How Does Private Firm Innovation Affect Anti-Takeover Provisions in Corporate Charters? Evidence from Firms Going Public

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Abstract

We make use of data on anti-takeover provisions (ATPs) and top management characteristics hand-collected from IPO prospectuses to analyze the effect of the pre-IPO innovativeness and the top management quality of private firms on the number and strength of ATPs in their corporate charters (formed at IPO). We test two opposing hypotheses: the "long-term value creation" hypothesis, which predicts that more innovative private firms and those with higher top management quality will include a larger number of (and stronger) ATPs in their corporate charters; and the "management entrenchment" hypothesis, which makes the opposite prediction. Our empirical findings are as follows. First, firms with greater pre-IPO innovativeness (as measured by the number of patents and citations per patent) and higher top management quality are each associated with a larger number of and stronger ATPs; the joint effect of pre-IPO innovativeness and top management quality on the number and strength of ATPs is also positive. Second, the IPO market rewards firms with a combination of greater pre-IPO innovation productivity and stronger ATPs with higher IPO and immediate post-IPO secondary market valuations. Third, we use an instrumental variable analysis by exploiting the quasi-random assignment of patent applications to examiners with different grant rates to show that the above results are causal. Finally, firms with stronger ATPs at IPO have significantly greater post-IPO innovation productivity, measured by the quantity and quality of innovation. Overall, our findings support the long-term value creation hypothesis and reject the management entrenchment hypothesis.

Keywords: Anti-Takeover Provisions (ATPs); Private Firms; Pre-IPO Innovation; Top Management Quality; Initial Public Offerings (IPOs)

JEL classification: G31; G34; K22; O31; O32

1 Introduction

The role of anti-takeover provisions (ATPs) in the corporate charters of firms has recently become a matter of considerable debate. On the one hand, earlier studies have argued that ATPs entrench firm management and therefore depress firm performance by mitigating the disciplining effect of the market for corporate control on firm management (see, e.g., Field and Karpoff (2002)). On the other hand, more recent papers have argued that ATPs in fact improve firm performance post-IPO. Chemmanur, Paeglis, and Simonyan (2011) argue that ATPs allow higher quality top management teams to create long-run value for the firm post-IPO and show that, in the hands of higher quality managers, firms with a larger number of ATPs obtain higher IPO valuations and have better post-IPO operating performance (see also Johnson, Karpoff, and Yi (2015), who show that IPO firms with a larger number of ATPs have higher valuations and better operating performance post-IPO when they have important business relationships to protect). The role of ATPs in the corporate charters of firms going public has also become controversial among practitioners. While, prior to 1990, firms with dual-class share structures were prohibited from listing on the New York Stock Exchange, many prominent technology firms have gone public recently with dual-class share structures and other strong ATPs in their corporate charters.[1]

The effect of having a larger number of ATPs in a firm's corporate charter on a specific aspect of corporate performance, namely, corporate innovation, has also been the subject of considerable debate in the literature. For example, Atanassov (2013) uses the enactment of business combination laws as a proxy for the decrease in the threat of hostile takeovers and finds that state anti-takeover laws stifle innovation.[2] However, Chemmanur and Tian (2018), using a variety of empirical methodologies, show that firm-level ATPs causally spur corporate innovation in seasoned firms.

[1] As Chemmanur and Tian (2018) note, some prominent examples of firms going public within the last decade with dual-class shares structures are Google, Facebook, and LinkedIn (these firms currently maintain their dual-class share structures). While a dual-class share structure is a strong ATP, several technology firms also have other strong ATPs such as staggered boards in their corporate charters (e.g., LinkedIn). Bebchuk (2003) points out that 82% of firms going public in 2002 made use of staggered boards, while only 35% of firms going public in 1988-1992 did so.

[2] Karpoff and Wittry (2018), however, point out that using state-level ATPs to identify empirical tests is problematic, since in many cases state-level ATPs did not raise the barriers to takeovers for firms incorporated in those states. Rather, the changes in state-level ATPs first reduced such barriers to takeovers in prior years before increasing them. Therefore, comparing firm innovation before and after the passage of state anti-takeover laws to identify empirical tests on the effect of state ATPs on innovation may yield misleading results.

Most of the papers in the above two literatures focus on the effect of ATPs on performance: either operating or stock return performance, or some other specific aspect of performance such as corporate innovation. One potential problem with studies analyzing how ATPs affect performance is endogeneity: i.e., is the effect of ATPs on subsequent performance (and innovation in particular) due to the ATPs themselves, or is it the case that more innovative firms choose a larger number of ATPs in their corporate charters? The existing literature has attempted to deal with this potential endogeneity problem by using various identification strategies, such as changes in state-level ATPs (Atanassov (2013)) or a regression discontinuity analysis using changes in ATPs in firms' corporate charters (Chemmanur and Tian (2018)).

In contrast to the above literature, our objective in this paper is to contribute to the aforementioned debate on the link between ATPs and corporate innovation by analyzing the reverse relationship: i.e., to study how the innovativeness of a firm prior to its IPO affects the number of ATPs in its corporate charter. Since many ATPs are included in restated corporate charters of firms going public immediately before their IPOs, we are able to avoid the potential endogeneity problem affecting the existing literature on the relationship between ATPs and firm performance.[3] Thus, in the first part of our paper, we establish, for the first time in the literature, that firm innovativeness pre-IPO has a positive effect on the total number of ATPs as well as the number of strong ATPs in its corporate charter at IPO. We also analyze the effect of a firm's top management team quality on the above relationship between the pre-IPO innovativeness of a firm and the number of ATPs in its corporate charter. In the second part of our paper, we attempt to shed light on why firms that are more innovative pre-IPO choose a larger number of ATPs and stronger ATPs in their corporate charters. We shed light on this issue by studying the joint effect of a firm's pre-IPO innovativeness and the number of ATPs (and strong ATPs) in its corporate charter on its IPO and immediate secondary market valuations. We also do this by empirically analyzing the relationship between having a larger number of ATPs (and stronger ATPs) in a firm's corporate charter (established at IPO) and post-IPO innovation outcomes (i.e., innovation in the years immediately after IPO), while controlling for the pre-IPO innovativeness of the firm.[4]

[3]Firms amend and restate their corporate charters immediately before going public to reflect their new status as a public company, and include many ATPs in such restated corporate charters immediately before going public.

[4]Given that we control for pre-IPO innovativeness, even our analysis of the effects of the number and strength of the ATPs in a firm's corporate charter on post-IPO innovation is not subject to an endogeneity problem. Our analysis in the first part of this paper shows that firms that are more innovative pre-IPO indeed choose to have a larger number of (and

We develop our testable hypotheses based on two strands in the theoretical literature that produce opposing predictions regarding the effect of ATPs on innovation. The first strand is the literature which suggests that firms innovate more when managers are insulated from the pressure coming from short-term equity market investors. Stein (1988) argues that shareholders may not be able to properly evaluate a manager's decision to invest in long-term (innovative) projects due to information asymmetry and face a higher probability of their firm being taken over by a rival if they undertake long-term projects. To protect themselves against such takeover threats, Stein (1988) argues that managers may invest less in long-term projects and invest more in short-term projects that offer quicker and more certain payoffs ("corporate myopia"). Chemmanur and Jiao (2012) suggest a solution to the above myopia problem by demonstrating that ATPs such as dual-class share structures allow more talented firm managers to undertake a greater proportion of long-term (innovative) projects rather than short-term projects, thus mitigating the problem of corporate myopia.[5] The theoretical model of Chemmanur and Jiao (2012) implies that more innovative firms (those with a larger number of long-term projects available to them) will benefit to a greater extent from including more ATPs (and stronger ATPs) in their corporate charters, since this will allow such firms to be insulated to a greater extent from takeovers, thus obtaining the time required to bring their long-term (more innovative) projects to fruition. The theoretical model of Manso (2011) also can be viewed (with some additional assumptions) as suggesting that more innovative firms may include more ATPs in their corporate charters. This is because ATPs allow incumbent firm management more time (by reducing the probability of takeovers) to implement their innovative projects thereby increasing shareholders' failure tolerance for their managers and for the innovators working under their guidance (even after these firms have gone public).[6] Thus, the implication of the above strand in the literature is that, first, firms that are more innovative pre-IPO will have more

stronger) ATPs in their corporate charters. Our analysis in the second part of the paper, however, demonstrates that, even after controlling for pre-IPO innovativeness, firms with a larger number of stronger ATPs in their corporate charters are able to generate more innovations.

