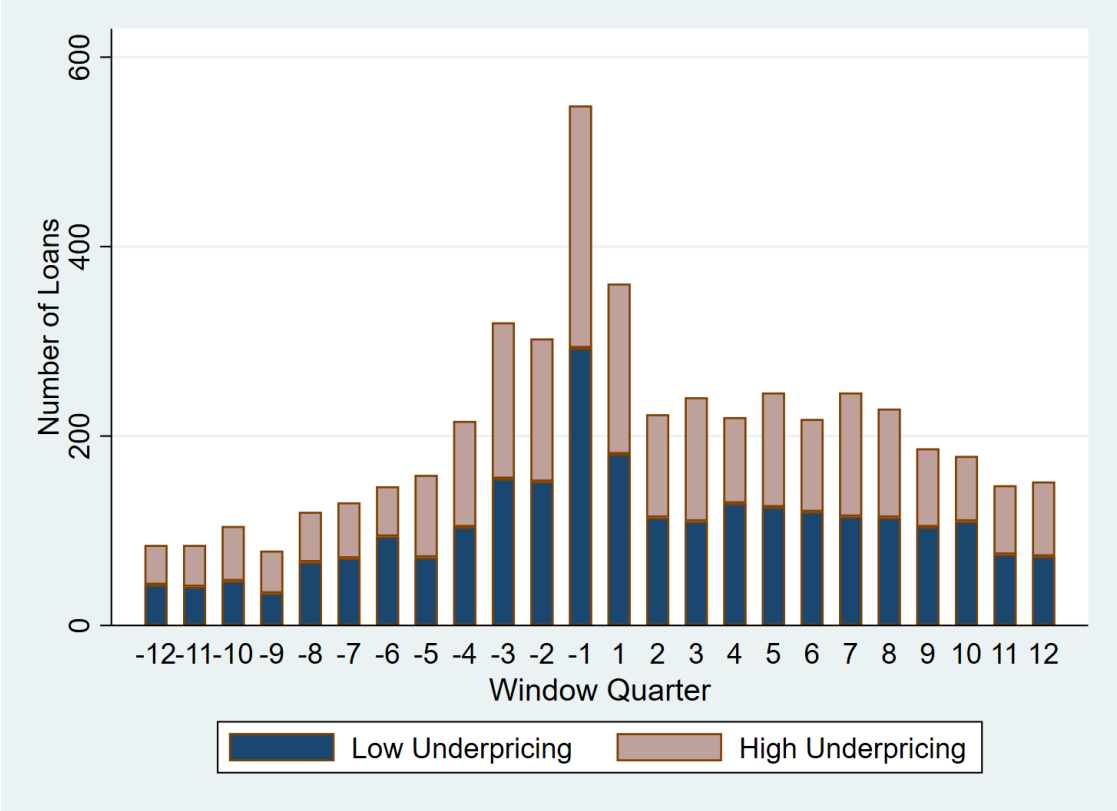

Figure 4: The Number of Loans over Window Quarters

This figure shows the distribution of the number of loans in our sample across the 24 quarters between 3 years before IPO and 3 years after IPO. The full sample consists of 4,948 bank loan facilities in 1987-2016 made by 1,010 IPO firms. We require the firm to be non-utility and non-financial firms, which complete IPO on the NYSE, AMEX and NASDAQ stock exchanges between 1990 and 2013. We also exclude REITs, units, ADRs, and offerings with the stock price below U.S. $5, and require every firm to have at least one loan (with non-missing all-in-spread-drawn in DealScan) within 3 years before IPO and one loan (with non-missing all-in-spread-drawn in DealScan) within 3 years after IPO. We show the distribution of loans for two subsamples: loans issued by IPO firms with high (i.e. above-median) underpricing and loans issued by IPO firms with low (i.e. below-median) underpricing.

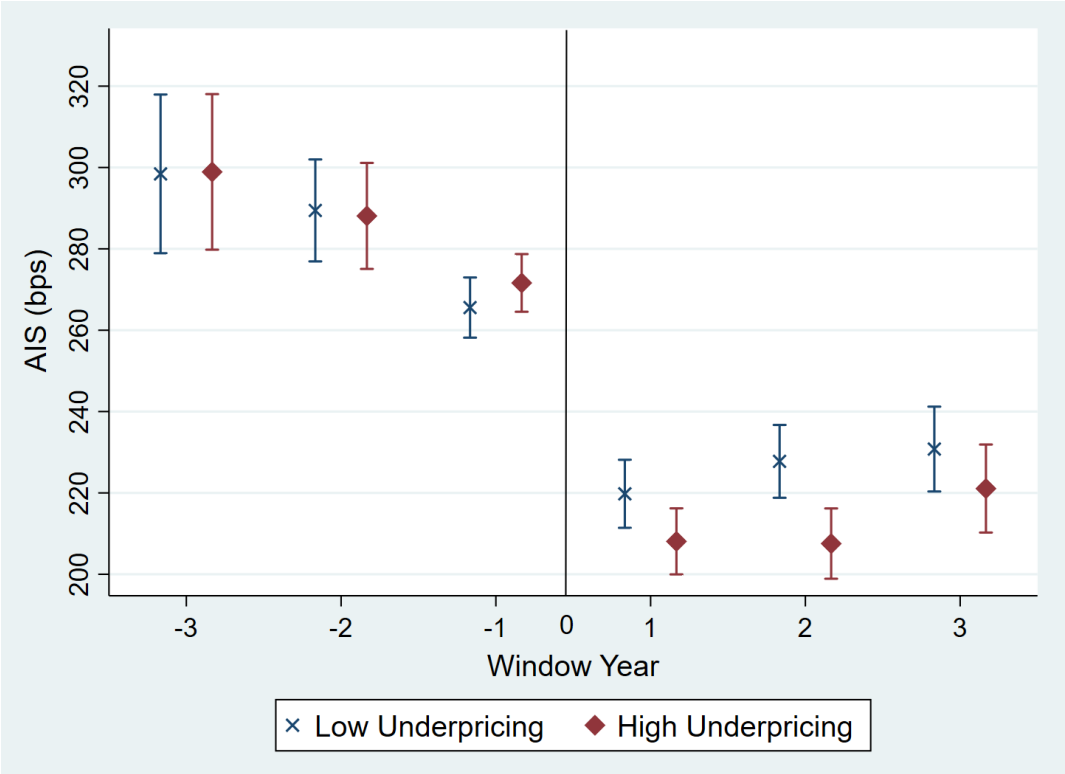

Figure 5: Loan Spread Before and After IPO

This figure shows the average loan interest spread (AIS) of the bank loan facilities in our sample across the three window years before and after IPO. The full sample consists of 4,948 unique bank loans between 1987 and 2016, each of which is issued by an IPO firm between 3 years before IPO and 3 years after IPO. We compare two subsamples: loans issued by IPO firms with high (i.e. above-median) underpricing and loans issued by IPO firms with low (i.e. below-median) underpricing.

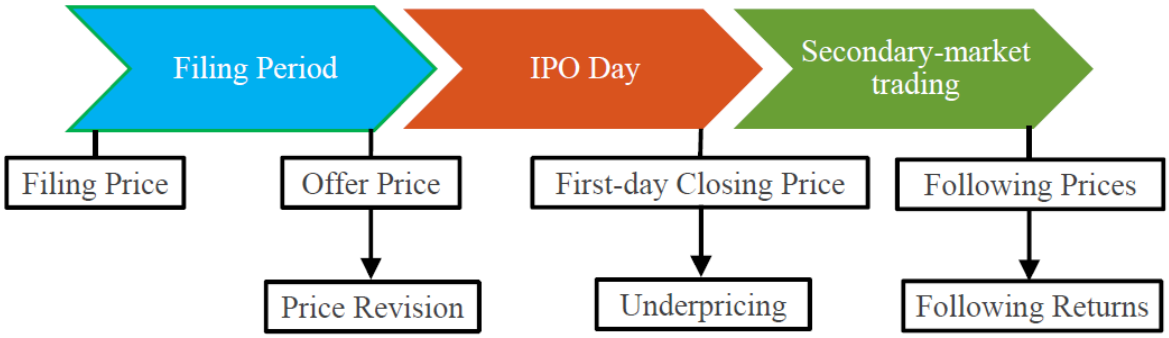

Figure 6: Timeline of IPO Pricing

This figure shows the timeline of IPO pricing. We split the IPO period into three subperiods: the filing period, the IPO day and the following secondary trading period. Respectively at the end of each subperiod, the lender can observe the price revision, underpricing, and stock returns following the first day.

Table 1: Summary Statistics for IPOs

This table reports summary statistics for key IPO variables for the 1,010 IPOs in our full sample and two subsamples split by median underpricing. To construct the full sample, we start with all non-utility and non-financial firms in SDC Global New Issues Database, which completed IPO on the NYSE, AMEX and NASDAQ stock exchanges between 1990 and 2013. We then exclude REITs, units, ADRs, and offerings with the stock price below U.S. $5. We further require every firm to have at least one loan (with non-missing all-in-spread-drawn in DealScan) within 3 years before IPO and one loan (with non-missing all-in-spread-drawn in DealScan) within 3 years after IPO. Panel A, and B report statistics for key IPO variables for the full sample, the subsample with high (i.e. above-median) underpricing and the subsample with low (i.e. below-median) underpricing respectively. All variables are winsorized at the 1^{st} and 99^{th} percentiles, and are summarized in Appendix I. All dollar amounts are in 2010 real dollars.

Panel A: Full Sample

Variables	N	Mean	SD	p1	p25	p50	p75	p99
Gross Proceedings (U.S. $ million)	1,010	169.12	232.03	11.29	46.21	90.36	183.30	1,488
VC-backed IPO (dummy)	1,010	0.24	0.43	0.00	0.00	0.00	0.00	1.00
Underwriter Ranking	905	8.04	1.35	3.00	8.00	8.63	9.00	9.00
Offer Price (U.S. $)	1,010	18.67	5.89	7.17	14.50	18.21	21.78	37.47
Book Assets (U.S. $ million)	951	642.21	1,562	2.38	44.77	152.46	464.14	11,082
Firm Age in the IPO Year (years)	1,008	25.25	27.97	0.00	6.00	14.00	33.00	104.00
Book Leverage	949	0.50	0.35	0.00	0.25	0.48	0.67	1.94
Cash Ratio	950	0.09	0.14	0.00	0.01	0.03	0.09	0.73
Profitability	938	-0.00	0.21	-1.20	-0.02	0.02	0.08	0.41
Tangibility	951	0.32	0.26	0.01	0.11	0.24	0.48	0.93
Underpricing (%)	1,010	13.52	20.41	-10.29	0.77	7.46	18.41	119.57
Underpricing (U.S. $ million)	1,010	22.46	51.30	-19.14	0.44	6.05	22.17	354.08
High Underpricing (dummy)	1,010	0.50	0.50	0.00	0.00	0.50	1.00	1.00
Price Revision (%)	1,007	-0.82	12.34	-34.00	-7.69	0.00	7.14	26.67

Panel B: Subsamples with High Underpricing and Low Underpricing

	High Underpricing				Low Underpricing				Diff.
Variables	N	Mean	p50	SD	N	Mean	p50	SD	
Gross Proceedings	505	170.16	95.00	227.30	505	168.08	86.78	236.89	-2.08
VC-backed IPO	505	0.30	0.00	0.46	505	0.19	0.00	0.39	-0.11***
Underwriter Ranking	452	8.10	8.88	1.28	453	7.98	8.00	1.42	-0.12
Offer Price	505	19.83	19.49	5.69	505	17.50	16.81	5.85	-2.34***
Book Assets	476	566.21	128.77	1,474	475	718.36	193.08	1,644	152.14
Firm Age	504	22.21	11.00	26.25	504	28.30	17.00	29.31	6.09***
Book Leverage	475	0.46	0.43	0.32	474	0.53	0.51	0.37	0.07***
Cash Ratio	476	0.10	0.04	0.15	474	0.07	0.03	0.13	-0.03***
Profitability	471	0.00	0.03	0.21	467	-0.01	0.02	0.21	-0.01
Tangibility	476	0.32	0.23	0.26	475	0.33	0.26	0.25	0.01
Underpricing (%)	505	26.12	18.41	22.39	505	0.92	0.77	3.75	—
Underpricing (U.S. $)	505	41.94	20.60	64.04	505	2.99	0.44	20.20	—
Price Revision (%)	503	5.20	6.25	10.66	504	-6.84	-5.41	10.88	—

Table 2: Loan and Borrower Characteristics: Pre- and Post-IPO

This table compares the key loan and borrower characteristics for the 4,948 observations in our full sample. Each of the loans is issued by an IPO firm between 3 years before IPO and 3 years after IPO. Panel A, B and C are respectively for the full sample, the subsample with high (i.e. above-median) underpricing and the subsample with low (i.e. below-median) underpricing. We split the loans into pre- and post-IPO loans, with the last column reporting the pre- and post-IPO difference in means of the loan characteristics. All variables are winsorized at the 1^{st} and 99^{th} percentiles, and are summarized in Appendix I. All dollar amounts are in 2010 real dollars. *,**, and *** indicate that differences in means are statistically significant at the 10%, 5%, and 1% levels, respectively.

	Pre-IPO				Post-IPO				Diff.
	N	Mean	Median	SD	N	Mean	Median	SD	
Panel A: Full Sample (obs: 4,948)									
AIS (bps)	2,298	276.79	275.00	111.32	2,650	219.05	200.00	111.24	-57.74***
Maturity (month)	2,210	53.36	60.00	25.84	2,553	52.57	60.00	23.17	-0.79
Loan Amount ($ million)	2,298	170.01	59.39	457.28	2,650	219.25	98.98	382.37	49.23***
Fin_Covenant (dummy)	2,298	0.46	0.00	0.50	2,650	0.60	1.00	0.49	0.14***
Book Assets ($ million)	2,129	1,396	264.44	6,612	2,566	1,949	482.43	8,848	552.66**
Book Leverage	2,087	0.52	0.50	0.33	2,566	0.40	0.40	0.26	-0.12***
Cash Ratio	2,037	0.08	0.03	0.13	2,558	0.08	0.03	0.13	0.00
Profitability	2,078	0.00	0.02	0.14	2,560	0.01	0.03	0.12	0.01**
Tangibility	2,031	0.34	0.27	0.25	2,558	0.32	0.25	0.25	-0.01
Panel B: Subsample with High Underpricing (obs: 2,405)									
AIS (bps)	1,125	277.34	255.00	110.66	1,280	209.47	200.00	107.06	-67.86***
Maturity (month)	1,080	52.03	60.00	26.79	1,238	52.46	60.00	23.91	0.43
Loan Amount ($ million)	1,125	135.99	46.19	291.92	1,280	201.81	99.12	311.74	65.83***
Fin_Covenant (dummy)	1,125	0.48	0.00	0.50	1,280	0.64	1.00	0.48	0.15***
Book Assets ($ million)	1,048	943.40	205.35	2,761	1,239	1,434	477.04	3,534	490.52***
Book Leverage	1,018	0.48	0.46	0.34	1,239	0.36	0.36	0.26	-0.12***
Cash Ratio	1,002	0.10	0.04	0.15	1,234	0.10	0.04	0.14	0.00
Profitability	1,018	0.00	0.02	0.16	1,234	0.01	0.03	0.14	0.01
Tangibility	996	0.33	0.23	0.26	1,231	0.32	0.25	0.25	0.01
Panel C: Subsample with Low Underpricing (obs: 2,543).									
AIS (bps)	1,173	276.27	275.00	111.99	1,370	228.00	225.00	114.32	-48.27***
Maturity (month)	1,130	54.64	60.00	24.84	1,315	52.68	60.00	22.45	-1.96**
Loan Amount ($ million)	1,173	202.65	70.60	570.89	1,370	235.53	97.31	437.68	32.89
Fin_Covenant (dummy)	1,173	0.44	0.00	0.50	1,370	0.57	1.00	0.50	0.13***
Book Assets ($ million)	1,081	1,835	395.00	8,852	1,327	2,430	486.77	11,802	94.47
Book Leverage	1,069	0.56	0.55	0.31	1,327	0.44	0.44	0.26	-0.12***
Cash Ratio	1,035	0.06	0.02	0.10	1,324	0.07	0.02	0.11	0.01**
Profitability	1,060	0.01	0.01	0.12	1,326	0.02	0.03	0.11	0.01*
Tangibility	1,035	0.34	0.30	0.24	1,327	0.32	0.26	0.25	-0.02*

Table 3: Post-IPO Reduction in Borrowing Costs

This table examines the benefit of going public in terms of reducing borrowing costs in bank loan markets. The sample consists of 4,948 unique bank loans in 1987-2016, each of which is issued by an IPO firm between 3 years before IPO and 3 years after IPO. The dependent variable is either all-in-spread-drawn (AIS) or the logarithm of AIS , log*AIS*, indicated by column headers. *Post* is a dummy variable that equals to one if the loan is issued after the firm goes public. We add firm and year fixed effects, and a list of firm and loan controls. In the last three columns, we exclude loans made within one quarter before IPO, loans with maturity less than two years, and loans issued during hot market period (1998-2000). All variables are winsorized at the 1^{st} and 99^{th} percentiles, and are summarized in Appendix I. The model is estimated using OLS. Standard errors are clustered at the firm level to correct for heterogeneity and t-values are presented in parentheses. *, **, and *** indicate that the coefficient is statistically significant at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Sample	Full Sample				Exclude Quarter -1	Exclude Maturity ≤ 2	Exclude 1998-2000
Y-variable	log*AIS*	log*AIS*	log*AIS*	*AIS*	log*AIS*	log*AIS*	log*AIS*
Post	**-0.199*** **	**-0.177*** **	**-0.176*** **	**-41.051*** **	**-0.222*** **	**-0.181*** **	**-0.189*** **
	(-8.03)	**(-6.57)**	**(-6.81)**	**(-7.25)**	**(-7.28)**	**(-6.58)**	**(-6.53)**
log(Book Assets)		-0.011	0.003	-2.071	0.013	0.007	0.008
		(-0.54)	(0.17)	(-0.52)	(0.65)	(0.35)	(0.36)
Book Leverage		0.209***	0.190***	39.060***	0.171**	0.207***	0.237***
		(3.26)	(3.09)	(2.75)	(2.50)	(3.19)	(3.21)
Tangibility		-0.294	-0.304	-65.718*	-0.233	-0.353*	-0.317
		(-1.58)	(-1.57)	(-1.80)	(-1.07)	(-1.73)	(-1.48)
Profitability		-0.441***	-0.398***	-101.612***	-0.415***	-0.442***	-0.347***
		(-4.61)	(-4.15)	(-4.31)	(-4.14)	(-3.34)	(-2.72)
Cash Ratio		-0.064	-0.128	-47.969*	-0.176	-0.148	-0.060
		(-0.51)	(-1.00)	(-1.80)	(-1.29)	(-0.92)	(-0.42)
log(Firm Age)		0.004	0.005	4.409	-0.012	0.011	-0.025
		(0.06)	(0.08)	(0.32)	(-0.18)	(0.18)	(-0.36)
log(Loan Amount)			-0.070***	-15.625***	-0.061***	-0.067***	-0.074***
			(-7.35)	(-7.22)	(-5.98)	(-6.95)	(-7.24)
log(Maturity)			0.053***	10.359**	0.056***	0.206***	0.048**
			(2.80)	(2.53)	(2.72)	(6.15)	(2.28)
Fin_Covenant			-0.021	-7.179	-0.016	-0.023	-0.026
			(-0.92)	(-1.34)	(-0.67)	(-1.01)	(-1.05)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loan Purpose FE	No	No	Yes	Yes	Yes	Yes	Yes
N	4,948	4,481	4,327	4,327	3,803	3,712	3,660
adj. R^2	0.212	0.226	0.283	0.268	0.309	0.317	0.301

Table 4: Is the post-IPO Reduction in Borrowing Costs Mainly due to Increased Equity from IPO? A Comparison between IPOs and SEOs

This table compares the difference in the post-issue reduction in borrowing costs between IPOs and SEOs. For each IPO in our sample, we match a SEO through a propensity score matching approach. We use six variables (log*(Book Assets)*, *Book Leverage*, *Tangibility*, *Profitability*, *Cash Ratio*, *Issue Ratio*), in addition to year and industry fixed effects, to compute the propensity scores and Panel A compares the variables used to compute the propensity scores between IPOs and SEOs. Panel B shows results of DiD tests using loans issued by IPO and SEO firms. Specifically, in Columns (1) to (3) we use all SEOs made in the same sample period (1990-2013) as control group; while in Columns (4) to (6), we use the matched IPOs and SEOs as treated and control groups. The dependent variable is log*AIS*, and we include firm and loan year fixed effects in all columns. We add an interaction term, *Post*×*Treated*, to regressions of Table 3. *Treated* is a dummy variable that equals to one for IPOs and zero for SEOs. All variables are winsorized at the 1^{st} and 99^{th} percentiles, and are summarized in Appendix I. Standard errors are clustered at the firm level to correct for heterogeneity and t-values are presented in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Panel A: Difference in Matching Variables

	IPOs			SEOs			Diff.	t-value
	Mean	SD	N	Mean	SD	N		
log(Book Assets)	5.637	1.617	569	5.649	1.538	569	0.01	0.13
Book Leverage	0.429	0.273	569	0.435	0.282	569	0.01	0.36
Tangibility	0.335	0.257	569	0.334	0.256	569	0.00	-0.05
Profitability	0.011	0.149	569	0.013	0.129	569	0.00	0.27
Cash Ratio	0.088	0.137	569	0.083	0.126	569	-0.01	-0.77
Issue Ratio	0.673	0.750	569	0.615	0.935	569	-0.06	-1.14

Panel B: DiD Regressions (Treated: IPOs; Control: SEOs)

	(1)	(2)	(3)	(4)	(5)	(6)
	Full Sample			Matched Sample		
Y-variable	log*AIS*	log*AIS*	log*AIS*	log*AIS*	log*AIS*	log*AIS*
Post × Treated	**-0.119*** **	**-0.046** **	**-0.041** **	**-0.111*** **	**-0.093*** **	**-0.086*** **
	(-6.45)	**(-2.36)**	**(-2.17)**	**(-3.55)**	**(-3.02)**	**(-2.87)**
Post	-0.121***	-0.086***	-0.073***	-0.142***	-0.087***	-0.071***
	(-9.76)	(-7.60)	(-6.58)	(-4.73)	(-3.14)	(-2.70)
Treated	0.169***	0.099***	0.087***	0.160***	0.120***	0.107***
	(10.89)	(6.19)	(5.63)	(5.78)	(3.96)	(3.58)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm Controls	No	Yes	Yes	No	Yes	Yes
Loan Controls	No	No	Yes	No	No	Yes
N	23,099	21,851	21,236	6,070	5,781	5,572
adj. R^2	0.185	0.244	0.315	0.192	0.244	0.304

Table 5: DiD Tests: The Post-IPO Reduction in Borrowing Costs and IPO Underpricing

This table examines the relationship between the benefit of going public and IPO underpricing. The sample consists of 4,948 unique bank loans in 1987-2016, each of which is issued by an IPO firm between 3 years before IPO and 3 years after IPO. We run the following DiD regression:

$$\log AIS = \alpha + \beta \cdot \textit{Post} + \gamma \cdot \textit{Post} \times \textit{High Underpricing} + \lambda \cdot \textit{High Underpricing} + \Gamma \cdot \mathbf{X}' + FEs + \epsilon$$

The dependent variable is either all-in-spread-drawn (AIS) or the logarithm of AIS, log*AIS*, indicated by column headers. *Post* is a dummy variable that equals to one if the loan is issued after the firm goes public. In Columns (1) to (3), we examine the differences in borrowing costs for firms with high underpricing and low underpricing, captured by the coefficient of the interaction term between *Post* and *High Underpricing* dummy, which equals to one if IPO underpricing is above-median. In Columns (4)-(5), we compare the differences in borrowing costs for firms in the top tercile underpricing and bottom tercile underpricing, where *Top Underpricing* is a dummy variable that equals one if the firm's IPO underpricing is in the top tercile. In Column (6) we examine the marginal effect of underpricing on post-IPO reduction in borrowing cost, indicated by the coefficient of the interaction term *Post* and continuous variable of underpricing, *Underpricing*. In all columns, underpricing is defined by either the percentage change (indicated by column header, %) of the first-day closing price relative to the offer price or the dollar amount of money left on the table (indicated by column header, $). We include firm, year and loan purpose fixed effects, and a list of firm and loan characteristics as controls. All variables are winsorized at the 1^{st} and 99^{th} percentiles, and are summarized in Appendix I. The model is estimated using OLS. Standard errors are clustered at the firm level to correct for heterogeneity and t-values are presented in parentheses. *, **, and *** indicate that the coefficient is statistically significant at the 10%, 5%, and 1% levels, respectively.

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	(1)	(2)	(3)	(4)	(5)	(6)
Underpricing defined in	%	%	$	%	$	%
Y-variable	log*AIS*	*AIS*	log*AIS*	log*AIS*	log*AIS*	log*AIS*
Post× High Underpricing	**-0.111*** **	**-23.199*** **	**-0.092*** **			
	(-3.40)	**(-3.17)**	**(-2.65)**			
Post× Top Underpricing				**-0.147*** **	**-0.150*** **	
				(-3.33)	**(-3.46)**	
Post× Underpricing						**-0.002** **
						(-2.39)
Post	-0.126***	-30.644***	-0.129***	-0.105***	-0.103***	-0.152***
	(-4.11)	(-4.46)	(-3.91)	(-2.63)	(-2.60)	(-5.38)
log(Book Assets)	0.011	-0.370	0.005	-0.003	-0.014	0.010
	(0.61)	(-0.09)	(0.30)	(-0.10)	(-0.67)	(0.53)
Book Leverage	0.177***	36.300**	0.187***	0.130*	0.188**	0.183***
	(2.91)	(2.58)	(3.06)	(1.68)	(2.48)	(2.99)
Tangibility	-0.272	-59.195	-0.302	-0.286	-0.491**	-0.307
	(-1.40)	(-1.63)	(-1.57)	(-1.29)	(-2.30)	(-1.59)
Profitability	-0.407***	-103.379***	-0.389***	-0.274**	-0.394***	-0.416***
	(-4.26)	(-4.41)	(-4.07)	(-2.51)	(-3.72)	(-4.30)
Cash Ratio	-0.120	-46.313*	-0.123	-0.083	-0.112	-0.113
	(-0.94)	(-1.74)	(-0.97)	(-0.53)	(-0.76)	(-0.89)
log(Firm Age)	0.007	4.889	0.012	0.159**	0.136**	0.020
	(0.12)	(0.35)	(0.20)	(2.18)	(2.02)	(0.33)
log(Loan Amount)	-0.069***	-15.435***	-0.070***	-0.083***	-0.070***	-0.070***
	(-7.31)	(-7.19)	(-7.37)	(-7.54)	(-6.45)	(-7.41)
log(Maturity)	0.052***	10.280**	0.052***	0.060**	0.056**	0.053***
	(2.79)	(2.52)	(2.76)	(2.57)	(2.49)	(2.80)
Fin_Covenant	-0.016	-6.260	-0.019	-0.016	-0.040	-0.020
	(-0.72)	(-1.17)	(-0.85)	(-0.51)	(-1.45)	(-0.91)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Loan Purpose FE	Yes	Yes	Yes	Yes	Yes	Yes
N	4,327	4,327	4,327	2,511	2,745	4,327
adj. R^2	0.287	0.272	0.286	0.308	0.332	0.285

Table 6: Effects on the Post-IPO Reduction in Borrowing Costs: Underpricing vs. Price Revision and Other Returns

This table compares the differences between the effects of underpricing, price revision and other stock returns on the post-IPO reduction in borrowing costs. The dependent variable is the logarithm of all-in-spread-drawn (AIS), log*AIS*. *Post* is a dummy variable that equals one if the loan is issued after the firm goes public. *High Underpricing* is a dummy that equals to one if the IPO firm has above-median underpricing, defined as the percentage change of the first-day closing price relative the offer price. *High Price Revision* is a dummy that equals to one if the IPO's adjustment of its offer price from the midpoint filing price is above median. *High First-week Return* and *High First-month Return* are dummy variables equal to one if the first-week and first-month returns following IPO offer day are above median. Column (1) replicates Column (1) in Table 5, but replaces *Underpricing* with *Price Revision*. In Column (2), we add *Post*×*High Underpricing* to Column (1). That is, we run a horse race of underpricing and price revision. In Column (3), we further include two more stock returns in the regression, the first-week stock return and the first-month stock return, both excluding the first-day return. Finally, in Columns (4) to (6), we replicate Columns (1) to (3) respectively but replace the dummy variables of underpricing, price revision and stock returns by their continuous variables. We also include firm, year and loan purpose fixed effects, and a list of firm and loan characteristics in all columns. All variables are defined in Appendix I. The model is estimated using OLS. Standard errors are clustered at the firm level to correct for heterogeneity and t-values are presented in parentheses. *, **, and *** indicate that the coefficient is statistically significant at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Y-variable	log*AIS*	log*AIS*	log*AIS*	log*AIS*	log*AIS*	log*AIS*
Post×High Price Revision	**-0.022**	**0.040**	**0.040**			
	(-0.65)	**(1.01)**	**(1.01)**			
Post×High First-week Return			0.000			
			(0.01)			
Post×High First-month Return			-0.040			
			(-1.06)			
Post×High Underpricing		-0.130***	-0.123***			
		(-3.39)	(-3.19)			
Post×Price Revision				**-0.001**	**0.000**	**0.000**
				(-1.15)	**(0.04)**	**(0.06)**
Post× First-week Return						-0.165
						(-0.80)
Post×First-month Return						0.091
						(0.79)
Post×Underpricing					-0.002**	-0.002**
					(-2.11)	(-2.13)
Post	-0.164***	-0.140***	-0.124***	-0.178***	-0.151***	-0.156***
	(-5.09)	(-4.22)	(-3.03)	(-6.82)	(-5.09)	(-5.28)
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes
All Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
N	4,327	4,327	4,327	4,308	4,308	4,222
adj. R^2	0.283	0.288	0.288	0.282	0.284	0.289