[5]While, for modeling simplicity, Chemmanur and Jiao (2012) set up a private firm's choice pre-IPO as being one between single-class versus dual-class share structures, the analysis goes through for any strong ATP (for example, staggered boards) or a combination of ATPs that reduce the probability of takeover of a firm once it is public.

[6]Thus, Manso (2011) states: "In the public debate on corporate governance, critics often hold that golden parachutes, option repricing, and managerial entrenchment are detrimental because they protect or even reward the manager after poor performance, potentially undermining the incentives for the manager to exert effort. Occasionally there are proposals to adopt regulations that restrict the use of some of these practices. However, these practices may be part of an optimal incentive scheme that motivates innovation, in which case regulations that restrict their use may have an adverse effect on innovation. To assess the actual impact of such regulations, it remains to be studied empirically the actual contribution of these practices to innovation."

and stronger ATPs in their corporate charters at the time of going public; and, second, firms that have more and stronger ATPs in their corporate charters at the time of IPO will produce a larger number of innovations and higher quality innovations post-IPO. We will refer to this hypothesis as the "long-term value creation" hypothesis.

The arguments made by Chemmanur and Jiao (2012) also imply that for a given level of innovativeness, firms with higher quality top management teams will have a larger number of ATPs in their corporate charters. This is because, as Chemmanur and Jiao (2012) assume, higher quality managers are able to create long-run value by investing in long-term projects and by implementing them more ably. On the other hand, lower quality managers (with higher effort costs) have a lower ability to create such long-run value and instead are more likely to shirk while using ATPs as a shield against takeovers. Further, given that the individual effects of pre-IPO innovation and top management quality on the number of ATPs in a firm's corporate charter are expected to be positive under the long-term value creation hypothesis, we expect their joint effect on the number of ATPs (and strong ATPs) to be positive as well.

In contrast to the above strand in the theoretical literature, a second strand in the theoretical literature suggests that if a firm's top managers are not properly monitored and left to themselves, they will shirk and enjoy their private benefits from controlling the firm: see, e.g., the seminal works of Grossman and Hart (1988), Harris and Raviv (1988), and Harris and Raviv (1989).[7] In such a setting, hostile takeovers serve as an effective disciplining mechanism to mitigate this moral hazard problem and encourage managers to exert effort, thus increasing firm value. Such arguments imply that ATPs serve mainly to entrench incumbent firm management, since they reduce the effectiveness of the market for corporate control in disciplining firm management and consequently reduce managerial effort and therefore innovation output. Under this line of reasoning, the firms that are more innovative pre-IPO will incorporate a smaller number of (or weaker) ATPs in their corporate charters at the time of their IPOs (assuming that the founder/entrepreneur chooses the number and type of ATPs in his firm's corporate charter to maximize the sum of his control benefits from managing the firm and the firm's equity value, and that innovative projects are more sensitive to managerial effort than non-innovative projects). Further, the above argument implies that

[7] See also Cary (1969) and Williamson (1975), who made earlier, more informal, arguments that ATPs act primarily to entrench incumbent management.

firms with more (or stronger) ATPs in their corporate charters at IPO will produce less innovation post-IPO (since ATPs reduce managerial incentives to exert effort post-IPO). We will refer to this hypothesis as the "management entrenchment" hypothesis. If we add the additional assumption to the above setting that the effort cost of higher quality managers is smaller (so they benefit less from shirking), then, for a given level of firm innovativeness, the number of ATPs included in a firm's corporate charter will be decreasing in its management quality. Further, given that the individual effects of pre-IPO innovation and management quality on the number of ATPs in a firm's corporate charter at IPO are expected to be negative under the management entrenchment hypothesis, we expect their joint effect on the number of ATPs to be negative as well.

Based on the above testable hypotheses, we address the following four research questions in this paper. First, what is the effect of the pre-IPO innovativeness of a private firm, as measured by the quantity (number of patents) and quality (citations per patent) of innovation, on the number and strength of ATPs in its corporate charter (formed at IPO)? Second, what is the joint effect of the pre-IPO innovativeness and the top management quality of a firm on the number and strength of ATPs in its corporate charter? Third, does the IPO market reward firms with a combination of greater pre-IPO innovation and a larger number of (or stronger) ATPs in their corporate charters with higher valuations? Fourth, what is the effect of the number and strength of ATPs in a firm's corporate charter at the time of IPO on the quantity and quality of the firm's innovation output after the IPO (controlling for its pre-IPO innovativeness)? In addressing the above four research questions, we analyze not only the effect of a firm's pre-IPO innovativeness and top management quality on the total number (or strength) of ATPs in its corporate charter, but also analyze their effect on the prevalence of individual ATPs such as staggered boards, dual-class share structures, poison pills, and others.

We test the above hypotheses using data on a sample of venture capital (VC)-backed firms going public during 1993-2015. The data on top management quality and ATPs (the 19 firm-level ATPs we analyze are described in Appendix A) were hand-collected from IPO prospectuses. We make use of individual proxies for top management quality used by Chemmanur and Paeglis (2005) and Chemmanur, Paeglis, and Simonyan (2011). We follow the methodologies in these papers to conduct common factor analysis on the above individual top management quality proxies to generate a management quality factor (MQFactor) as a single measure of a firm's top management

quality. We make use of the number of patents granted to a firm and the number of citations received by each patent obtained from the U.S. Patent and Trademark Office (USPTO) website as our main measures of firm innovation. Specifically, patent counts measure the quantity of innovation and citations per patent measure the quality of innovation. The use of patent data to capture firms' innovation productivity has now become standard in the innovation literature (see, e.g., Seru (2014) or Chemmanur, Loutskina, and Tian (2014)).

We confine our study to VC-backed entrepreneurial firms for two reasons. First, VC-backed firms typically belong to industries where innovation is an important component of firm value (e.g., software, pharmaceutical, biotechnology).[8] Second, since VC backing may directly affect the number of ATPs in a firm's corporate charter, and the focus of this study is on the effect of pre-IPO innovation on the number of ATPs, we are able to eliminate the confounding effects of VC backing by confining our study to firms that are similar to each other in terms of VC backing.

Our baseline empirical findings on the relationship between pre-IPO innovation and the ATPs in a firm's corporate charter (established at IPO) are as follows. First, firms that are more innovative pre-IPO (as measured by either the quantity or the quality of innovation) are likely to have a larger number of ATPs and stronger ATPs in their corporate charters at IPO. Second, the number and strength of ATPs in a firm's corporate charter is also increasing in the quality of its top management team. Third, the joint effect of pre-IPO innovativeness and top management quality on the number and strength of ATPs in a firm's corporate charter at IPO is also positive. In other words, when we divide our sample into four quadrants: high versus low pre-IPO innovativeness and high versus low top management quality, we find that firms belonging to the first quadrant (high pre-IPO innovativeness and high top management quality) have the largest number of (and stronger) ATPs in their corporate charters compared to the average for firms in the other three quadrants. We also find that the above relationships hold for several of the individual (and strongest) firm-level ATPs that we study in this paper. In particular, we find that pre-IPO innovativeness and top management quality are positively and significantly related to the prevalence of staggered boards, poison pills, restrictions on action by written consent, and supermajority required to amend charters or by laws, which are likely to greatly reduce takeover probability. Finally, we find that the IPO market

[8] Since most of the firms in our non-VC-backed IPO sub-sample are in industries that are not innovation-intensive, we do not find significant variation in patents and citations per patent in this sub-sample.

rewards firms with a combination of greater pre-IPO innovation and a larger number of stronger ATPs in their corporate charters with higher valuations. Our findings provide strong support for the long-term value creation hypothesis and contradict the management entrenchment hypothesis.