Table 7: Controlling Other Factors that Affect Underpricing

This table reports robustness analyses for the regressions in Table 5. The dependent variable is the logarithm of all-in-spread-drawn (AIS), log*AIS*. *Post* is a dummy variable that equals one if the loan is issued after the firm goes public. *High Underpricing* is a dummy that equals to one if the IPO firm has above-median underpricing, defined as the percentage change of the first-day closing price relative the offer price. *High Price Revision* is a dummy that equals to one if the IPO's adjustment of its offer price from the midpoint filing price is above median. In addition to the interaction terms between *Post* and *High Underpricing* and *High Price Revision*, we include the interaction terms between *Post* and *Underwriter Ranking* in Column (1), *VC-backed IPO* in Column (2), log*(*Gross Proceedings) in Column (3), log(*Book Assets*) in Column (4), log(*Sales*) in Column (5), *IPO Age* in Column (6), and all these factors in Columns (7). These factors are important drivers of IPO underpricing, documented in the literature. We also include firm, year and loan purpose fixed effects, and a list of IPO, firm and loan characteristics. All variables are defined in Appendix I. The model is estimated using OLS. Standard errors are clustered at the firm level to correct for heterogeneity and t-values are presented in parentheses. *, **, and *** indicate that the coefficient is statistically significant at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Y-variable	log*AIS*	log*AIS*	log*AIS*	log*AIS*	log*AIS*	log*AIS*	log*AIS*
Post× High Underpricing	**-0.126*** **	**-0.131*** **	**-0.131*** **	**-0.128*** **	**-0.131*** **	**-0.130*** **	**-0.123*** **
	(-2.89)	**(-3.41)**	**(-3.44)**	**(-3.32)**	**(-3.37)**	**(-3.41)**	**(-2.78)**
Post× Underwriter Ranking	-0.032**						-0.037**
	(-2.47)						(-2.26)
Post× VC-backed IPO		0.032					-0.010
		(0.73)					(-0.20)
Post× log(Gross Proceedings)			-0.009				-0.034
			(-0.53)				(-1.24)
Post× log(Book Assets)				-0.000			0.093***
				(-0.04)			(3.86)
Post× log(Sales)					-0.015		-0.074***
					(-1.30)		(-3.52)
Post× IPO Age						-0.028	-0.029
						(-1.35)	(-1.07)
Post× High Price Revision	0.053	0.039	0.043	0.039	0.037	0.040	0.067
	(1.17)	(1.00)	(1.07)	(0.97)	(0.92)	(1.00)	(1.45)
Post	0.109	-0.144***	-0.099	-0.137*	-0.054	-0.054	0.280**
	(0.99)	(-4.29)	(-1.18)	(-1.88)	(-0.72)	(-0.73)	(2.13)
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
All Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	3,725	4,327	4,327	4,193	4,089	4,327	3,493
adj. R^2	0.284	0.288	0.288	0.291	0.293	0.290	0.298

Table 8: IV (2SLS) Tests: Evidence from Exogenous Variations of IPO Underpricing

This table examines the relationship between the benefit of going public and IPO underpricing through 2-stage Least Squares (2SLS) estimations. The instrumental variable is *High Nasdaq Return*, a dummy equals to one if the 3-week Nasdaq return before IPO is above median. In Columns (1) to (2), we report the first-stage regressions, where the dependent variables are *High Underpricing* and *Post* $\times$ *High Underpricing* respectively, and the F-statistics is reported at the bottom of the columns. We include the same control variables as in the corresponding second-stage regressions, including industry, loan year and issue year fixed effects, as well as a list of firm, IPO and loan characteristics. Column (3) presents our second-stage estimation, where the dependent variable is the logarithm of all-in-spread-drawn (AIS), log*(AIS)*. The independent variables include the instrumented *High Underpricing* and instrumented *Post* $\times$ *High Underpricing*. Columns (4) to 6) replicate Columns (1) to (3), but replace *High Underpricing* dummy with a continuous variable, *Underpricing*. All variables are winsorized at the 1^{st} and 99^{th} percentiles, and are summarized in Appendix I. Standard errors are clustered at the firm level to correct for heterogeneity and t-values are presented in parentheses. *, **, and *** indicate that the coefficient is statistically significant at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	1^{st} Stage		2^{nd} Stage	1^{st} Stage		2^{nd} Stage
Y-variable	Post×High Underp.	High Underp.	log*AIS*	Post×Underpricing	Underpricing	log*AIS*
Post×High Nasdaq Return	**0.163*** **	0.053		**4.818*** **	1.185	
	(4.10)	(1.62)		**(3.49)**	(1.20)	
High Nasdaq Return	0.000	**0.108*** **		0.203	**3.336** **	
	(0.03)	**(2.63)**		(0.41)	**(2.53)**	
Post×High Underpricing			**-0.807** **			
			(-2.05)			
High Underpricing			0.800**			
			(2.00)			
Post×Underpricing						**-0.025***
						(-1.90)
Underpricing						0.027*
						(1.86)
Post	0.384***	-0.049*	0.262	8.850***	-1.564	0.184
	(13.02)	(-1.77)	(1.36)	(9.83)	(-1.59)	(1.11)
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Loan Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Issue Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Loan Purpose Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
N	4,327	4,327	4,327	4,327	4,327	4,327
1st Stage F-Stat.		23.37			15.62	
2nd Stage Wald χ^2			3.44			2.80
p-value of χ^2			0.00			0.02

Passive Investors and Corporate Social Responsibility: a Risk-Management Perspective*

Wenxuan Hou Xiaoyu Zhang†

Abstract

This paper develops a risk-management view of CSR by arguing that CSR provides insurance-like effects in adverse corporate events. Since passive investors have diversified away most idiosyncratic risks, we predict that they demand less CSR as a strategic approach to manage risks. Using the annual Russell 1000/2000 index reconstitution as an instrument for passive investor ownership, we find that firms with higher passive fund ownership exhibit significantly lower CSR engagement. The effects are more pronounced among better-diversified passive investors and firms that are not in CSR-sensitive industries. We also find that passive investors hold back CSR activities through the channel of "voice" by reducing the number of socially responsible investment (SRI) proposals. Overall, the findings shed light on the risk-management function of CSR and provide original evidence that passive investors imprint their preference on firm policy.

Keywords: *Passive investor, Institutional investor, Corporate social responsibility, Portfolio diversification, Risk management.*

*We have benefited from discussions with Einar Bakke, Carsten Bienz, Nils Friewald, Astrid Kunze, Tore Leite, Jøril Mæland, Svein-Arne Persson, Konrad Raff, Francisco Santos, Joshua Spizman, Xunhua Su, Karin Thorburn, Darya Yuferova, and seminar participants at the 2017 FMA meeting, 2017 NFN PhD workshop, 2016 ABFC meeting and seminar participants at Norwegian School of Economics. Xiaoyu is very grateful to Xunhua Su (supervisor) for his invaluable supports and guidance.

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1 Introduction

There has been a dramatic explosion of index funds in the past two decades. Passive funds increased from 10% of the total assets of US funds in 1997 to 45% in 2017 (Morning Star, 2017[1]). Meanwhile, more funds started engaging CSR by applying ESG (environmental, social and governance) screen criteria in their investment, as evident by a 14-fold increase in the assets of socially responsible funds from 1995 to 2016 (US SIF Foundation, 2016[2]). Since passive funds need to minimize tracking error, it's unlikely for their managers to apply these criteria in selecting stocks. This raises an important question about whether and how passive investors influence portfolio companies' corporate social responsibility (CSR).

While there is considerable literature on the governance implications of institutional investors (see, e.g., Edmans and Holderness, 2016), passive funds remain under-researched. Unlike other institutional investors, passive ones are not able to discipline management through exit. But they can still exert their influence through proposals and voting. Appel, Gormley, and Keim (2016a) show that an increase in passive fund ownership is associated with more independent boards, the removal of takeover defenses, a lower chance of unequal voting rights, a decline in support for management proposals and an improvement in firm performance. Appel, Gormley, and Keim (2016b) document evidence that passive funds facilitate the tactics and successes of activists. Schoenfeld (2017) shows that index fund holding is positively related to voluntary disclosure. Schmidt and Fahlenbrach (2017) further note that the benefits are limited to low-cost governance activities. In this study, we extend the focus to CSR activities.

While the literature provides evidence that passive funds play a governance role and have the voting power to exert their influence on firm policy and outcome, their impact on CSR is still not clear. On the one hand, CSR has become an increasingly important business activity that brings necessary legitimacy. Proponents of CSR believe in "doing well by doing good," where CSR brings material benefits through the channels of sales, financing cost and productivity, among others. Dhaliwal, Li, Tsang, and Yang (2011) find that the voluntary disclosure of CSR reports is associated with a subsequently lower cost of equity capital. Goss and Roberts (2011) further show

[1] 2017 *Global Asset Flows Report* by Moringstar, 16 May 2018. See https://newsroom.morningstar.com.

[2] See *2016 Report on US Sustainable, Responsible and Impact Investing Trends*, by the US SIF Foundation.

that creditors charge a higher interest rate for firms with social responsibility concerns. Dhaliwal, Radhakrishnan, Tsang, and Yang (2012) find that CSR reports help to improve the forecast accuracy of sell-side analysts, especially in stakeholder-oriented countries. Passive funds therefore have incentive to strengthen the CSR activities of portfolio firms and to reap the benefits. In addition, the corporate culture view of CSR holds that an ethical corporate culture is in line with corporate governance. This is supported by the empirical evidence of CSR's negative relation to earnings management (Kim, Park, and Wier, 2012) and tax avoidance (Hoi, Wu, and Zhang, 2013). The casual effects of corporate governance on CSR established in Ferrell, Liang, and Renneboog (2016) also imply that the governance role played by passive investors (Appel, Gormley, and Keim, 2016a,b) can potentially map onto CSR activities.

On the other hand, passive funds also have good reasons not to engage in CSR. Hoi, Wu, and Zhang (2013) indicate that risk management is an important motivation of CSR activities. The reputation built through CSR activities turns from latent to manifest resources in negative corporate events and protects firms from the risk of adverse political, regulatory and social sanctions. In the case study of Minor and Morgan (2011), Boston Scientific enjoyed a 5.54% abnormal return following the recall of their products because the market interpreted the call as a positive event, given the firm's past reputation with CSR. Lins, Servaes, and Tamayo (2017) show that firms engaging CSR are better off in financial crisis because of the trust installed through CSR activities. From a risk-management perspective, the cost of CSR activities amounts to an insurance premium to reduce the loss in negative corporate events.

Since the idiosyncratic risks can be mitigated through diversification, we conjecture that a CSR-based risk-management strategy would be different for undiversified and diversified investors. While extreme negative corporate events are rare, undiversified investors without such "CSR insurance" can suffer unbearable losses when they happen. For index funds, however, they diversify away firm-specific risk of negative corporate events with their low-turnover and high-diversification strategy. The "CSR insurance" on each portfolio company brings little net benefits. Since passive funds charge a lower management fee, they are more sensitive to costs. For example, they even forego holding firms at the bottom of the tracked index to save transaction costs (Frino and Gallagher, 2001). Therefore, passive investors are less likely to spend on CSR insurance which

appears to be redundant.

Overall, the net effects of passive funds on CSR activities pose a timely and important research question. There is an empirical challenge in examining the causal effects because of the possible endogeneity issue. Ownership by institutional investors could be correlated with factors – such as firms' access to capital, investment opportunities or cash constraints – that directly affect their CSR choices. Failure to control for such factors could introduce an omitted variable bias that confounds inferences. Moreover, a reverse causality or simultaneity bias might exist because firms' CSR policies could affect firm performance and thus the likelihood of getting included in indexes.

To address the problem, we follow the recent studies on the causal effects of passive investors (Appel, Gormley, and Keim, 2016a,b; Schmidt and Fahlenbrach, 2017; Schoenfeld, 2017) to isolate exogenous shocks to passive investor ownership by employing a plausible setting of the reconstitution of the Russell Indexes. Every year in June, Russell Investments constructs the Russell 1000 (the largest 1000 firms) and the Russell 2000 (the next 2000 largest firms) indexes based on market capitalization rankings. Around the cutoff point of the two indexes, firms are randomly assigned to the indexes after controlling for market capitalization. This random assignment leads to big differences in value-weighted index weights for firms of similar size around the threshold and represents an exogenous shock in institutional ownership. Passive funds that benchmark against these indexes tend to hold big positions in the firms at the top of Russell 2000 relative to those at the bottom of Russell 1000. We use the index inclusion in Russell 2000 at the threshold as the instrumental variable to predict passive institutional ownership in the first stage. Based on a sample of 2,828 observations near the cutoff of the Russell 1000/2000 indexes over the period of 2003-2011, we find that, on average, firms just included in Russell 2000 index have 2.4% higher total institutional ownership relative to firms just excluded from the Russell 2000 index, and the result is mainly driven by an increase in passive institutional investors.

In the second stage, we regress the predicted ownership against CSR score from the KLD database. Since we focus only on variation of firms in a neighborhood close to the threshold in which firms are similar enough, the variation in institutional ownership is orthogonal to firm characteristics. The instrumental variable is likely to satisfy exclusion restriction in the sense that Russell index inclusion is exogenous to firms' CSR policy, except for its effect through institutional

ownership. Our estimates suggest that, on average, a one percent increase in passive ownership leads to a 0.3 point decrease in CSR score (i.e., 0.16 standard deviation). The results are robust to alternative bandwidth and polynomial order, additional control variables and various subsamples.