It may be argued that our baseline empirical findings may suffer from omitted variable bias. For example, higher quality firms (where quality is measured by some variables other than innovation productivity) may have both greater pre-IPO innovation productivity as well as a larger number of (and stronger) ATPs in their corporate charters at IPO. To identify the causal effect of pre-IPO innovation productivity on the prevalence of ATPs in firms' corporate charters at IPO, we conduct an instrumental variable (IV) analysis. In particular, we construct our instrumental variable for pre-IPO innovation productivity by making use of the quasi-random assignment of patent applications to examiners with different approval rates that are exogenous to application quality.[9] Specifically, there are two features of the patent examination process at the U.S. Patent and Trademark Office (USPTO) which make examiner leniency an ideal instrument for firms' pre-IPO innovation productivity: (1) each patent application is assigned to examiners based on its filing date - an application with the earliest filing date is assigned to the first available examiner; (2) there are considerable variations in approval rates among examiners (see, e.g., Cockburn, Kortum, and Stern (2003)). Our IV analyses confirm all our baseline results, suggesting that the greater pre-IPO innovativeness of firms going public has a positive causal effect on the number (and strength) of ATPs in their corporate charters at IPO. Our IV analysis also causally establishes that IPO market rewards firms with a combination of greater pre-IPO innovation and a larger number of stronger ATPs in their corporate charters with higher valuations.

We also empirically show that firms with stronger ATPs in their corporate charters at the time of IPO have significantly greater innovation productivity in the years immediately post-IPO in terms of the quantity of innovation output. Overall, the findings of our empirical analysis suggest that more innovative private firms choose to have a larger number of and stronger ATPs in their corporate charters so as to provide some insulation for top management from potential takeovers, thus lengthening their investment horizon and motivating them to undertake a larger proportion of long-term (innovative) projects without interference from the market for corporate control. Consistent

[9]Several recent papers exploit this fact to make causal inferences in their studies (see, e.g., Maestas, Mullen, and Strand (2013), Farre-Mensa, Hegde, and Ljungqvist (2019), and Sampat and Williams (2019)).

with the long-term value creation hypothesis, this relationship is stronger in firms with higher top management quality. Our finding that the IPO market rewards firms with a combination of greater pre-IPO innovation productivity and stronger ATPs with greater firm valuations provides further support for the notion that the motivation for firms to include a larger number of (and stronger) ATPs in their corporate charters is indeed to create greater long-run value for shareholders.

The rest of this paper is organized as follows. Section 2 discusses how our paper is related to the existing literature and its contribution relative to this literature. Section 3 summarizes the relevant theory and develops testable hypotheses. Section 4 describes our data and discusses our measures of anti-takeover protection, product market innovation, top management team quality as well as other measures of firm quality and internal governance. Section 5 presents our empirical tests and results (section 5.4 discusses our identification strategy). Section 6 concludes.

2 Relation to the Existing Literature and Contribution

Our paper contributes to several strands in the existing literature. The first strand our paper contributes to is the literature analyzing how the ATPs in a firm's corporate charter affect its performance in general and its innovation productivity in particular. The evidence in this literature has been mixed, as it provides contradictory findings on the effect of ATPs on future firm performance. On the one hand, in an earlier paper, Field and Karpoff (2002) argued that ATPs play a role in entrenching firm managers. On the other hand, a more recent paper by Chemmanur, Paeglis, and Simonyan (2011) shows that firms with higher top management quality have a larger number of ATPs in their corporate charters. They also show that firms with a combination of higher top management quality and above the median number of ATPs have better post-IPO operating performance and higher IPO valuations than the average firm in the rest of their sample. Johnson, Karpoff, and Yi (2015) show that a larger number of ATPs in private firms' corporate charters is associated with higher IPO valuations and better post-IPO operating performance when they have important business relationships to protect. Bhojraj, Sengupta, and Zhang (2017) show that firms incurring greater R&D expenditures experience an increase in market valuation (Tobin's Q) following a state law change in Delaware that increases the effectiveness of ATPs in defending against hostile takeovers.

The broader literature on the relationship between ATPs and innovation in seasoned firms is also related to our study. Atanassov (2013) finds that state anti-takeover laws stifle innovation in seasoned firms. Sapra, Subramanian, and Subramanian (2014) also focus on state anti-takeover laws, but present more of a mixed picture: they find greater innovative activity by firms based in states which either do not have any anti-takeover laws (such laws are practically non-existent) or have anti-takeover laws which are strong enough to deter takeovers. Neither of the above two papers, however, analyze firm-level ATPs. Chemmanur and Tian (2018) use a regression discontinuity analysis to show that firm-level ATPs spur innovation in seasoned firms. In contrast to the above literature, where the focus is on how ATPs affect an established firm's performance (and innovation in particular), our primary focus in this paper is on the reverse relationship: i.e., on how the innovativeness of a private firm prior to its IPO affects the number of ATPs in its corporate charter. Since many ATPs are included in restated corporate charters of firms going public immediately before their IPOs, we are able to mitigate the potential endogeneity problem affecting the existing literature on the relationship between ATPs and firm performance. Along with our IV analysis, we are able to establish, for the first time in the literature, a positive causal relationship between a firm's pre-IPO innovativeness and the number of ATPs in its corporate charter. It is also important to note that, while the existing literature analyzing the relationship between ATPs and innovation in established firms makes use of the G-index as a measure of anti-takeover protection, we make use of data on firm-level ATPs hand-collected from IPO prospectuses in our empirical analysis.

Of course, once established, a corporate charter involving a larger number of (or stronger) ATPs may help an innovative firm perform better subsequently in terms of innovation productivity (as we demonstrate in the second part of our paper). This is consistent with the prediction of the theoretical model of Chemmanur and Jiao (2012), who argue that firms with a greater proportion of long-term (innovative) projects will incorporate stronger ATPs in their corporate charters, which, in turn, will incentivize talented firm managers to invest more in long-term (innovative) projects and thus create greater long-term value for shareholders. Thus, the findings of our analysis are also consistent with those of Chemmanur and Tian (2018), who show that ATPs spur corporate innovation; they, however, focus only on innovation by established firms (and not on pre-IPO innovations by private firms, as we do).

The second strand our paper is related to is the broader theoretical and empirical literature on

the characteristics of private firms, their decision to go public (and private versus public status), and innovation productivity. Two theoretical models that analyze the effect of going public on the innovation productivity of a firm are Ferreira, Manso, and Silva (2012) and Spiegel and Tookes (2019). Both models predict that firms will be more innovative pre-IPO rather than post-IPO, though for reasons different from each other. An important empirical analysis that studies the relationship between a firm's public versus private status and its innovation productivity is Bernstein (2015), who shows that the innovation productivity of a firm declines post-IPO and demonstrates a causal relationship between going public and the decline in innovation productivity. Another paper that studies the relation between entrepreneurial exit choice and innovation outcomes is Aggarwal and Hsu (2013), who find that innovation quality is highest under private ownership and lowest under public ownership, with acquisition intermediate between the two. Gao, Hsu, and Li (2018) compare the innovation strategies of public and private firms and show that, compared to those of private firms, public firms' patents rely more on existing knowledge and are more exploitative (and less likely to involve new technology classes). Acharya and Xu (2017) examine the relationship between innovation and a firm's financial dependence and demonstrate that public firms in external (internal) financing dependent industries have better (worse) patent portfolios than their private counterparts.[10,11] Our paper contributes to the above literature by showing, for the first time, that the innovative activities undertaken by a firm prior to its going public affect the number and strength of ATPs in its corporate charter formed at IPO. We further demonstrate that the number and strength of ATPs in a firm's corporate charter at IPO affect its post-IPO innovation productivity, even after controlling for its pre-IPO innovation productivity.[12]

The third and final strand our paper contributes to is the theoretical and empirical work on the role of human capital of a firm's employees and top management in affecting its performance. The

[10] In a contemporaneous paper, Chemmanur, Gupta, and Simonyan (2018) use measures of top management quality similar to ours and study the relationship between the top management quality of a private firm and its pre-IPO innovation productivity and its innovation strategies.

[11] The broader empirical literature relating various firm characteristics of seasoned firms to their innovation outcomes is indirectly related to our paper. Some of these characteristics are: managerial compensation (Lerner and Wulf (2007), Ederer and Manso (2013), Baranchuk, Kieschnick, and Moussawi (2014)); institutional ownership (Aghion, Van Reenen, and Zingales (2013)); or conglomerate structure (Seru (2014)).

[12] Cao, Jiang, and Ritter (2015) show that VC-backed IPOs that have at least one patent at the time of the IPO substantially outperform other VC-backed IPOs. While, for the reasons discussed earlier, we use a sample of VC-backed private firms for our analysis, our focus here, unlike the above literature, is not on the effect of VC backing on innovation or on the effect of innovation on the probability of VC backing, but rather on how pre-IPO innovation affects the number of ATPs in a firm's corporate charter.

importance of the human capital of employees in affecting firm performance has been hypothesized (among others) in the seminal theoretical work of Becker (1962). The empirical studies related to our paper are Chemmanur and Paeglis (2005), who study how the management quality of a firm affects its IPO characteristics, and Chemmanur, Kong, Krishnan, and Yu (2019), who make use of a panel data-set from the BoardEx database to study how top management quality is related to corporate innovation in established (seasoned) firms. Our paper is also indirectly related to the literature on how firms' CEO characteristics affect innovation: see, e.g., Hirshleifer, Low, and Teoh (2012), who find that overconfident CEOs invest more in research and development (R&D) and obtain more patents and citations; Barker and Mueller (2002), who relate CEO characteristics and R&D spending; and Custódio, Ferreira, and Matos (2019), who analyze how the general versus firm-specific human capital of CEOs affects corporate innovation. Unlike this literature, our focus here is on how a private firm's top management quality affects the relationship between its pre-IPO innovativeness and the number and strength of ATPs in its corporate charter at IPO.

3 Theory and Hypotheses Development

In this section, we derive testable hypotheses on the effect of pre-IPO innovativeness and top management quality of a firm on the number of ATPs in its corporate charter at the time of IPO (usually, this is the first time a firm decides on a comprehensive set of provisions to incorporate into its corporate charter). The theoretical model of Chemmanur and Jiao (2012) implies that firms with a greater proportion of long-term (innovative) projects can benefit to a greater extent from more ATPs in their corporate charters, since top management can be insulated from potential takeover threats from rival firms to a greater extent and obtain the longer time necessary to bring their long-term (innovative) projects to fruition. A larger number of (and stronger) ATPs will motivate top management to undertake a larger proportion of innovative projects post-IPO as well. As discussed in the introduction, Manso (2011) also predicts that firms with more innovative projects will have more ATPs in their corporate charters, though, in his setting, these are part of an optimal incentive scheme to motivate innovation. Thus, we hypothesize that firms that are more innovative pre-IPO will have more ATPs in their corporate charters at the time of IPO (**H1A**). We will refer to this hypothesis as the "long-term value creation" hypothesis.

In contrast to the above arguments, moral hazard models (extensions of the seminal works of Grossman and Hart (1988), Harris and Raviv (1988), and Harris and Raviv (1989)) suggest that managers who are not properly monitored will shirk (exert less innovation effort themselves and/or exert less effort in supervising scientists and engineers working for the firm who may be directly in charge of producing innovation) and thereby produce a smaller quantity and lower quality of innovation. In such a setting, hostile takeovers serve as an effective disciplining mechanism to mitigate this moral hazard problem thereby encouraging innovation (and monitoring) effort, thus increasing firm value. Such arguments imply that ATPs serve mainly to entrench incumbent firm management, thus mitigating the disciplining effect of the market for corporate control and consequently reducing future corporate innovation and cash flows (thus potentially lowering firm value). Under this line of reasoning, private firms which are more innovative pre-IPO will include a smaller number of ATPs in their corporate charters at IPO (**H1B**), assuming that the entrepreneurial founders of these firms make the choice of the number (and strength) of ATPs to include in their corporate charters in order to maximize a weighted average of the long-term equity value of their firm and their private benefits arising from remaining in control of these firms (and that managerial effort is more important to successfully implement innovative projects compared to non-innovative projects). We will refer to this hypothesis as the "management entrenchment" hypothesis.[13]

Bebchuk, Cohen, and Ferrell (2008) argue that not all ATPs are equally strong: they show that some ATPs (e.g., staggered boards and poison pills) are more strongly correlated with firm value and stock returns. Based on such arguments, we examine whether more innovative private firms are more likely to have certain individual ATPs ("strong ATPs" from now on) that have been documented in the literature to have a stronger effect on preventing takeovers. Under the long-

[13]In the above models, the founder or incumbent manager of a firm (large shareholder) obtains not only cash flow benefits (arising from his equity ownership in the firm) but also private benefits of control that are lost in the event of a takeover; outside shareholders receive only cash flow benefits. These models imply that ATPs may potentially reduce shareholder value, since they decrease the chance of takeovers by rival management teams who can increase the cash flows to current shareholders by managing the firm better than does the incumbent. Thus, in these models, ATPs are inefficient, since they entrench existing managers by reducing the chance of their losing control and thereby reducing managerial incentives to exert effort. Therefore, under the management entrenchment hypothesis, the number and strength of ATPs included in a firm's corporate charter arises from the trade-off faced by the founder (and other top management team members who may play a role in making the decision on the number of ATPs to be included in the firm's charter): on the one hand, increasing the number of ATPs (and including stronger ATPs) will lead to a reduction in the value of the firm's equity (as investors infer that top management will exert less effort) and therefore in the value of their equity holdings in the firm; on the other hand, including a larger number of ATPs (and stronger ATPs) in the firm's corporate charter will reduce the probability of the firm being taken over by a rival, so that their expected benefits from controlling the firm will increase with the number and strength of the ATPs included in the firm's charter at IPO.

term value creation hypothesis, we would expect more innovative firms to be more likely to have stronger ATPs in their corporate charters (**H2A**); under the management entrenchment hypothesis, we would expect the opposite to be true (**H2B**).

Next, we examine the joint effect of pre-IPO innovation and management quality on the number of ATPs in a firm's corporate charter. The arguments made by Chemmanur and Jiao (2012) imply that for a given level of pre-IPO innovativeness, higher top management quality firms will have a larger number of (and stronger) ATPs in their corporate charters at the time they go public. This is because, in their setting, higher quality managers are able to create long-run value by investing in innovative (long-term) projects and implementing them more ably (lower quality managers, on the other hand, have higher effort cost and are unable to create such long-run value and instead are more likely to shirk while using ATPs as a shield against takeovers). Thus, for a given level of innovativeness, firms with higher quality managers will obtain greater benefits (arising from their equity holdings in the firm) from having a larger number of ATPs in their corporate charters under the long-term value creation hypothesis. Further, as argued earlier, more innovative firms are likely to have a larger number of (and stronger) ATPs in their corporate charters under the long-term value creation hypothesis. Given that the individual effects of pre-IPO innovation and management quality on the number of ATPs in a firm's corporate charter are expected to be positive under the long-term value creation hypothesis, we expect their joint effect on the number of ATPs to be positive as well (**H3A**). Similarly, following the arguments we made earlier, under the long-term value creation hypothesis, we also expect more innovative firms with higher management quality to have a higher likelihood of adopting stronger ATPs in their corporate charters (**H4A**).