To explore the influencing channels of passive investors on firms' CSR choices, we investigate the firms' probability of initiating Socially Responsible Investment (SRI) proposals in the annual meeting. The results reveal a negative association between passive investor ownership and the probability of initiating, and the number of, CSR projects, providing evidence that institutional investors exert their influence through their voice, i.e., by communicating with management and using their ownership stake to ensure conformity with their views on corporate policy. Finally, by decomposing the net CSR score into a strength score and a concern score, we find the lower total CSR scores are mainly driven by a lower strength score, rather than a higher concern score. This suggests that passive investors strategically reduce CSR costs.

This paper contributes to the literature in two important ways. It answers Moser and Martin (2012) call for a broader perspective of CSR and adds to the CSR literature by shedding new light from a risk-management perspective (Minor and Morgan, 2011; Hoi, Wu, and Zhang, 2013). Existing literature largely focuses on the impact of CSR on incremental value gain, leaving its function of risk mitigation or insurance-like effects under-researched. We provide original evidence of the risk-management incentives of CSR engagement, and we look beyond management to understand the role played by passive investors. We show that passive investors' intention to engage CSR is weak, in that they have already diversified the majority of idiosyncratic risks away and do not demand the insurance effects of CSR activities.

Second, it extends the growing literature on causal effects of passive investors on firm outcome by using the unique setting of the annual reconstitution of the Russell 1000 and 2000 indexes that bring exogenous shocks to passive investor ownership. The popularity of passive investment solutions is growing at an accelerated pace. Studies on institutional investors are abundant in the literature, but few explore the motivation and influence of passive investors. Recently, Appel, Gormley, and Keim (2016a,b), Schmidt and Fahlenbrach (2017), Bird and Karolyi (2016b) explore their influence on corporate governance and tax avoidance. We extend the scope to their influence on CSR activities.

2 Hypothesis Development

2.1 Passive Investors: Corporate Governance View of CSR

Corporate social responsibility (CSR) refers to actions or investments that firms undertake beyond what is legally required with respect to their employees, communities and environment (Kitzmueller and Shimshack, 2012). Fortune 500 firms spend more than $15 billion a year on CSR activities.[3] However, the motivation and rationale of CSR has been debated since 1930 (Macintosh, 1999). The fundamental question is to whom the company is accountable? One view is that managers should be solely responsible to shareholders, while the other view is that managers are trustees for both shareholders and society. Friedman (2007) regards CSR as a violation of market mechanisms in determining the allocation of resources and a manifestation of agency problem. His review is supported by evidence that managers may pursue private benefits by engaging in costly but value-destroying CSR projects (e.g., Masulis and Reza, 2015).

However, it is not true that no CSR activities are in line with shareholder interests. For example, CSR can be used to enhance firm legitimacy, social capital (Lins, Servaes, and Tamayo, 2017) and corporate image, and in turn trigger positive market reactions (Flammer, 2015) and enhance financial performance. A corporate governance view suggests that appropriate incentive and effective monitoring lead to better managerial decisions on CSR activities; for example, managers choosing to engage value-adding and effective CSR activities. This view is supported by evidence from Ferrell, Liang, and Renneboog (2016) that stronger corporate governance leads to higher CSR ratings. They find well-governed firms, as indicated by lower cash holding, higher payout and leverage ratio and stronger pay-for-performance, are more likely to be socially responsible. The results suggest that corporate governance helps to develop a corporate culture in favor of CSR, and are in line with the evidence of a negative relation between CSR and tax avoidance (Hoi, Wu, and Zhang, 2013) and a negative relation between CSR and earnings management (Kim, Park, and Wier, 2012).

The literature suggests that institutional investors play an active governance role with their specialized expertise, lower coordination costs and higher incentives, which may in turn influ-

[3] See http://www.huffingtonpost.com/linda-novick-okeefe/csr-grows-in-2016-as-comp_b_13657368.html.

ence CSR activities. Aggarwal, Erel, Ferreira, and Matos (2011) show that institutional investors promote better governance as measured by an index with 41 governance attributes. McCahery, Sautner, and Starks (2016) find that institutional investors tend to intervene intensively when motivated by concerns about a firm's corporate governance or strategy. Recent studies use changes in index membership as an identification strategy to study their causal effects. This quasi-random assignment permits a regression discontinuity research design to mitigate endogeneity concerns. Mullins (2014) documents that firms just included in the Russell 1000 increase the performance sensitivity of CEO pay. Crane, Michenaud, and Weston (2016) find that institutional shareholders mitigate agency costs and pressure firms to pay higher dividends. Bird and Karolyi (2016b) argue that institutional investors align the incentives of managers and shareholders and in turn make the level of tax avoidance closer to the preferred choice from shareholders' perspectives.

The corporate governance view suggests that if institutional investors can play an active monitoring role, they should be able to enhance CSR as well. Gibson and Krueger (2017) find that institutional investors such as pension fund increases the CSR of portfolio firms. They make a causal inference based on exogenous shocks of natural disasters and an instrumental variable of state-level constituency statutes related to non-shareholder interests. Dyck, Lins, Roth, and Wagner (2017) document similar results from 41 countries.[4] Chang, Kabongo, and Li (2016) show that investment horizon and geographical proximity strengthen the positive link between institutional ownership and CSR. Chen, Dong, and Lin (2018) find that the link is more pronounced in consumer-oriented industries, financially constrained firms and firms with inferior corporate governance.

It is important to note that institutional investors are far from a homogeneous group. Bushee (2001) classifies institutional investors into quasi-indexers (i.e., passive investors), transient and dedicated based on past portfolio turnover, diversification and investment horizon. This study focuses on passive investors for three reasons. First, little is understood about the impact of quasi-indexers on firm outcome and especially CSR. Institutional investors influence management through direct intervention, including the channel of "voice" and threat of exit (McCahery, Saut-

[4]When the endogeneity issue was not controlled, Liang and Renneboog (2017) present a negative association between pension fund and CSR, and argue that institutional ownership is not a channel of legal origin to influence CSR.

ner, and Starks, 2016), but passive investors can only use the former. Second, passive funds have become increasingly popular in the past few years, and investors have yanked record amounts from actively managed funds (*Los Angeles Times*, 9 April 2017[5]). The assets managed by passive mutual funds grew 18 per cent to $6.7 trillion in 2016, which is 4.5 times faster than the assets growth of active funds (*Financial Times*, 12 February 2017[6]). Third, the Russell 1000/2000 index reconstitution serves as a more plausible instrumental variable in studying passive funds because quasi-indexers are more sensitive to change at the top of their benchmark index. In fact, there is no evidence that index assignment is related to ownership by actively managed funds (Appel, Gormley, and Keim, 2016a) or by dedicated investors (Crane, Michenaud, and Weston, 2016).

A number of recent studies use the index-fund-inclusion setting to study the impact of passive funds on corporate governance. Appel, Gormley, and Keim (2016a) find that passive funds are not passive owners. In fact, they have incentives to govern through voice. An increase in their ownership is associated with more independent directors, a higher likelihood of the firm removing a poison pill and reducing restrictions on shareholders' ability to call special meetings, and a lower likelihood of having dual class shares. Appel, Gormley, and Keim (2016b) present evidence that passive investors mitigate the free-rider problem and facilitate activism by influencing the campaigns, tactics and success of activism. Schoenfeld (2017) argues that index funds prefer more disclosure and communicate such preference directly to companies through investor conferences and private conversations. Index funds use both hard power (proxy votes) and soft power (informal negotiation and influence in the CEO labor market) to exert influence on managers and increase voluntary disclosure. From the corporate governance perspective of CSR (Ferrell, Liang, and Renneboog, 2016), passive investors mitigate the agency problem by improving the incentives and monitoring of managers and engaging managers with appropriate and effective CSR conduct. We hereby propose our first hypothesis as follows:

H1: *Passive investors are positively associated with corporate social responsibility*

[5] *Los Angeles Times*, 9 April 2017. See www.latimes.com.

[6] *Financial Times*, 12 February 2017. See https://www.ft.com/content/c4f6ee56-e48c-11e6-9645-c9357a75844a.

2.2 Passive Investors: Risk-Management View of CSR

CSR is also a strategic approach to managing risks. It serves as safety nets by increasing firms' ability to withstand adverse conditions. The loss in market value associated with negative events is often substantial and often larger than the hard costs incurred from the actual event itself (Davidson and Worrell, 1992), but CSR engagement is found to have insurance-like effects that effectively mitigate adverse impact on stock price upon the occurrence of negative corporate events (Shiu and Yang, 2017). Godfrey (2005) provides a rationale for the insurance-like effects of CSR. Philanthropic activities are perceived by the market and regulators to be altruistic and therefore bring moral value to firms, which helps to offset the adverse assessment in negative events. In this context, CSR expenses can be regarded as insurance premiums paid to mitigate the loss of market value in unexpected negative firm-specific events (Peloza, 2006; Minor and Morgan, 2011). The risk-management perspective of CSR remains under-studied in the accounting literature.

Given the significant effect of negative events on firm value, the benefits of the insurance-like effects of CSR are tremendous. Peloza (2006) believes such benefit is even greater than the incremental gains expected from CSR. Klein and Dawar (2004) argue that consumer perceptions of CSR moderate their attributions of blame on the part of the firm for a product failure. In a negative corporate event, the CSR reputation of the involved firms drives perception from "bad management" towards "bad luck" (Minor and Morgan, 2011). The latter, seen as an honest mistake, leads to much less damage. The meta-analysis results from Orlitzky and Benjamin (2001) show that a lower level of CSR increases firm risks. Lee and Faff (2009) confirm that CSR firms exhibit lower idiosyncratic risk and a lower probability of financial distress.

Passive investors make their CSR decisions after weighing the benefits of CSR activities against the costs of potential loss in hazardous events. Since they typically hold a large number of index constituents, the idiosyncratic risks can be largely diversified away. Solnik (1995) shows that around 73% of risks can be diversified away when an investor holds more than 30 stocks in the U.S. market. Passive investors are already covered in this sense and therefore are unlikely to encourage their portfolio firms to engage in CSR for the insurance-like effects.

"CSR insurance" does not come cheap. Fortune Global 500 companies spend $15.2 billion a

year on corporate social responsibility activities (*Financial Times*, 2014[7]). The aggregate cost of portfolio firms' CSR activities brings down the profitability of passive investors. Khan, Srinivasan, and Tan (2016) emphasize that the focus of passive investors is to increase profitability, and they allow managers to take any feasible cost-reduction strategies, even including tax avoidance. It's natural to expect that they would also cut CSR-related costs to achieve this.

The cost of "CSR insurance" is exaggerated by the fact that consistent inputs are required. Godfrey (2005) and Vanhamme and Grobben (2009) argue that only consistent philanthropic activities can avoid the impression of opportunism. A track record of CSR is needed in crisis communications to counter negative publicity. Shiu and Yang (2017) confirm that only long-term CSR engagement earns the trust and goodwill of stakeholders and produces insurance-like effects. Even with consistent inputs, unlike a traditional insurance contract, the insurance-like effects of CSR disappear if the negative events recur. For example, Boston Scientific, a CSR active firm, enjoyed positive market reaction to its product recall in 1998, but lost 5.66% of its market value in a second recall in 1999. Minor and Morgan (2011) interpret this as the balance of blame shifting from bad luck to bad management.

In corporate hazards, the cost for institutional shareholders is often not limited to economic loss. Hazards attract unfavorable attention from the media and public outrage for firms' recklessness and venality. Passive investors, however, are less likely to be blamed, because they hold index constituents based on their index weights, and such investment decision does not imply their endorsement of the shared value or policy of portfolio firms. The public does not have high expectations for passive investors to take the initiative to influence firm policy. Such perception further eases the pressure on the cost-sensitive passive funds to engage CSR.

Finally, in addition to the insurance role, CSR also has a license-effect on doing business. Engaging CSR helps firms enter new industries. Passive investors hold well-diversified portfolios and therefore have no interest in encouraging the industry diversification of their portfolio firms. Based on the discussions of the cost-benefit trade-offs, we expect that the diversified holding of passive investors allows them save CSR costs, and we propose the second hypothesis as follows:

[7] *Financial Times*, 2014. See https://www.ft.com/content/95239a6e-4fe0-11e4-a0a4-00144feab7de.

H2: *Passive investors are negatively associated with corporate social responsibility*

It is worth noting that we do not argue that passive investors would like their portfolio firms to stop all CSR activities. For example, the benefits of CSR outweigh the cost for certain types of firms. Peloza (2006) indicates that firms with higher environmental impact, under greater scrutiny from a broader range of stakeholders, or having greater exposure to consumer boycotts are subject to a higher risk of negative events and therefore need CSR insurance more. Shiu and Yang (2017) find that insurance-like effects are more pronounced for financial and final goods firms than for non-final goods firms. We therefore conjecture that the association is less pronounced among firms with a higher exposure to risks.

3 Data and Empirical Strategy

3.1 Russell Index Reconstitution Setting

Identifying the impact of passive investors on firms' CSR policy poses an empirical challenge. The changes in Russell 1000 and Russell 2000 membership provide an exogenous variation in passive investor ownership. Stocks at the top of the Russell 2000 exhibit greater ownership by passive investors relative to stocks at the bottom of the Russell 1000. A growing number of studies rely on this setting to study the effect of institutional investors on corporate governance, firm transparency, public disclosure and tax avoidance (Boone and White, 2015; Appel, Gormley, and Keim, 2016a,b; Bird and Karolyi, 2016a,b; Khan, Srinivasan, and Tan, 2016). We extend this literature by examining the effect of passive investors on corporate social responsibility.

To validate our methodology, the underlying assumption is that institutional ownership varies around the Russell index threshold because of mechanical weighting differences that are orthogonal to firm characteristics. In other words, assignment to an index cannot be based on CSR policy or any determinant of CSR policy outside of its effect on institutional ownership. Because index assignment is determined by an arbitrary rule surrounding the cutoff point of the Russell 1000 and Russell 2000 indexes, this variation in passive fund ownership is plausibly exogenous after controlling firms' market capitalization. A remaining concern is that large and small firms have different CSR policies, and index assignment is based on firm size. Therefore, we focus only on variation

in a neighborhood close to the threshold, in which firms are similar enough that the variation in institutional ownership is plausibly exogenous to the CSR score under study.

Our sample consists of the Russell 1000 and Russell 2000 index constituents, for which Russell Investments provides monthly index weights, and proprietary free-floating market capitalization over the years 2003-2011. We merge these data with S12 mutual fund ownership data compiled by Thomson Reuters, available from Wharton Research Data Services (WRDS). Since May 2004, all mutual funds are required to report their holdings of U.S. stocks to the Securities and Exchange Commission (SEC) on a quarterly basis; before that they were only required to report twice a year. To classify a mutual fund as either passively managed or actively managed, we use a method similar to that of Busse and Tong (2012) and Iliev and Lowry (2015). Specifically, we merge Thomson Reuters S12 data with the Center for Research in Security Prices (CRSP) mutual fund data using the MFLINKS table available on WRDS. We then flag a fund as passively managed if it satisfies one of the following two requirements: (1) the CRSP Mutual Fund Database classifies it as an index fund; or (2) the fund name includes a string that identifies it as an index fund.[8] All other mutual funds that can be matched to the CRSP mutual fund data are defined as actively managed, and those remaining are unclassified funds. We estimate the mutual fund ownership of each stock as the ratio of total mutual fund holdings to the market capitalization from the CRSP. We exclude observations in which mutual fund holdings exceed a firm's market capitalization.

Figure 1 shows the index weights for firms near the threshold of Russell 1000/2000 indexes over the years 2003-2011. The average portfolio weight of the top 250 stocks in the Russell 2000 (the smallest firms in the index) was 0.014%, while that of the bottom 250 stocks in the Russell 1000 (the largest firms in the index) was ten times higher, with an average portfolio weight of 0.136%. This means that for each dollar invested in the Russell 1000 index, very little will be invested in stocks at the bottom of the index; while for each dollar invested in the Russell 2000 index, a large proportion will be invested in stocks at the top of the index. These differences in portfolio weights can have a significant impact on the stock's ownership by passive investors, because passive investors weight their holdings based on the portfolio weights. In addition, in

[8]The strings we use to identify index funds are: Index, Idx, Indx, Ind_(where_ indicates a space), Russell, S & P, S and P, S&P, SandP, SP, DOW, Dow, DJ, MSCI, Bloomberg, KBW, NASDAQ, NYSE, STOXX, FTSE, Wilshire, Morningstar, 100, 400, 500, 600, 900, 1000, 1500, 2000 and 5000 .

order to reduce transaction costs, passive investors might exclude the smallest firms at the bottom of Russell 1000, inducing a larger difference in passive ownership for firms around the cutoff. Moreover, the Russell 2000 index faces less competition in mid-to-small-cap stocks relative to the Russell 1000 index, which competes against the popular S&P 500 index in representing large firms in the US stock market. This, combined with the fact that Russell 2000 is the principal Russell index in terms of dollars benchmarked, indicates more fund managers (and dollars) would be benchmarked to the Russell 2000 index compared to the Russell 1000 index. According to Chang, Hong, and Liskovich (2016), the amount of institutional assets benchmarked to the Russell 2000 index was more than $200 billion in 2005, while only $90 billion was tracked to the Russell 1000 index.

All these factors contribute to the discontinuity in passive investor ownership near the cutoff point of the Russell 1000/2000 indexes, where firms just included in the Russell 2000 receive much higher institutional ownership compared to firms just included in the Russell 1000, and this difference in institutional ownership is not caused by the individual firms' characteristics but rather the composition of the benchmarks. This result can be observed in Figure 2, where we graphically present the difference in total mutual fund ownership (Panel A), passive fund ownership (Panel B), active fund ownership (Panel C) and unclassified fund ownership (Panel D) for firms near the cutoff points, with the x-axis representing distance from the threshold. Institutional ownership increases in line with firm size. However, we can see that at the threshold, the slightly smaller firms at the top of the Russell 2000 index have much higher institutional ownership relative to the slightly larger firms at the bottom of the Russell 1000 index. To be specific, we find that the ownership by mutual fund is, on average, about 23.3% higher for stocks at the top of the Russell 2000 index relative to stocks at the bottom of the Russell 1000 index.

Overall, Russell index inclusion leads to an exogenous variation in institutional ownership as the index rule is transparent and mechanically implemented close to the threshold. A very small change in the capitalization of firms ranked near 1000 move them between the Russell 1000 and Russell 2000 indexes. A firm's index membership becomes random when controlling for differences in market capitalization.

3.2 Model Specifications

To examine the impact of passive fund ownership on CSR, we employ the following regression:

$$Passive\%_{i,t} = \alpha + \beta \cdot Russell2000_{i,t} + \sum_{n=1}^{N} \gamma_n (\ln(Mktcap_{i,t}))^n + \delta \cdot \ln(Float_{i,t}) + \eta \cdot \mathbf{X'_{i,t}} + FEs + \epsilon_{i,t}, \quad (1)$$

$$CSR_{i,t} = \alpha + \beta \cdot \widehat{Passive\%}_{i,t} + \sum_{n=1}^{N} \gamma_n (\ln(Mktcap_{i,t}))^n + \gamma \cdot \ln(Float_{i,t}) + \eta \cdot \mathbf{X'}_{i,t} + FEs + \varepsilon_{i,t}, \quad (2)$$

where $Russsell2000_{i,t}$ is a dummy variable equals to one if stock i is in the Russell 2000 index for reconstitution year t (i.e., from end-of-June of year t to end-of-June of year t+1). The dependent variable for the first-stage estimation in Equation 1 is ownership from passive fund, $Passive\%_{i,t}$, measured in the next available quarter after index assignment in year t (i.e., September). $\ln(Mktcap_{i,t})$ is the logarithm of the end-of-May CRSP market capitalization of stock i in year t; and $\ln(Float_{i,t})$ is the logarithm of the float-adjusted market capitalization calculated by Russell when initially setting the portfolio weights during the end-of-June reconstitution. We control for float-adjusted market capitalization because it is used by Russell to compute portfolio weights within each index and could be related to a firm's liquidity and institutional holdings. The main explanatory variable in the second-stage estimation in Equation 2 is the fitted value for passive institutional ownership, $\widehat{Passive\%}_{i,t}$ from Equation 1, and the dependent variable $CSR_{i,t}$ is firm CSR score.

The most commonly used measure for corporate social responsibility is the CSR rating constructed by Kinder, Lydenberg, Domoni, Co. (KLD) (e.g., Dhaliwal, Li, Tsang, and Yang, 2011; Flammer, 2015; Davidson, Dey, and Smith, 2018) . KLD scans public databases like macro data from academic, government and NGO datasets, company disclosure in 10-K filings and news from more than 1,600 media sources to evaluate different dimensions of firm goodness, including community relations, product characteristics, environmental impact, employee relations, workforce diversity and corporate governance. KLD uses a simple binary scoring model, where "1" indicates that the company meets the assessment criteria established for this indicator, and "0" otherwise.

For example, KLD generated a strength indicator for Abott Inc when *Working Mother Magazine* ranked the company among the 100 best workplaces for working mothers in the U.S. In contrast, a negative environmental indicator was assigned to Air Products Inc when *Tulsa World* reported an explosion at a company plant (Krüger, 2009). The KLD database reports the number of strengths and concerns for each firm across different dimensions. Following previous studies, we mainly focus on five dimensions: community activities, diversity, employee relations, environmental policies and the social benefits of their products (Hong, Kubik, and Scheinkman, 2011). We then construct a firm's net CSR score by aggregating the total number of CSR strengths and subtracting the total number of CSR concerns across these five dimensions. In further analysis, we also decompose the total CSR score into a strength score and a concern score. We start our sample period in 2003, which is when KLD began a staggered expansion to include all Russell 3000 companies, having previously included only the SP 500 and Domini 400 Social Index constituents.

We also control for a list of firm characteristics documented in the literature that could affect a firm's CSR policy, including $\ln(Asset)$, *lagged ROA*, *Market-to-Book*, *Tangibility*, *Cash Ratio* and *Dividend* (e.g., Waddock and Graves, 1997; Stanwick and Stanwick, 1998; Davidson, Dey, and Smith, 2018). Firm-level accounting data are from Compustat. Because our main sample consists of firms around the cutoff point of the two indexes, one potential concern is that there might be systematic differences in the types of firms on either side of the Russell 1000/2000 threshold. For example, stocks that experienced a significant drop in stock price ("the fallen angels") are more likely to appear in the Russell 2000, while those that experienced a significant increase in stock price ("the rising stars") are more likely to appear in the Russell 1000. To alleviate this concern, we also include index switcher controls, $I1000_{t-1}$ to $I2000_t$ and $I2000_{t-1}$ to $I1000_t$, where the former is defined as a dummy variable equals to one if a stock switches from Russell 1000 in year t-1 to Russell 2000 in year t, and the latter as a dummy variable equals to one if a stock switches from Russell 2000 in year t-1 to Russell 1000 in year t. We also control for a firm's ownership by active investors, $Active\%$, in order to disentangle the specific effect from passive investors. Both regressions include industry and reconstitution year fixed effects. The final sample includes 2,594 observations from 2003 to 2011.

3.3 Descriptive statistics

For our main analysis, we restrict our sample to firms around the Russell 1000 and Russell 2000 cutoff with a bandwidth of 250. Table 1 provides summary statistics of key variables for our sample, with the final column presenting the p-value of a t-test for differences in means across the Russell 1000 and Russell 2000 index constituents. We winsorize all continuous variables at the 1^{st} and 99^{th} percentiles. The definitions of variables are summarized in Appendix I.

Panel A shows summary statistics for mutual fund ownership, firm characteristics and CSR scores for all the companies in the Russell 1000 and Russell 2000 indexes. The average level of total mutual fund ownership (as a percentage of shares outstanding) is 27.1% for firms in Russell 1000 and 22.4% for firms in Russell 2000. This is consistent with the notion that larger firms attract more institutional investors. The firms included in Russell 1000 have a mean *Total Assets* of US $17.8 billion, approximately 13 times larger than those in Russell 2000. Furthermore, firms in Russell 1000 have higher return-on-assets (*ROA*), meaning they are more profitable, relative to smaller firms included in Russell 2000. Finally, the CSR scores are higher for Russell 1000 members, which might be due to the fact that they are larger, more profitable firms with greater free cash flows.

Panel B, on the other hand, presents descriptive statistics for our main sample of firms around the threshold of Russell 1000 and Russell 2000, with a bandwidth of 250. Different from the whole sample, smaller firms at the top of Russell 2000 have higher mutual fund ownership compared to larger firms at the bottom of Russell 1000, and the differences are statistically significant. In particular, total mutual fund and passive fund ownerships are 25.9% and 3.8% for the bottom firms in Russell 1000, and 32.0% and 5.6% for the top firms in Russell 2000. Actively managed funds are the largest category of mutual funds for firms in both indexes, compared to passive funds and unclassified funds. These statistics are very similar to those reported in other studies that use Russell indexes (e.g., Appel, Gormley, and Keim, 2016a; Schmidt and Fahlenbrach, 2017). Firms just excluded from Russell 2000 are still larger than firms just included in Russell 2000, but the difference is much smaller compared to the whole sample. *lagged ROA*, on the other hand, is similar for firms near the threshold, with no significant difference between the two groups.

In terms of CSR performance, firms at the top of the Russell 2000 index have lower CSR scores relative to those at the bottom of the Russell 1000 index. This difference is mainly caused by a lower strength score, rather than a higher concern score.

4 Empirical Results

4.1 Baseline Results

In this section, we present results on the effect of passive investors on CSR. We first demonstrate the first-stage estimation. In Table 2, we present the first-stage regression of our IV analysis in Equation 1 using firms near the cutoff of the Russell 1000/2000 indexes, with a bandwidth of 250 and polynomial order of two. The dependent variable is the percentage of shares outstanding held by all mutual funds in Column (1); the percentage of shares outstanding owned by passive funds in Column (2); the percentage of shares outstanding owned by active mutual funds in Column (3); and the percentage of shares outstanding owned by unclassified mutual funds in Column (4). According to the estimates, if a firm near the threshold is assigned to Russell 2000, it exhibits 2.4% higher total mutual fund ownership one quarter after index reconstitution compared to a firm assigned to Russell 1000. Consistent with Appel, Gormley, and Keim (2016a), the effect of index inclusion on mutual fund ownership is driven entirely by passive fund, the coefficient of which is significant at the 1% level with a t-value around 8. Inclusion in Russell 2000 increases passive fund ownership by 1.2%, and the results are robust to using lower order polynomials and a smaller bandwidth near cutoff. By contrast, the coefficients for actively managed and unclassified funds are not insignificant.

We then test the hypotheses by examining whether the predicted passive investor ownership affects firms' CSR rating. Table 3 presents the second-stage estimates of Equation 2 using a bandwidth of 250 and applying different polynomial orders for market capitalization. The key explanatory variable is the fitted value for passive mutual fund ownership, $\widehat{Passive\%}$ from the first stage, and the dependent variable is the net CSR score (equal to CSR strengths minus CSR concerns) for the year after reconstitution. In Columns (1) to (3), we use the whole sample period over the years 2003-2011. Across all columns, the estimates are both economically and statistically significant.

A one percentage increase in institutional ownership decreases CSR rating by around 0.3 points (i.e., 0.16 standard deviation).

In 2007, Russell implemented a "banding" policy in which firms remain in its original index if their market capitalization does not deviate much from the threshold, to maintain consistency in the respective indexes and mitigate index turnover. For example, a firm that was in the Russell 2000 index in the previous year but is currently among the 1000 largest firms would only move to the Russell 1000 index if its market capitalization exceeds a certain threshold, and vice versa. In response to this new policy, we repeat the tests using samples before 2007, and present the results in Columns (4) to (6) of Table 3. The coefficients for the parameter estimates are still significant at the 5% level. Taken together, the results suggest that passive investors are not passive in a firm's CSR policy, and higher ownership by passive investors significantly reduces a firm's CSR rating.

The net CSR score is constructed by aggregating the total number of CSR strengths and subtracting the total number of CSR concerns across five dimensions of corporate goodness. A lower net CSR score can be due to either a lower strength score or a higher concern score. Chang, Kim, and Li (2014) point out that CSR strengths and CSR concerns are both empirically and conceptually distinct constructs. We therefore examine CSR strength score and weakness score separately. Table 4 shows that the negative impact of passive investors on CSR is only observed for strength ratings, where a one percentage increase in passive investors leads to a 0.3 (i.e., 0.19 standard deviation) decrease in CSR strength score. This implies that passive investors reduce CSR costs strategically by ensuring that CSR concerns do not arise.

4.2 Evidence on SRI Proposals

Given that passive investors are not able to exert influence through exit, the only channel left to them is voice. In particular, institutional investors can communicate with management and use their ownership stake to vote to ensure corporate policy that confirms to their views. If institutional investors engage in a firm's CSR policy through their voice, we would expect a negative association between the level of ownership by passive investors and the number of Socially Responsible Investment (SRI) proposals. To test our prediction, we download shareholder proposals and voting results from Institutional Shareholder Services (ISS), formerly known as RiskMetrics.

This database provides information on different aspects of corporate governance for firms in the S&P 1500. We use the same instrumental variable but replace the dependent variable with SRI proposals in the second stage.