In contrast to the above arguments, the agency theoretic (moral hazard) models generating the management entrenchment hypothesis do not assume a value-enhancing role for ATPs. In other words, ATPs only serve to reduce the disciplining effect of takeovers, thus allowing firm management to shirk to a greater extent without losing control to rival management teams. Thus, if we add the additional assumption that the effort cost is smaller for higher quality managers (so that their benefit from shirking is smaller) to the management entrenchment hypothesis, then, for a given level of firm innovativeness, the number of ATPs included in a firm's corporate charter will be decreasing in its top management quality. Further, as we discussed earlier, firms that are more innovative can be expected to have a smaller number of ATPs (and a lower likelihood of adopting

stronger ATPs) in their corporate charters under the management entrenchment hypothesis. Given that the individual effects of pre-IPO innovation and management quality on the number of ATPs are expected to be negative under the management entrenchment hypothesis, we expect their joint effect on the number of ATPs to be negative as well (**H3B**). Following a similar logic, under the management entrenchment hypothesis we would also expect more innovative firms with higher top management quality to have a lower likelihood of adopting stronger individual ATPs in their corporate charters when they go public (**H4B**).

It is also important to analyze the joint effect of the number (and strength) of ATPs in a firm's corporate charter and its pre-IPO innovativeness on the firm's IPO and immediate post-IPO secondary market valuations.[14] Under the long-term value creation hypothesis, the main role of ATPs is to lengthen managerial horizons, thus allowing them to create greater long-term value post-IPO when they have a significant proportion of long-term (innovative) projects available to them. This means that the joint effect of ATPs (strong ATPs) and pre-IPO innovativeness on IPO firm valuation will be positive (**H5A**), since the IPO market will infer and correctly value the potential for greater long-term value creation post-IPO at the time of IPO itself. On the other hand, if the role of ATPs is mainly to entrench firm management, and managerial effort is particularly crucial for the successful implementation of innovative (rather than non-innovative) projects, then we expect the joint effect of pre-IPO firm innovativeness and the number of ATPs (strong ATPs) on a firm's IPO valuation to be negative (**H5B**).

Finally, if the purpose of having ATPs in a firm's corporate charter at the time of IPO is to lengthen corporate investment horizon and thereby encourage the production of innovation by insulating top firm management from takeovers after the firm goes public (as predicted by the long-term value creation hypothesis) then this should be evident in the firm's immediate post-IPO innovation performance. We therefore expect firms with a larger number of (and stronger) ATPs in their corporate charters to produce a greater quantity and quality of innovation in the years immediately post-IPO under the long-term value creation hypothesis (**H6A**). On the other hand, under management entrenchment hypothesis, we would expect the relationship between the number and strength of ATPs in a firm's corporate charter at IPO and its post-IPO innovation performance to be negative (**H6B**), since top management may be expected to exert less effort

[14] We control for top management quality in this analysis.

post-IPO as the number (and strength) of ATPs in a firm's corporate charter becomes greater.

4 Data, Sample Selection, and Variable Construction

4.1 Data and Sample Selection

The list of U.S. IPOs in 1993-2015 comes from the SDC/Platinum Global New Issues database. We excluded non-VC-backed firms, real estate investment trusts (REITs), closed-end funds, unit IPOs, spin-offs, equity carve-outs, financial firms (with SIC codes between 6000 and 6999), foreign firms, and former leveraged buy-outs (LBO). While the VC backing status is available from the SDC database, we also double-checked this status form the VentureXpert database to consistently identify VC-backed IPO firms. Thus, our final sample consists of 2,692 VC-backed IPO firms.

Information on firm-level ATPs was hand-collected from the "Capital Stock" section of IPO prospectuses. Innovation data came from the USPTO website. Information on management quality proxies, such as team size, education, prior managerial experience, functional expertise, and tenure of management team members was hand-collected from the "Management" section of IPO prospectuses. Data on internal governance mechanisms (CEO/Chairman-of-the-board duality, proportion of outside directors, and insider stock ownership) came from the prospectuses as well. IPO prospectuses were obtained from the Thomson Financial database. Accounting data came from Compustat.

4.2 Measures of Anti-Takeover Protection

We study 19 firm-level ATPs described in detail in Appendix A. The descriptions of these ATPs are taken from Chemmanur, Paeglis, and Simonyan (2011). We measure the strength of an IPO firm's anti-takeover protection by using two proxies. The first proxy (ATP) is the total number of firm-level ATPs in firm's corporate charter at the time of going public. The second proxy is the sum of five strong ATPs only (Strong ATP) in a firm's corporate charter at the time of going public. These strong ATPs include staggered boards, poison pills, supermajority required to approve mergers, supermajority required to amend charter or bylaws, and unequal voting rights. We make use of these five strong provisions given that Bebchuk, Cohen, and Ferrell (2008) argue that staggered boards, limits to shareholder amendments of the bylaws, supermajority requirements for mergers, and su-

permajority requirements for charter amendments limit the ability of a majority of shareholders to impose their will on management, and poison pills and golden parachutes are important in defending against hostile takeovers. Further, Gompers, Ishii, and Metrick (2009) argue that firms with dual-class share structures are virtually immune to a hostile takeover and the other forms of anti-takeover protection are no match for the power of dual-class stock.

Table 1 reports the frequencies (means) of individual firm-level ATPs for our sample of VC-backed IPO firms. It shows that the average total number of ATPs in the corporate charters of our sample firms is 5.96 with the maximum of 13 and the minimum of 0, and the average number of strong ATPs is 1.32 with the maximum of 5 and the minimum of 0. Further, Table 1 shows that the ATP with the highest frequency is the blank-check preferred stock (98.0% of our sample firms have this provision). Among strong ATPs, 65.9% of our sample firms included staggered boards in their corporate charters, 49.5% included supermajority requirements to amend charter or bylaws, 7.1% had dual-class share structures (unequal voting rights), and 3.3% included poison pills. Other ATPs which have the highest frequencies are prohibition of cumulative voting (77.9%), meetings called only by directors or executives (72.1%), restrictions on action by written consent (69.2%), and advance notice requirements (67.5%).

4.3 Measures of Management Quality and Reputation

We follow Chemmanur, Paeglis, and Simonyan (2011) and Chemmanur and Paeglis (2005) in constructing our management quality measures. Management quality is affected by the amount of human and knowledge resources (including education and experience) available to the management team. Our first proxy for management quality, the management team size, measures the amount of human resources available. It is the number of executive officers with a title of a vice president or higher on the team (TSize). The next two proxies measure the education level of managers. Our second proxy of management quality is the percentage of management team members with an MBA degree (PMBA) and the third proxy is the percentage of management team members who are Certified Public Accountants (PCPA). The greater the percentages of MBAs and CPAs on the management team, the greater its quality.

We measure prior managerial experience of management team members by using the following two proxies. Our fourth proxy is the percentage of managers who have served as executive officers

at other firms prior to joining the IPO firm (PPriorExp) and our fifth proxy is the percentage of managers who were partners at law or accounting firms prior to joining the IPO firm (PLawAcc). Clearly, the greater the percentage of management team members with prior managerial experience (including experience in the areas of law and accounting) the greater the management team quality.

Our sixth proxy of management quality is the percentage of team members with core functional expertise, namely, the percentage of team members holding positions in the areas of operations and production, R&D, sales and marketing, and finance (PCore). The greater the percentage of team members with core functional expertise, the greater the management quality.