Table 5 presents the results, where the dependent variable in Columns (1) and (2) is the probability of initiating SRI proposals, and the dependent variable in Columns (3) and (4) is the number of SRI proposals initiated. In addition, we use the full sample in Columns (1) and (3) and use a subsample of data from 2003-2006 (before the banding policy) in Columns (2) and (4). The coefficients of predicted passive investor ownership are significantly negative, indicating that greater ownership by passive investors is associated with a lower probability of initiating SRI proposals and fewer initiated SRI proposals. Specifically, a one percentage increase in passive investor ownership lowers the probability of initiating a social responsibility proposal by approximately 20%, and decreases the number of SRI proposals by 0.2. The results provide insights into the influencing channel of passive investors.

4.3 Diversification, Risk and CSR

The empirical results support the risk-management review of CSR (H2) in that passive investors significantly reduce firms' CSR ratings. To further establish that the reduction is attributed to the diversification of passive investors, we examine whether the results are more pronounced for better diversified passive investors. Some passive investors are more diversified than others, and the former should have less of a need for CSR as an insurance-like tool to mitigate adverse impact during negative corporate events. To test the prediction, we define a well-diversified passive investor as one who invests is more than 50 stocks or more than 15 industries. We then partition our sample into two groups based on the degree of diversification of the largest passive owners of the firms, and we generate a dummy variable *Diversified* that equals to one if the firm is owned by a well-diversified passive investor, and zero otherwise. The results are presented in Table 6. The results show that the negative impact of passive investors on CSR rating is concentrated on the subsample of well-diversified ones. The effects differ significantly between the two groups, as shown by the coefficients on the interaction term $Diversified \times \widehat{Passive(\%)}$ in the DID tests in Columns (3) and (6). Our cross-sectional results still hold when we use other cutoffs, at 45 or 70, for the number of stocks invested, and 8, 15 or 20 for the number of industries invested. Overall,

this result confirms a diversified position as the reason why passive investors are not keen on CSR.

Liang and Renneboog (2017) argue that firms in food and energy related industries have a higher probability of getting involved in a CSR crisis, and thereby have a higher legitimation risk. We therefore predict that passive investors prefer not to reduce CSR rating for CSR-sensitive industries. To perform the analyses, we classify firms into sensitive industries (food and energy related) and non-sensitive ones using their two-digit SIC codes. The results are presented in Table 7, with two definitions of sensitive industries. The results confirm our prediction that passive investors only reduce CSR ratings in non-sensitive industries.

5 Robustness Checks

5.1 Alternative Specification of CSR

Since the number of strengths and concerns within each category can differ across years (Mănescu, 2011), we conduct a robustness check using adjusted CSR score (Cao, Liang, and Zhan, 2018). Specifically, we scale the strengths and concerns for each firm-year to a range of 0 to 1 by dividing the number of strengths (or concerns) for each firm-year within each CSR category by the maximum possible number of strengths (or concerns). Results based on the adjusted CSR score remain consistent. Results are reported in Table 8. Consistent with our main results, instrumented passive investor ownership is negatively associated with adjusted CSR score, at a significance level of 1% or 5%. Table 8 suggests that the main finding is robust to alternative specifications of CSR score.

5.2 Alternative Bandwidth and Sample

To make sure that our results are not sensitive to the chosen number of firms near the threshold chosen, we replicate our baseline estimates using a bandwidth of 150. Results are presented in Columns (1) and (2) of Table 9. The results remain consistent.

At the end of June, Russell publishes the actual index weights based on the investable shares calculated using a proprietary method. This adjustment may reduce the randomness of the membership assignment. To eliminate firms with a large float adjustment made by Russell, we exclude observations that experienced a large float adjustment. Following Crane, Michenaud, and Weston

(2016), in Columns (3) and (4) we drop firms in the top 5% of squared percent difference between the unadjusted weight using CRSP market capitalization and the adjusted weight reported by Russell. The effect of passive investors on CSR ratings is robust after excluding these firms.

In the last columns of Table 9, we incorporate free cash flow as a measure for the agency problem (Jensen and Meckling, 1976). Friedman (2007) argues that CSR is a manifestation of agency problems inside the firm, while Ferrell, Liang, and Renneboog (2016) show that corporate governance is in line with CSR rating. The model might be subject to the omitted-variable bias if we do not control for the agency problem. The findings in Table 9 remain consistent.

5.3 Placebo Tests

We run falsification tests using alternative market cap thresholds at the 500^{th}, 750^{th}, 1250^{th} and 1500^{th} instead of the Russell 1000/2000 cutoff. The results are presented in Table 10. Similar to our baseline regression, we use a bandwidth of 250 and polynomial order of two; we also include additional controls, as well as industry and year fixed effects across all columns. However, we do not find any significant effect of passive institutional investors on firms' CSR score at these random thresholds, suggesting that the main results in this paper are not picking up random patter in the sample.

5.4 Alternative Specifications

We rely on the Russell index reconstitution as identification to conduct the two-stage IV estimation method following Appel, Gormley, and Keim (2016a). We acknowledge that other shock-based methods, such as difference-in-differences (DiD) and regression discontinuity (RD), are also applicable for the setting (Atanasov and Black, 2016). We additionally use the methodology of Bird and Karolyi (2016a), which uses rank as the running variable, or the non-parametric RD design with Rule of Thumb bandwidth, as featured in Boone and White (2015), Khan, Srinivasan, and Tan (2016) and Calonico, Cattaneo, and Titiunik (2014). Results presented in Table 11 remain consistent with the main findings.

6 Conclusion

Passive investors have become increasingly important in the U.S. stock market in the last few decades. Existing literature has documented the significant role passive investors play in corporate governance, disclosure and tax avoidance. Their influence on CSR policies, however, remains unclear. We develop a risk-management view of CSR which focuses on the insurance-like effects of CSR in negative corporate events. We predict that passive investors engage less CSR because they have diversified away idiosyncratic risks. By exploiting exogenous variation in passive investor ownership caused by the annual reconstitution of the Russell 1000 and Russell 2000 indexes, we find that an increase in passive investors' ownership significantly decreases firms' CSR rating, especially CSR strengths. The effects are mainly driven by better-diversified passive investors, and are less pronounced for firms in CSR-sensitive industries. We also find that passive investors influence firms' CSR engagement by decreasing socially responsible investment (SRI) proposals, i.e., through the channel of "voice." Overall, our study brings a new perspective to the study of CSR. Future research may seek to better understand the risk-management function of CSR activities. This study also provides original evidence on the role played by passive investors on CSR policies.

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Appendix I: Variable Definitions

Variable	Definition
A. Dependent Variables	
CSR score	The sum of yearly community activities, diversity, employee relations, products and environmental strengths minus concerns. *Source: KLD Database*
Adjusted CSR score	The sum of yearly adjusted community activities, diversity, employee relations, products and environmental record KLD CSR Scores. Adjusted CSR is estimated by scaling the raw strength and concern scores of each category by the number of items of strength and concerns of that category in the year and then taking the net difference between adjusted strength and concern scores for that category.. *Source: KLD Database*
CSR strength score	The sum of yearly community activities, diversity, employee relations, products and environmental strengths. *Source: KLD Database*
CSR concern score	The sum of yearly community activities, diversity, employee relations, products and environmental concerns. *Source: KLD Database*
B. Institutional Holdings	
Total mutual fund ownership	Percentage of shares outstanding held by total mutual funds in September of year t. *Source: Thomson Reuters S12 Files*
Active %	Percentage of shares outstanding held by total mutual funds in September of year t. *Source: Thomson Reuters S12 Files*
Passive %	Percentage of shares outstanding held by total mutual funds in September of year t. *Source: Thomson Reuters S12 Files*
Unclassified %	Percentage of shares outstanding held by total mutual funds in September of year t. *Source: Thomson Reuters S12 Files*
C. Russell Index	
Russell 2000	Dummy variable equals to one if the firm is in the Russell 2000 index. *Source: Russell Investments*
$\ln(Float)$	The natural logarithm of the float-adjusted end-of-June market capitalization calculated by Russell when initially setting the portfolio weights. *Source: Russell Investments*
$I1000_{t-1}\,to\,I2000_t$	Dummy variable equals to one if a stock switches from the Russell 1000 in year t-1 to the Russell 2000 in year t. *Source: Russell Investments*
$I1000_{t-1}\,to\,I2000_t$	Dummy variable equals to one if a stock switches from the Russell 2000 in year t-1 to the Russell 1000 in year t. *Source: Russell Investments*
C. Firm Characteristics	
$\ln(Asset)$	The natural logarithm of book assets, i.e., $\ln(at)$. *Source: Compustat*
lagged ROA	Net income (ni) / total assets (at) in year t-1. *Source: Compustat*
Market-to-Book	The market-to-book ratio, i.e., $(at-(at-lt+txditc)+(prcc*csho))/at$ *Source: Compustat*
Tangibility	PP&E (property, plant, and equipment) scaled by total assets, i.e., $ppent/at$. *Source: Compustat*
Cash Ratio	Cash and short-term investment scaled by total assets, i.e., che/at. *Source: Compustat*
Dividend	Dummy variable equals to one if the firm pays dividend in year t. *Source: Compustat*
$\ln(Mktcap)$	The natural logarithm of end-of-May CRSP market capitalization, i.e., $prc * shrout$. *Source: CRSP*

Figure 1: Russell Index Weights around the Threshold

This figure shows the average index weights for firms near the cutoff of the Russell 1000 and the Russell 2000 indexes with a bandwidth of 250 for the years 2003-2011. Firms are assigned to the Russell 1000 and Russell 2000 based on the firm's market capitalization at the end of each May. Index weights are determined using a float-adjusted market capitalization within each index at the end of June. The x-axis represents the distance from the Russell 1000/2000 thresholds using the actual Russell ranks in the indexes, with zero representing the last firm in the Russell 1000. Firms that end up in the Russell 1000 are on the left-hand side of the cutoff, while those that end up in the Russell 2000 are on the right-hand side.

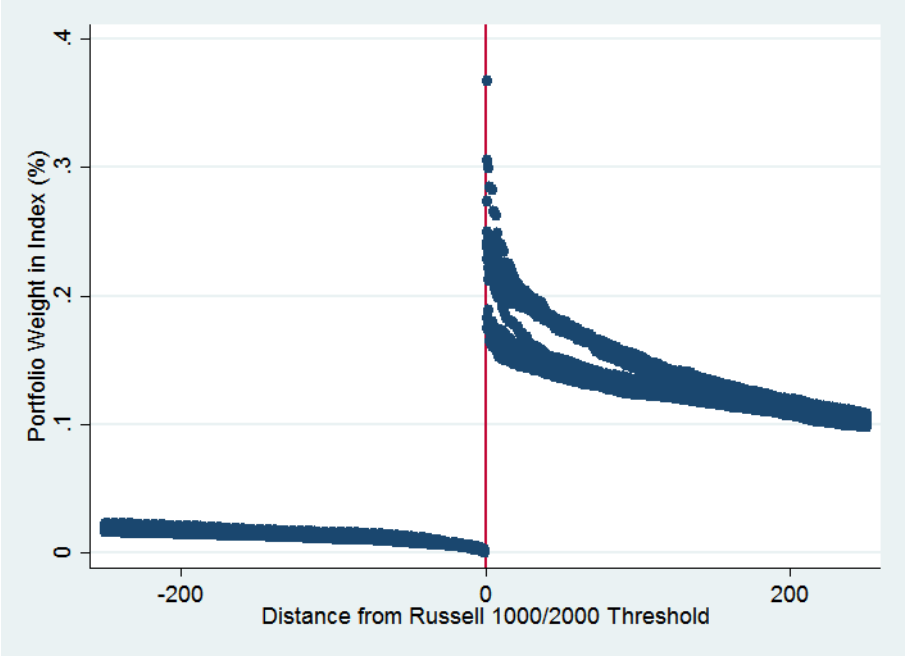

Figure 2: Mutual Fund Ownership Discontinuity

This figure shows the mutual fund ownership for firms around the Russell 1000/2000 cutoff points one quarter (i.e., end of September) after the June index reconstitution. The sample includes the bottom 250 firms of the Russell 1000 and the top 250 firms of the Russell 2000, as determined using end-of-June Russell-assigned portfolio weights for each index for the years 2003-2011. The x-axis represents the distance from the Russell 1000/2000 thresholds using the actual Russell ranks in the indexes, with zero representing the last firm in the Russell 1000. Mutual fund ownership is the percentage of shares outstanding owned by mutual funds. The regression discontinuity plots represent local sample means using bins of ten firms, and the lines represent a fourth-order polynomial regression curve. We decompose mutual fund ownership into passive fund ownership (Panel B), active fund ownership (Panel C) and unclassified fund ownership (Panel D) according to fund names following Appel, Gormley, and Keim (2016a).