Our seventh proxy of management quality is the natural logarithm of the average compensation (salary plus bonus) of team members in the fiscal year before the IPO (PComp). Higher quality managers are expected to be valued higher in a competitive labor market and thus the higher the average compensation of management team members the greater the management quality.

Our eighth proxy of management quality measures the reputation of management team members in the business community. It is the number of other firms' corporate boards that team members sit on (Board). While the measures discussed above also partially capture management team reputation, this proxy is a better representation of the reputation and visibility of managers in the business community. The greater the value of Board, the greater the quality and reputation of a firm's management team.

Our last two proxies of management quality measure the degree of uniformity or heterogeneity in the tenures of management team members. Our ninth proxy of management quality is the average tenure of team members (Tenure), defined as the average number of years that team members have been with the firm.[15] Greater average tenure may indicate shared experiences and cohesion and thus lower costs of interaction between team members. However, longer tenures may also result in complacency and rigidity in team interactions. Thus, we are agnostic about the direction of the expected impact (positive or negative) of this measure of management quality. An ideal management team would have members from different cohorts, which would ensure an inflow of new ideas and perspectives. Further, a higher management quality would be associated with greater dispersion in such tenures. Therefore, we use the heterogeneity in management team tenures (TenHet)

[15] In our empirical tests, we have also used the median team tenure instead of the average team tenure. Our results were similar using this alternative measure.

as our tenth management quality proxy. It is defined as the coefficient of variation of management team members' tenures.

4.4 Common Factor Analysis of Management Quality Variables

Although the individual proxies discussed above are expected to measure management quality, they may each have unique limitations in capturing the underlying unobservable construct. Therefore, we use common factor analysis to construct a single factor for management quality that will capture the variation common to the observable measures of management quality and reputation discussed above.[16] In order to ensure that this single factor captures only the effect of management quality and not that of other variables such as firm size, firm age, or industry characteristics, we use firm-size-, firm-age-, and industry-dummies-adjusted individual management quality proxies to extract the common factor. Thus, our management quality factor score (MQFactor) is constructed using firm-size-, firm-age-, and industry-dummies-adjusted TSize, MBA, PriorExp, Core, LawAcc, CPA, Comp, and Board.[17] These variables refer, respectively, to the management team size, the number of management team members with MBA degrees, the number of management team members with prior managerial experience, the number of management team members with core functional expertise, the number of management team members with prior experience as law or accounting partners, the number of management team members who are CPAs, the natural logarithm of the management team's total compensation (salary plus bonus) in the fiscal year preceding the IPO, and the number of other firms' corporate boards that management team members currently sit on.

We exclude Tenure and TenHet from the construction of the above common factor since these two proxies have negative factor loadings and negative scoring coefficients if included in the common factor analysis. The interpretation of our common management quality factor becomes problematic when some individual management quality proxies have positive scoring coefficients and others have negative scoring coefficients. Therefore, we restrict our common factor analysis to the

[16] Several papers in the empirical finance and accounting literature make use of factor analysis to isolate the unobservable construct underlying several proxy variables. See, e.g., Gaver and Gaver (1993) and Guay (1999), who make use of factor analysis to study the size of a firm's investment opportunity set.

[17] We adjust individual management quality proxies for firm size, firm age, and industry characteristics by regressing those management quality proxies on firm size, firm age, and 2-digit SIC code industry dummies, and take the residuals of such regressions (in other words, the variation in individual management quality proxies not explained by firm size, firm age, or industry characteristics) to be our firm-size-, firm-age-, and industry-dummies-adjusted individual management quality proxies.

first eight management quality proxies, since they have positive factor loadings and positive scoring coefficients when included in the common factor analysis. We then use Tenure and TenHet as control variables in our regressions.[18]

Table 2 presents the results of our common factor analysis. Panel A of Table 2 shows the starting communalities of eight management quality proxies (for the MQFactor described above), estimated as the squared multiple correlations from regressions of each management quality proxy on the remaining management quality proxies used in our common factor analysis. Panel B of Table 2 presents the eigenvalues of the reduced correlation matrices. As suggested by Harman (1976), the number of factors necessary to approximate the original correlations among individual measures is equal to the number of summed eigenvalues necessary to exceed the sum of communalities. The first factor's eigenvalue in our common factor analysis of MQFactor is 1.826 and it is larger than the sum of communalities of 1.162. This means that MQFactor parsimoniously explains the intercorrelations between individual management quality proxies. Panel C of Table 2 presents the correlations between MQFactor and the eight management quality proxies and Panel D of Table 2 provides the summary statistics of MQFactor.

4.5 Measures of Innovation

Following the innovation literature, we use patent-based metrics to capture firm innovativeness. We obtain information on entrepreneurial firm's patenting from PatentsView.org, which is one of the research datasets provided by the USPTO.[19] This dataset contains detailed information on more than seven million patents granted by the USPTO from 1976 to 2018, including patent assignee names, citations received by each patent, and a patent's application and grant dates. We use the name standardization routine developed by the NBER Patent Data Project to standardize assignee names

[18]Negative factor loadings and negative scoring coefficients of Tenure and TenHet are due to negative correlations that these two proxies have with other management quality variables. For example, the correlation between Tenure (TenHet) and the percentage of management team members with prior managerial experience at other firms (PPriorExp) is -0.41 (-0.10) and the correlation between Tenure (TenHet) and the percentage of management team members with MBA degrees (PMBA) is -0.10 (-0.04). Indeed, firms that have management teams with longer average tenures are more likely to develop their managers internally, rather than to hire them from outside, and consequently such managers are less likely to have prior managerial experience at other firms. Similarly, managers who have longer average tenures with their firms are more likely to acquire their managerial skills internally, rather than externally at an educational institution.

[19]For a complete list of research datasets provided by the USPTO please see: https://www.uspto.gov/ip-policy/economic-research/research-datasets.

and company names from each data set and then match datasets using standardized names.[20] After standardization, each IPO firm in our sample is matched with patent data from PatentsView. Patents tend to receive citations over a long period of time, so that the citation counts of more recent patents are significantly downward biased. Following Hall, Jaffe, and Trajtenberg (2001) and Hall, Jaffe, and Trajtenberg (2005), the citation truncation is corrected using the simulated citation-lag distribution by each technology field from Hall, Jaffe, and Trajtenberg (2001). In addition, we include time fixed effects in all of our regressions to control for time-induced truncation for all patents.

The patent data used in this paper is unlikely to be subject to survivorship bias. An eventually granted patent application is counted and attributed to the applying firm at the time when the patent application is submitted, even if the firm is later acquired or goes bankrupt.[21] In addition, patent citations attribute to a patent, but not a firm. Hence, a patent assigned to an acquired or bankrupt firm can continue to receive citations for many years even after it goes out of existence. We construct two measures of innovation output. The first measure, LnCount, is the natural logarithm of annual truncation-adjusted patent count for a firm. Specifically, this variable counts the number of patent applications filed in that year that are eventually granted and measures the quantity of innovation. However, a simple count of patents may not distinguish breakthrough innovations from incremental technological discoveries.[22] Therefore, we construct a second measure which intends to capture the quality of innovation, LnCite, which is the natural logarithm of the number of citations (received by each patent in subsequent years) per patent. Since the distributions of patent counts and citations per patent are highly right-skewed, we use the natural logarithm of patent counts and citations per patent in our analysis. To avoid losing firm-year observations with zero patents or zero citations per patent, we add one to the actual values when taking natural logarithm. We construct these innovation variables for years -1 and -2 prior to a firm's IPO (LnCount-1, LnCount-2, LnCite-1 and LnCite -2) and for years 1 and 2 after IPO (LnCount1, LnCount2, LnCite1, and LnCite2). We also construct these variables for years -1 and -2 combined (LnCount-1&-2 and LnCite-1&-2) and

[20] The name standardization routine comes from the NBER Patent Data Project: https://sites.google.com/site/patentdataproject.

[21] We construct the innovation variables based on the patent application year. As suggested by the innovation literature (e.g., Griliches, Pakes, and Hall (1987)), the application year is more important than the grant year since it is closer to the time of the actual innovation.

[22] Griliches, Pakes, and Hall (1987) show that the distribution of patents' value is extremely skewed, i.e., most of the value is concentrated in a small number of patents.

years 1 and 2 combined (LnCount1&2 and LnCite1&2).

It is important to note that using patenting activity to measure corporate innovation is not without limitations. For example, different industries have various innovation propensity and duration. Young firms in some industries might abstain from patenting for competitive reasons. Therefore, fewer patents generated in an industry might not necessarily be reflective of a less innovative industry. However, we believe that an adequate control for heterogeneity across industries and firms should alleviate this concern and lead to reasonable inferences that can be applicable across industries and firms.

4.6 Measures of Firm Quality and Governance

In order to separate the effects of pre-IPO innovativeness and management quality from those of other aspects of firm quality and internal governance, we control for these other aspects by including the following variables as controls in our regressions. We use two proxies for firm quality: firm size, defined as the natural logarithm of the book value of firm's assets immediately prior to IPO (LnAssets), and firm age, defined as the natural logarithm of one plus the firm's age (LnAge) at IPO.[23] Further, we control for the proportion of outside directors (directors who are not executive officers, founders, former employees, or anyone engaged in business dealings with the firm) in the firm's board of directors (OutDir). Outside directors can enhance firm quality by, first, providing linkages to external parties (underwriters, financial institutions, and auditors), and, second, by providing additional knowledge and expertise (inputs and perspectives) to the firm's management.[24] We also control for insider stock ownership defined as the proportion of voting power held by firm insiders such as executive officers and directors immediately after the IPO (InsideOwn). Next, we control for CEO/Chairman-of-the-board duality by creating a dummy variable equal to one if a firm's CEO is also its Chairman of the board of directors, and zero otherwise (CEO/Chair). Separation of the roles of CEO and the Chairman of the board of directors creates greater accountability and enhances internal governance and top management quality.[25] Finally, we also control for the level of capital expenditures normalized by assets prior to IPO (CapEx/Assets), the level of R&D expenses

[23] These measures of firm quality have been widely used in the literature (Ritter (1984), Michaely and Shaw (1994)).

[24] Several studies in the corporate control literature demonstrated that outside directors enhance firm value (see, e.g., Cotter, Shivdasani, and Zenner (1997) and Borokhovich, Parrino, and Trapani (1996)).

[25] Yermack (1997) shows that firms which separate the roles of a CEO and a Chairman of the board receive higher valuations. Rechner and Dalton (1991) show that such firms outperform those that combine these roles.

normalized by assets prior to IPO (R&D/Assets), and return on assets (net income over assets) prior to IPO (ROA).

4.7 Summary Statistics of Innovation, Management Quality, and Other Control Variables

Table 3 summarizes our measures of innovation, management quality, and other control variables that we use in our regressions. Table 3 shows that in pre-IPO years firms produce more innovation in year -1 and less in year -2 both in terms of the quantity (LnCount) and the quality (LnCite) of patents obtained. Further, both the quantity and the quality of innovation produced in post-IPO year 1 are somewhat greater than those of innovation produced in year 2.

Next, we turn to management quality variables used in this study. Table 3 shows the mean (median) size of a firm's management team (TSize) is 6.81 (6), with the smallest management team consisting of one member and the largest of 20 members. On average, 18.1% of management team members have an MBA degree (PMBA), 7.0% have a CPA certification (PCPA), 61.0% have held a top management position at another firm prior to joining the IPO firm (PPriorExp), 3.0% have been partners in a law or accounting firm (PLawAcc), 57.4% are employed in core functional areas of their firms (PCore). The average compensation (salary plus bonus) of management team members (PComp) is $280,383. The average tenure of management team members (Tenure) ranges from one to 30 years, with a mean (median) of 4.66 (3.63) years. The mean (median) tenure heterogeneity (TenHet) of management teams is 0.67 (0.59). The average number of management team members who sit on other companies' boards is 0.58 (Board).

Finally, we discuss our control variables. The average (median) book value of assets immediately prior to IPO of the firms in our sample is $290 million ($32.6 million) and the average (median) firm age at IPO is 11.97 (7) years. On average, 73.1% of the directors on the boards of the firms in our sample are outsiders (OutDir). The mean (median) percentage of voting power owned by firm officers and directors immediately after IPO (InsideOwn) is 41.7% (43.7%). CEOs act as board chairmen (CEO/Chair) in 50.2% of our sample firms. Finally, in our regressions we also control for capital expenditures, R&D expenses, and net income as a percentage of assets (CapEx/Assets, R&D/Assets, and ROA, respectively) in the year prior to IPO.[26]

[26]We winsorize all accounting variables (i.e., LnAssets, CapEx/Assets, R&D/Assets, and ROA) at the 1% and 99% levels

5 Empirical Tests and Results

5.1 Relationship between Pre-IPO Innovation and ATPs

In this section, we test our long-term value creation and management entrenchment hypotheses, which predict that firms which are more innovative pre-IPO will have either more or less ATPs in their corporate charters at IPO, respectively. To test these hypotheses, we run Poisson regressions of the total number of firm-level ATPs in a firm's corporate charter at IPO (ATP) and the total number of strong ATPs in a firm's corporate charter at IPO (Strong ATP) on pre-IPO innovation variables (LnCount-1, LnCount-2, LnCount-1&-2, LnCite-1, LnCite-2, and LnCite-1&-2), and other controls as described above. We also include 4-digit SIC code industry dummies, year dummies, and state dummies in our regressions to capture industry, year, and state effects, and for efficiency, we cluster the standard errors of our estimates by state in all regressions.

The results of our regressions testing hypotheses H1 and H2 are reported in Panels A and B of Table 4. Panel A of Table 4 shows that all three measures of innovation quantity (LnCount-1, LnCount-2, and LnCount-1&-2) have a significantly positive impact on both the total number of ATPs and the number of strong ATPs in a firm's corporate charter at IPO. Further, Panel B of Table 4 shows a significantly positive relationship between all three measures of innovation quality (LnCite-1, LnCite-2, and LnCite-1&-2,) and the number of strong ATPs in a firm's corporate charter at IPO. We also find that the quality of innovation in years -1 and -2 combined (LnCite-1&-2) has a significantly positive effect on the total number of ATPs in a firm's corporate charter at IPO. These findings indicate that private firms which are more innovative pre-IPO (both in terms of the quantity and the quality of innovation) are more likely to include a greater number of ATPs and are more likely to include a greater number of stronger ATPs in their corporate charters when going public. Thus, our findings in Table 4 provide support for the long-term value creation hypotheses **H1A** and **H2A** and contradict the management entrenchment hypotheses **H1B** and **H2B**.

Next we study the effect of private firms' pre-IPO innovation on the likelihood of including certain individual ATPs in their corporate charters at the time of IPO. The results of our analysis are reported in Table 5: Panel A reports the effect of the quantity of pre-IPO innovation (LnCount-

to reduce potential biases in our analysis caused by outliers. Our results without winsorization are quantitatively similar to those reported in this paper.

1&-2) and Panel B reports the effect of the quality of pre-IPO innovation (LnCite-1&-2) on the prevalence of individual ATPs in a firm's corporate charter at IPO. For the sake of brevity, we report the results on eight firm-level ATPs only (staggered board, poison pill, restrictions on action by written consent, supermajority required to replace directors, supermajority required to approve mergers, supermajority required to amend charter or bylaws, unequal voting rights, and prohibition of cumulative voting). We choose to report our findings on these eight individual ATPs because five of these provisions are considered to be strong takeover deterrents in the literature (and make up our Strong ATP variable) and, to conserve space, we report results on another three individual ATPs because our empirical results are statistically significant for such ATPs. The regression specification we use for individual firm-level ATPs is similar to that of the total number of ATPs discussed above; however, the dependent variables now are dummies that take a value of one if a firm has the individual ATP in its corporate charter and zero otherwise. Since our dependent variables are dummies, we employ probit regressions for these empirical tests.