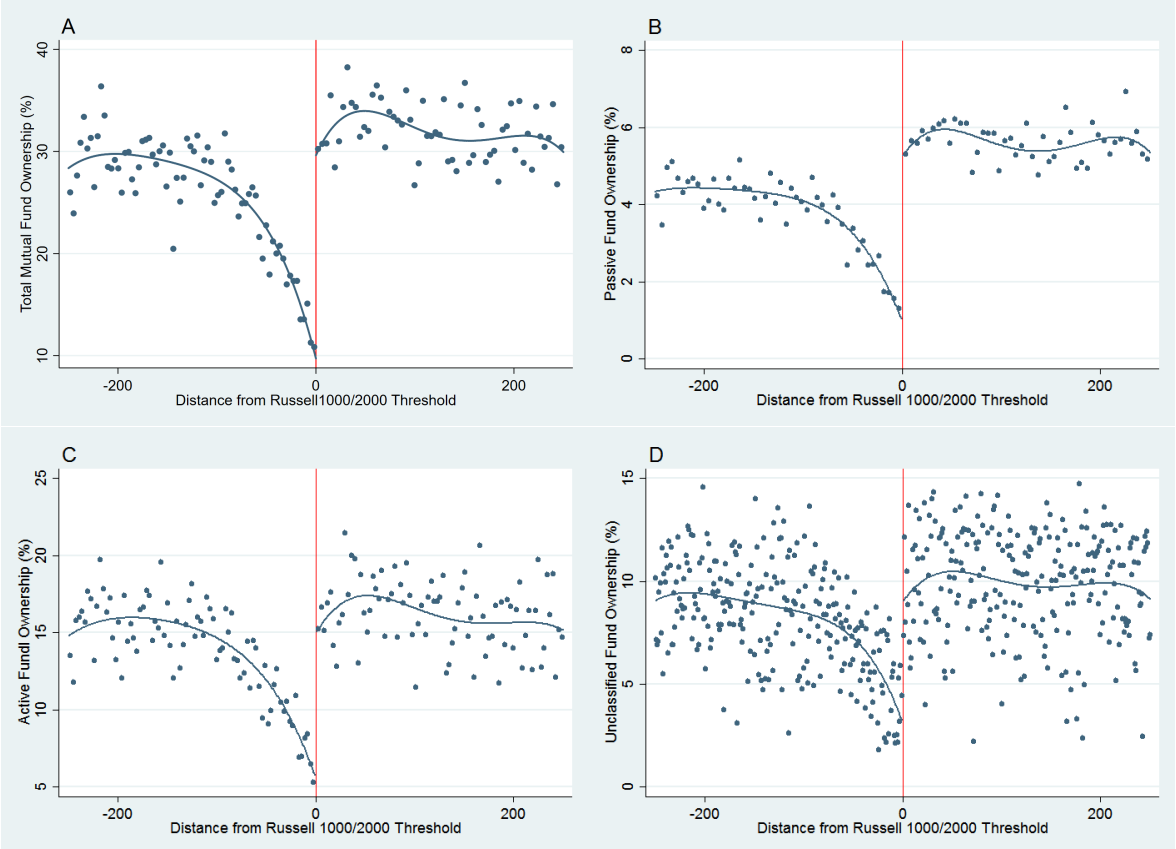

Table 1: Summary Statistics

This table reports summary statistics of our key variables for firms in the Russell 1000 and Russell 2000 indexes in years 2003-2011. Panel A displays mutual fund holdings, firm characteristics and CSR scores for all 3,000 firms in the Russell 1000 and 2000 indexes; Panel B reports summary statistics for our main sample, the 250 firms at the bottom of Russell 1000 and the 250 firms at the top of Russell 2000. Mutual fund ownership is the sum of all reported ownership of a security in the S12 filing as a percentage of the shares outstanding at the end of September. We further decompose mutual fund ownership into passive fund ownership, active fund ownership and unclassified fund ownership according to their names following Appel, Gormley, and Keim (2016a). We report both the firm's market value reported in CRSP (end-of-May) and the float-adjusted market value (end-of-June) based on Russell Indexes' proprietary measure. All continuous variables are winsorized at the 1^{st} and 99^{th} percentiles. Definitions for all variables are provided in Appendix I. The rightmost column reports the p-value of a t-test for differences in means between the Russell 1000 and Russell 2000 samples.

	Russell 1000			Russell 2000			Difference
	Mean	Median	SD	Mean	Median	SD	p-value
Panel A: Whole sample in the index							
Total mutual fund ownership (%)	27.06	29.32	14.34	22.41	22.55	15.74	(< 0.001)
Total assets (in million $)	17,795	5,552	33,004	1,252	600	2,080	(< 0.001)
Market value (CRSP)	10,663	4,563	15,275	649	488	495	(< 0.001)
lagged ROA	0.05	0.05	0.09	0.01	0.03	0.14	(< 0.001)
CSR score	0.32	0.00	2.92	-0.66	-1.00	1.42	(< 0.001)
CSR strength score	2.39	1.00	2.95	0.48	0.00	0.91	(< 0.001)
CSR concern score	2.07	2.00	1.99	1.14	1.00	0.99	(< 0.001)
Panel B: Firms with a bandwidth of 250 at each side of the cutoff							
A: Institutional holdings							
Total mutual fund ownership (%)	25.93	27.75	15.35	31.98	35.40	15.97	(< 0.001)
Passive (%)	3.82	3.04	3.90	5.63	5.39	4.91	(< 0.001)
Active (%)	13.90	13.06	12.73	16.19	17.67	13.64	(< 0.001)
Unclassified (%)	8.17	3.69	11.36	9.92	3.72	13.94	(< 0.001)
B. Firm characteristics							
Total assets (in million $)	5,076	2,544	8,446	2,431	1,470	3,001	(< 0.001)
Market value (CRSP)	2,280	2,085	1,080	1,508	1,474	451	(< 0.001)
Market value (Russell)	1,680	1,705	657	1,445	1,403	420	(< 0.001)
lagged ROA	0.04	0.04	0.10	0.05	0.05	0.09	(0.42)
C. KLD CSR scores							
CSR score	-0.38	0.00	2.02	-0.46	-1.00	1.65	(0.193)
CSR strength score	1.06	1.00	1.51	0.69	0.00	1.21	(< 0.001)
CSR concern score	1.44	1.00	1.39	1.14	1.00	1.13	(< 0.001)

Table 2: First-stage Estimation of Index Assignment on Mutual Fund Ownership

This table reports the first-stage regression of mutual fund ownership, on an indicator for membership in the Russell 2000 index plus additional controls. Specifically, we estimate

$$MF\%_{i,t} = \alpha + \beta Russell2000_{i,t} + \sum_{n=1}^{N} \gamma_n (\ln(Mktcap_{i,t}))^n + \delta \ln(Float_{i,t}) + \eta \, \mathbf{X'_{i,t}} + FEs + \epsilon_{i,t},$$

where $Russell2000_{i,t}$ is a dummy variable equal to one if stock i is in the Russell 2000 index at the end of June in year t, $\ln(Mktcap_{i,t})$ is the natural logarithm of the end-of-May CRSP market value of stock i in year t, N is the polynomial order we use to control for $\ln(Mktcap_{i,t})$, and $\ln(Float_{i,t})$ is the natural logarithm of the end-of-June float-adjusted market value of equity (provided by Russell) in year t. In all columns, we control for firm characteristics, industry and year fixed effects, as described in Section 3. We use four different definitions to measure our dependent variable $MF\%$ followingAppel, Gormley, and Keim (2016a): (1) the percentage of shares outstanding owned by all mutual funds (from S12 filings); (2) the percentage of shares outstanding owned by passive funds; (3) the percentage of shares outstanding owned by active mutual funds; and (4) the percentage of shares outstanding owned by unclassified mutual funds. The data consist of firms near the cutoff point of Russell 1000 and Russell 2000 indexes using a bandwidth of 250 over the years 2003-2011, and polynomial order controls for $\ln(Mktcap)$ of N=2. An intercept is included but not reported. All continuous variables are winsorized at the 1^{st} and 99^{th} percentiles, and are summarized in Appendix I. Standard errors, ϵ, are clustered at the firm level and corrected for heteroskedasticity. Significance at the 10%, 5%, and 1% level is indicated by *, ** and ***, and t-values are in parentheses.

Dependent variable =	Percent of firm's common shares held by:			
	Total mutual funds	Passive funds	Active funds	Unclassified funds
	(1)	(2)	(3)	(4)
$Russell2000$	**2.384*** **	**1.214*** **	**0.628**	**0.259**
	(3.50)	**(7.84)**	**(1.20)**	**(0.79)**
Bandwidth	250	250	250	250
Polynomial order, N	2	2	2	2
Float control	Yes	Yes	Yes	Yes
Additional controls	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N	2,828	2,828	2,828	2,828
R^2	0.516	0.792	0.707	0.847

Table 3: Second-stage Estimation of Passive Investors on CSR

This table presents the second-stage estimation examining the effect of passive fund ownership on CSR scores. Specifically, we estimate

$$CSR_{i,t} = \alpha + \beta \widehat{Passive\%}_{i,t} + \sum_{n=1}^{N} \gamma_n (\ln(Mktcap_{i,t}))^n + \gamma \ln(Float_{i,t}) + \eta \, \mathbf{X'}_{i,t} + FEs + \varepsilon_{i,t},$$

where $CSR_{i,t}$ is the CSR score for firm i in year t (from KLD database), $\widehat{Passive\%}_{i,t}$ is the fitted value for passive mutual fund ownership for stock i at the end of September in year t, $\ln(Mktcap_{i,t})$ is the natural logarithm of the end-of-May CRSP market value of stock i in year t, N is the polynomial order we use to control for $\ln(Mktcap_{i,t})$, and $\ln(Float_{i,t})$ is the natural logarithm of the end-of-June float-adjusted market value of equity (provided by Russell) in year t. In all columns, we control for firm characteristics, industry and year fixed effects, as described in Section 3. The data consist of firms near the cutoff point of Russell 1000 and Russell 2000 indexes using a bandwidth of 250, and polynomial order controls for $\ln(Mktcap)$ of N=1, 2 and 3. In Columns (1) to (3), we use the whole sample period over the years 2003-2011; in Columns (4) to (6) we estimate the model using the subperiod of 2003-2006 (before the banding rule was introduced). An intercept is included but not reported. All continuous variables are winsorized at the 1^{st} and 99^{th} percentiles, and are summarized in Appendix I. Standard errors, ϵ, are clustered at the firm level and corrected for heteroskedasticity. Significance at the 10%, 5% and 1% level is indicated by *, ** and ***, and t-values are in parentheses.

Dependent variable =	CSR score					
	Sample years = 2003-2011			*Sample years* = 2003-2006		
	(1)	(2)	(3)	(4)	(5)	(6)
$\widehat{Passive(\%)}$	**-0.328*** **	**-0.325*** **	**-0.336*** **	**-0.325** **	**-0.325** **	**-0.347** **
	(-2.89)	**(-2.89)**	**(-2.59)**	**(-2.42)**	**(-2.39)**	**(-2.22)**
$\ln(Mktcap)$	-0.956**	1.595	8.877	-0.618	-0.848	14.433
	(-2.28)	(0.77)	(0.50)	(-1.21)	(-0.20)	(0.35)
$\ln(Float)$	1.029***	0.977***	1.010***	1.059***	1.064***	1.103***
	(3.12)	(3.00)	(2.68)	(3.10)	(3.06)	(2.89)
$(ln(Mktcap))^2$		-0.169	-1.152		0.015	-2.041
		(-1.20)	(-0.47)		(0.06)	(-0.37)
$(ln(Mktcap))^3$			0.044			0.091
			(0.40)			(0.37)
Polynomial order, N	1	2	3	1	2	3
Bandwidth	250	250	250	250	250	250
Additional controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	2,594	2,594	2,594	1,138	1,138	1,138
R^2	0.045	0.048	0.040	0.156	0.156	0.148

Table 4: The Effect of Passive Investors on CSR Strengths and CSR Concerns

This table studies the effect of passive institutional ownership on firms' CSR strength and concern scores using two-stage least-squares regressions. Specifically, we estimate

$$CSR_{i,t} = \alpha + \beta \cdot \widehat{Passive\%}_{i,t} + \sum_{n=1}^{N} \gamma_n (\ln(Mktcap_{i,t}))^n + \gamma \cdot \ln(Float_{i,t}) + \eta\, \mathbf{X'}_{i,t} + FEs + \varepsilon_{i,t},$$

where the dependent variable $CSR_{i,t}$ is firms' CSR strength score in Columns (1) to (3) and firms' CSR concern score in Columns (4) to (6). $\widehat{Passive\%}_{i,t}$ is the fitted value for the passive mutual fund ownership for stock i at the end of September in year t, $\ln(Mktcap_{i,t})$ is the natural logarithm of the end-of-May CRSP market value of stock i in year t, N is the polynomial order we use to control for $\ln(Mktcap_{i,t})$, $\ln(Float_{i,t})$ is the natural logarithm of the end-of-June float-adjusted market value of equity (provided by Russell) in year t. In all columns, we control for firm characteristics, industry and year fixed effects, as described in Section 3. The data consist of firms near the cutoff point of Russell 1000 and Russell 2000 indexes using a bandwidth of 250 over the years 2003-2011, and polynomial order controls for $\ln(Mktcap)$ of N=1, 2 and 3. An intercept is included but not reported. All continuous variables are winsorized at the 1^{st} and 99^{th} percentiles, and are summarized in Appendix I. Standard errors, ϵ, are clustered at the firm level and corrected for heteroskedasticity. Significance at the 10%, 5% and 1% level is indicated by *, ** and ***, and t-values are in parentheses.

Dependent variable =	CSR score					
	Strength score			Concern score		
	(1)	(2)	(3)	(4)	(5)	(6)
$\widehat{Passive(\%)}$	**-0.263*** **	**-0.261*** **	**-0.297*** **	**0.065**	**0.064**	**0.038**
	(-2.99)	**(-3.00)**	**(-2.89)**	**(1.00)**	**(0.98)**	**(0.53)**
$\ln(Mktcap)$	-0.562	0.937	25.354*	0.394	-0.658	16.477
	(-1.58)	(0.53)	(1.69)	(1.57)	(-0.44)	(1.63)
$\ln(Float)$	0.593**	0.562**	0.672**	-0.436**	-0.414**	-0.337
	(2.40)	(2.27)	(2.28)	(-2.19)	(-2.04)	(-1.48)
$(ln(Mktcap))^2$		-0.099	-3.398*		0.070	-2.245
		(-0.86)	(-1.65)		(0.72)	(-1.62)
$(ln(Mktcap))^3$			0.147			0.103*
			(1.59)			(1.65)
Polynomial order, N	1	2	3	1	2	3
Bandwidth	250	250	250	250	250	250
Additional controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	2,594	2,594	2,594	2,594	2,594	2,594

Table 5: Additional Analysis of Passive Investors on Socially Responsible Investment Proposals

This table presents estimates of our instrumental variable estimation identifying the effect of passive institutional ownership on SRI proposals. Specifically, we estimate

$$SRI_{i,t} = \alpha + \beta \cdot \widehat{Passive\%}_{i,t} + \sum_{n=1}^{N} \gamma_n (\ln(Mktcap_{i,t}))^n + \gamma \cdot \ln(Float_{i,t}) + \eta\, \mathbf{X'}_{i,t} + FEs + \varepsilon_{i,t},$$

where $SRI_{i,t}$ is the probability of initiating socially responsible investment (SRI) proposals (from RiskMetrics database) for firm i in year t in Columns (1) and (2), and the number of SRI proposals initiated in Columns (3) and (4). $\widehat{Passive\%}_{i,t}$ is the fitted value for the passive mutual fund ownership for stock i at the end of September in year t, $\ln(Mktcap_{i,t})$ is the natural logarithm of the end-of-May CRSP market value of stock i in year t, N is the polynomial order we use to control for $\ln(Mktcap_{i,t})$, $\ln(Float_{i,t})$ is the natural logarithm of the end-of-June float-adjusted market value of equity (provided by Russell) in year t. In all columns, we control for firm characteristics, industry and year fixed effects, as described in Section 3. The data consist of firms near the cutoff point of Russell 1000 and Russell 2000 indexes using a bandwidth of 250, and polynomial order controls for $\ln(Mktcap)$ of N. In Columns (1) and (3), we use the whole sample period over the years 2003-2011; in Columns (2) and (4) we estimate the model using the subperiod of 2003-2006 (before the banding rule). An intercept is included but not reported. All continuous variables are winsorized at the 1^{st} and 99^{th} percentiles, and are summarized in Appendix I. Standard errors, ϵ, are clustered at the firm level and corrected for heteroskedasticity. Significance at the 10%, 5% and 1% level is indicated by *, ** and ***, and t-values are in parentheses.

Dependent variable =	$Pr\,(SRI\ Proposal)$		$No.\,of\ SRI\ Proposals$	
	(1)	(2)	(3)	(4)
$\widehat{Passive}(\%)$	**-0.175****	**-0.267***	**-0.019****	**-0.026***
	(-2.10)	**(-1.79)**	**(-2.13)**	**(-1.74)**
$\ln(Mktcap)$	-1.134	-3.928	0.024	-0.317
	(-0.47)	(-0.71)	(0.14)	(-0.85)
$(ln(Mktcap))^2$	0.037	0.218	-0.006	0.017
	(0.23)	(0.59)	(-0.48)	(0.71)
$\ln(Float)$	1.079***	0.924**	0.089***	0.080**
	(4.27)	(2.35)	(3.33)	(2.45)
Polynomial order, N	2	2	2	2
Bandwidth	250	250	250	250
Additional controls	Yes	Yes	Yes	Yes
Sample period	2003-2011	2003-2006	2003-2011	2003-2006
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N	2,406	722	2,829	1,196

Table 6: Cross-sectional Analysis: Diversified vs Undiversified Investors

This table presents results of our cross-sectional results, where we divide the sample into firms whose largest passive owners are diversified investors and firms whose largest passive owners are undiversified investors. We classify passive investors as diversified if they invest in more than 50 stocks in Columns (1) to (3), and if they invest in more than 15 different industries in Columns (4) to (6). For each group, we redo the two-stage least-square analysis in Table 3. In Columns (3) and (6), we run a Difference-in-Differences (DiD) test by adding the interaction term $Diversified \times \widehat{Passive}(\%)$. In all columns, we control for firm characteristics, industry and year fixed effects, as described in Section 3. The data consist of firms near the cutoff point of Russell 1000 and Russell 2000 indexes using a bandwidth of 250, and polynomial order controls for $\ln(Mktcap)$ of N=2. An intercept is included but not reported. All continuous variables are winsorized at the 1^{st} and 99^{th} percentiles, and are summarized in Appendix I. Standard errors, ϵ, are clustered at the firm level and corrected for heteroskedasticity. Significance at the 10%, 5% and 1% level is indicated by *, ** and ***, and t-values are in parentheses.

Dependent variable =	CSR score					
Classification =	No. of Stocks Invest			No. of Industries Invest		
Sample =	Diversified investor	Undiversified investor	Full sample	Diversified industry	Undiversified industry	Full sample
	(1)	(2)	(3)	(4)	(5)	(6)
$\widehat{Passive}(\%)$	**-0.377*** **	**0.368**	-0.143	**-0.389*** **	**1.513**	-0.128
	(-3.22)	**(0.73)**	(-0.98)	**(-3.29)**	**(1.23)**	(-0.91)
$Dieversified \times \widehat{Passive}(\%)$			**-0.213***			**-0.223***
			(-1.84)			**(-1.87)**
$Dieversified$			0.858			0.912
			(1.30)			(1.30)
$\ln(Mktcap)$	1.092	9.341	1.608	1.528	10.967	1.563
	(0.53)	(1.22)	(0.78)	(0.66)	(0.88)	(0.75)
$\ln(Float)$	1.073***	-0.515	0.942***	1.117***	-2.181	0.928***
	(3.16)	(-0.46)	(2.85)	(3.18)	(-1.02)	(2.83)
$(ln(Mktcap))^2$	-0.145	-0.533	-0.169	-0.171	-0.356	-0.164
	(-1.01)	(-1.22)	(-1.20)	(-1.08)	(-0.56)	(-1.16)
Polynomial order, N	2	2	2	2	2	2
Bandwidth	250	250	250	250	250	250
Additional controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
N	2,236	331	2,567	2,365	229	2,594

Table 7: Cross-sectional Analysis: Sensitive and Non-sensitive Industries

This table presents results of our cross-sectional analysis, where we divide the sample into firms in sensitive and non-sensitive industries. In Columns (1) to (3), we define sensitive industries as energy and food related industries, while in Columns (4) to (6) we also add consumer-oriented industries as sensitive industries. In Column (1), Column (2), Column (4) and Column (5), we redo the two-stage least-square analysis in Table 3. In Columns (3) and (6), we run a Difference-in-Differences (DiD) test by adding the interaction term $Sensitive\,Ind. \times \widehat{Passive}(\%)$. In all columns, we control for firm characteristics, industry and year fixed effects, as described in Section 3. The data consist of firms near the cutoff point of Russell 1000 and Russell 2000 indexes using a bandwidth of 250, and polynomial order controls for $\ln(Mktcap)$ of N=2. An intercept is included but not reported. All continuous variables are winsorized at the 1^{st} and 99^{th} percentiles, and are summarized in Appendix I. Standard errors, ϵ, are clustered at the firm level and corrected for heteroskedasticity. Significance at the 10%, 5% and 1% level is indicated by *, ** and ***, and t-values are in parentheses.

Dependent variable =	CSR score					
Sample =	Non-sensitive industry	Sensitive industry	Full sample	Non-sensitive industry	Sensitive industry	Full sample
	(1)	(2)	(3)	(4)	(5)	(6)
$\widehat{Passive}(\%)$	**-0.387*** **	**0.169**	-0.376***	**-0.441*** **	**0.369**	-0.411***
	(-3.15)	**(0.67)**	(-3.13)	**(-3.38)**	**(1.51)**	(-3.28)
$Sensitive\,Ind. \times \widehat{Passive}(\%)$			**0.221****			**0.274*** **
			(2.23)			**(2.69)**
$Sensitive\,Ind.$			-1.676			-1.942*
			(-1.52)			(-1.78)
$\ln(Mktcap)$	1.220	2.672	0.786	0.833	2.494	0.244
	(0.54)	(0.46)	(0.36)	(0.33)	(0.52)	(0.11)
$\ln(Float)$	1.124***	-0.312	0.965***	1.230***	-0.450	1.013***
	(3.11)	(-0.49)	(2.90)	(3.22)	(-0.81)	(2.98)
$(\ln(Mktcap))^2$	-0.153	-0.137	-0.114	-0.137	-0.053	-0.082
	(-1.00)	(-0.40)	(-0.78)	(-0.81)	(-0.18)	(-0.54)
Polynomial order, N	2	2	2	2	2	2
Bandwidth	250	250	250	250	250	250
Additional controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
N	2,264	330	2,594	2,112	482	2,594

Table 8: Robustness Checks Using Adjusted CSR Score

This table presents the robustness tests for our second-stage estimation identifying the effect of passive investors on adjusted CSR scores. Specifically, we estimate

$$Adj\_CSR_{i,t} = \alpha + \beta \widehat{Passive\%}_{i,t} + \sum_{n=1}^{N} \gamma_n (\ln(Mktcap_{i,t}))^n + \gamma \ln(Float_{i,t}) + \eta \, \mathbf{X'}_{i,t} + FEs + \varepsilon_{i,t},$$

where dependent variable $Ajd\_CSR_{i,t}$ is the adjusted CSR score for firm i in year t (from KLD database) in Column (1) to (4) and adjusted strength score in Column (5). $\widehat{Passive\%}_{i,t}$ is the fitted value for passive mutual fund ownership for stock i at the end of September in year t, $\ln(Mktcap_{i,t})$ is the natural logarithm of the end-of-May CRSP market value of stock i in year t, N is the polynomial order we use to control for $\ln(Mktcap_{i,t})$, $\ln(Float_{i,t})$ is the natural logarithm of the end-of-June float-adjusted market value of equity (provided by Russell) in year t. In all columns, we control for firm characteristics, industry and year fixed effects, as described in Section 4. The data consist of firms near the cutoff point of Russell 1000 and Russell 2000 indexes using a bandwidth of 250, and polynomial order controls for $\ln(Mktcap)$ of N=2. An intercept is included but not reported. All continuous variables are winsorized at the 1^{st} and 99^{th} percentiles, and are summarized in Appendix I. Standard errors, ϵ, are clustered at the firm level and corrected for heteroskedasticity. Significance at the 10%, 5% and 1% level is indicated by *, ** and ***, and t-values are in parentheses.

Dependent variable =	Adjusted CSR score				
	Total score	Total score	Total score	Total score	Strength Score
	(1)	(2)	(3)	(4)	(5)
$\widehat{Passive}(\%)$	**-0.077*** **	**-0.076*** **	**-0.079** **	**-0.071** **	**-0.046*** **
	(-2.68)	**(-2.67)**	**(-2.44)**	**(-2.03)**	**(-2.61)**
Polynomial order, N	1	2	3	2	2
Bandwidth	250	250	250	250	250
Additional controls	Yes	Yes	Yes	Yes	Yes
Sample period	2003-2011	2003-2011	2003-2011	2003-2006	2003-2011
Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
N	2,594	2,594	2,594	1,138	2,594

Table 9: Robustness Tests: Different Bandwidth, Excluding Firms with Large Float Adjustments, and Adding Corporate Governance Controls

This table displays the robustness test for our instrumental variable estimation identifying the effect of passive institutional ownership on CSR scores. The dependent variables are total CSR scores. In Columns (1) to (2), we use a bandwidth of 150 instead of 250 in our main results. In Columns (3) to (4), we exclude firms with large float adjustments, and in Columns (5) to (6) we add additional corporate governance controls. The data consist of firms near the cutoff point of Russell 1000 and Russell 2000 indexes over the years 2003-2011 in Column (1), Column (3) and Column (5), and in Column (2), Column (4) and Column (6) we use a subsample over the years 2003-2006 (before the banding rule). An intercept is included but not reported. All continuous variables are winsorized at the 1^{st} and 99^{th} percentiles, and are summarized in Appendix I. Standard errors, ϵ, are clustered at the firm level and corrected for heteroskedasticity. Significance at the 10%, 5% and 1% level is indicated by *, ** and ***, and t-values are in parentheses.

Dependent variable =	CSR score					
	(1)	(2)	(3)	(4)	(5)	(6)
$\widehat{Passive}(\%)$	**-0.431*** (-2.92)**	**-0.345** (-2.22)**	**-0.395*** (-2.96)**	**-0.447*** (-3.08)**	**-0.400*** (-3.01)**	**-0.461*** (-3.10)**
Large float adj. firms	Including	Including	Excluding	Excluding	Including	Including
Polynomial order, N	2	2	2	2	2	2
Bandwidth	150	150	250	250	250	250
Additional controls	Yes	Yes	Yes	Yes	Yes	Yes
CG Controls	No	No	No	No	Yes	Yes
Sample period	2003-2011	2003-2006	2003-2011	2003-2006	2003-2011	2003-2006
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
N	1,554	684	2,458	1,066	2,453	1,063

Table 10: Placebo Tests with Hypothetical Cutoff Points

This table presents the placebo test for our instrumental variable estimation identifying the effect of passive institution ownership on CSR scores using hypothetical cutoff points. The data consist of firms near the cutoff point of Russell 1000 and Russell 2000 indexes using a bandwidth of 250 over the years 2003-2011 in Columns (1) to (4), and over the years 2003-2006 in Columns (4) to (8). Basically, we replicate our main results in Columns (2) and (5) of Table 3, but use the hypothetical cutoff points at the 500^{th}, 750^{th}, 1250^{th} and 1500^{th} instead of the real 1000^{th} cutoff point. An intercept is included but not reported. All continuous variables are winsorized at the 1^{st} and 99^{th} percentiles, and are summarized in Appendix I. Standard errors, ϵ, are clustered at the firm level and corrected for heteroskedasticity. Significance at the 10%, 5% and 1% level is indicated by *, ** and ***, and t-values are in parentheses.

Dependent variable =	CSR score							
	Sample years = 2003-2011				*Sample years* = 2003-2006			
Hypothetical cutoff point =	500^{th}	750^{th}	1250^{th}	1500^{th}	500^{th}	750^{th}	1250^{th}	1500^{th}
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\widehat{Passive}(\%)$	1.703	-0.399	25.593	-0.339	0.655	-1.396	-0.326	0.068
	(0.75)	(-0.20)	(0.04)	(-0.88)	(0.35)	(-1.24)	(-0.40)	(0.01)
$\ln(Mktcap)$	-8.935	0.954	-211.934	-2.535	-5.814	0.666	-2.443	3.182
	(-1.45)	(0.11)	(-0.04)	(-0.71)	(-1.01)	(0.13)	(-0.38)	(0.04)
$\ln(Float)$	-4.338	1.279	-81.331	1.375	-0.707	2.520	0.767	0.231
	(-0.62)	(0.30)	(-0.04)	(0.97)	(-0.32)	(1.61)	(0.50)	(0.02)
$(ln(Mktcap))^2$	0.843	-0.148	21.823	0.091	0.392	-0.175	0.138	-0.199
	(1.31)	(-0.17)	(0.04)	(0.44)	(1.29)	(-0.56)	(0.32)	(-0.04)
Polynomial order, N	2	2	2	2	2	2	2	2
Bandwidth	250	250	250	250	250	250	250	250
Additional controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	2,512	2,553	2,568	2,634	1,080	1,133	1,105	1,146

Table 11: Robustness Tests: Alternative Method Using Regression Discontinuity Design

This table displays the robustness test for the effect of passive institutional ownership on CSR scores using regression discontinuity design estimation as in Boone and White (2015). The dependent variables for Columns (1) and (2) are *Total CSR score*, and the dependent variables for Columns (3) and (4) are *Strength score*. The data consist of firms near the cutoff point of Russell 1000 and Russell 2000 indexes over the years 2003-2011 in Columns (1) and (3), and over the years 2003-2006 (before the banding rule) in Columns (2) and (4). We present the RD coefficients based on a triangle kernel and the rule of thumb bandwidth selection procedure prescribed in Calonico, Cattaneo, and Titiunik (2014). All continuous variables are winsorized at the 1^{st} and 99^{th} percentiles, and are summarized in Appendix I. Standard errors, ϵ, are clustered at the firm level and corrected for heteroskedasticity. Significance at the 10%, 5% and 1% level is indicated by *, ** and ***, and t-values are in parentheses.

Dependent variable =	Total CSR score	Total CSR score	Strength score	Strength score
	(1)	(2)	(3)	(4)
$RD\_Estimate$	**-0.206***	**-0.189**	**-0.434*****	**-0.391****
$Z-stat$	**(-1.96)**	**(-1.22)**	**(-3.52)**	**(-2.31)**
Sample period	2003-2011	2003-2006	2003-2011	2003-2006
Optimal bandwidth	Yes	Yes	Yes	Yes
Rule of Thumb bandwidth	304	367	228	281