Panel A of Table 5 shows that the quantity of pre-IPO innovation produced in years -1 and -2 combined prior to IPO (LnCount-1&-2) has a significantly positive effect on the prevalence of staggered boards, poison pills, restrictions on action by written consent, supermajority required to amend charter or by laws, unequal voting rights, and prohibition of cumulative voting. Panel B of Table 5 shows that the quality of pre-IPO innovation produced in years -1 and -2 combined prior to IPO (LnCite-1&-2) has a significantly positive effect on the prevalence of staggered boards, restrictions on action by written consent, supermajority required to amend charter or bylaws, and unequal voting rights, and a negative effect on the supermajority required to approve mergers.[27] Overall, the results in Table 5 indicate that private firms which are more innovative pre-IPO are more likely to include staggered boards, poison pills, restrictions on action by written consent, supermajority required to amend charter or bylaws, unequal voting rights, and prohibition of cumulative voting in their corporate charters at IPO. Further, our findings in Tables 5 indicate that the effect of entrepreneurial firms' pre-IPO innovativeness on the prevalence of strong individual ATPs in their corporate charters at IPO is in general positive. These results provide further support for

[27] The number of observations in our probit regressions in Table 5 drops due to the fact that certain right-hand variables such as industry or state dummies predict some individual ATPs perfectly, in which case the statistical package we use (Stata) drops those dummies from regressions and does not use observations with those dummies. In untabulated results, we have also estimated our regressions in Table 5 without industry, year, and state dummies and our results were similar (and stronger) to those reported here.

our long-term value creation hypothesis **H2A**.

5.2 Relationship between Pre-IPO Innovation, Management Quality, and ATPs

In this section, we investigate the effect of management quality on the relationship between pre-IPO innovativeness and ATPs in the corporate charters of IPO firms, i.e., test hypotheses H3 and H4. Under the long-term value creation hypothesis, higher quality managers, who are likely to invest in long-term (innovative) projects, will include more and stronger ATPs in the corporate charters of their firms. First, we study the effect of management quality on the prevalence of ATPs in the corporate charters of IPO firms by regressing the total number of ATPs or the number of strong ATPs (using Poisson regressions) and individual ATP dummies (using probit regressions) on our management quality proxy (MQFactor), average tenure of management team members (Tenure), tenure heterogeneity (TenHet), and other controls as described above.

The results of our regressions are presented in Table 6. We find that MQFactor has a significantly positive effect on the total number of ATPs, on the number of strong ATPs, as well as on such individual provisions as staggered boards, restrictions on action by written consent, supermajority required to replace directors, supermajority required to amend charter or bylaws, and prohibition of cumulative voting.[28] This indicates that firms with higher management quality are likely to include more ATPs in their corporate charters at IPO and more likely to adopt stronger ATPs even after controlling for firm size, age, internal governance mechanisms, and industry, year, and state effects. This finding provides support for our long-term value creation hypothesis.

Next, we examine the joint effect of a firm's pre-IPO innovativeness and management quality on ATPs in its corporate charter at IPO. We study this joint effect by dividing our sample firms into four quadrants based on their pre-IPO innovativeness and management quality. First, we split our sample into two groups of firms with high and low pre-IPO innovation productivity: firms with non-zero number of patents (or citations per patent) in years -1 and -2 combined prior to IPO and firms with zero patents (or citations per patent), and then we split each of these two groups further into two equal sub-groups of high and low management quality firms (firms with above and below the median MQFactor within each group of high and low pre-IPO innovation productivity firms).

[28] In untabulated results, we also find that management quality (MQFactor) has a significantly positive effect on the prevalence of supermajority required to replace directors.

Thus, the four quadrants are: high pre-IPO innovation and high management quality (quadrant 1), low pre-IPO innovation and high management quality (quadrant 2), high pre-IPO innovation and low management quality (quadrant 3), and low pre-IPO innovation and low management quality (quadrant 4). Our long-term value creation hypothesis predicts that firms in quadrant 1 will have more and stronger ATPs in their corporate charters at IPO relative to the firms in the other three quadrants; our management entrenchment hypothesis predicts the opposite.

We conduct our analysis by regressing the total number of ATPs or the number of strong ATPs (using Poisson regressions) and individual ATP dummies (using probit regressions) on a dummy variable for quadrant 1 (which takes a value of 1 for firms with high management quality within the group of firms with non-zero number of patents or citations per patent pre-IPO, and 0 for the remaining firms in our sample). We also include the average tenure of management team members (Tenure), tenure heterogeneity (TenHet), and other controls as described above in these regressions. We expect a positive coefficient for the dummy variable for quadrant 1 if the joint effect of pre-IPO innovation and management quality on ATPs is positive.

The results of our regressions are reported in Panels A and B of Table 7. In Panel A of Table 7 we construct a dummy variable for quadrant 1 using the quantity of innovation in years -1 and -2 combined before IPO (Q1CountMQF) and in Panel B of Table 7 we construct a dummy variable for quadrant 1 using the quality of pre-IPO innovation over the same period (Q1CiteMQF). We find that both Q1CountMQF (in Panel A) and Q1CiteMQF (in Panel B) have a significantly positive effect on the total number of ATPs, the number of strong ATPs, as well as on the prevalence of staggered board, poison pill, restrictions on action by written consent, supermajority required to replace directors, supermajority required to amend charter or bylaws. These findings indicate that the joint effect of pre-IPO innovation and management quality on ATPs in a firm's corporate charter at IPO is significantly positive: firms with higher management quality combined with greater pre-IPO innovativeness tend to have more and stronger ATPs in their corporate charters when they go public compared to the other firms in our sample. These findings provide support for the long-term value creation hypotheses **H3A** and **H4A** and contradict the management entrenchment hypotheses **H3B** and **H4B**.

5.3 Relationship between Pre-IPO Innovation, ATPs, and IPO Firm Valuation

In this section we study the effect of pre-IPO innovation and the number of strong ATPs in a firm's corporate charter at IPO on the firm's valuation in both the IPO market and the immediate post-IPO secondary market. We measure IPO firm valuation using Tobin's Q, which is the ratio of the market value of assets over the book value of assets, where the market value of assets is equal to the book value of assets minus the book value of equity plus the product of the number of shares outstanding and share price. We measure firm valuation in the IPO market by using the IPO offer price as the share price in the above definition (QOP). We measure IPO firm valuation in the secondary market by using either the first trading day closing price as the share price in the above definition (QFTD) or the share price at the end of the IPO issue month (QIM). The book value of assets and the book value of equity are taken from the first available post-IPO quarter on Compustat. In constructing QOP and QFTD, the number of shares outstanding is as of the end of the first trading day; in constructing QIM, the number of shares outstanding is as of the end of the first available post-IPO fiscal quarter on Compustat.

In order to study the joint effect of pre-IPO innovativeness and the number of strong ATPs in a firm's corporate charter at IPO on IPO firm valuation, we divide our sample into four quadrants: firms with non-zero versus zero pre-IPO innovation (measured either by the quantity or the quality of pre-IPO innovation) and firms with a greater number versus smaller number of strong ATPs. We create two dummy variables for the firms falling into the first quadrant with non-zero pre-IPO innovation and a greater number of strong ATPs: dummy variable Q1StATPCount takes a value of one for firms with more than 1 (median value) strong ATP and non-zero (positive) number of patents filed for and eventually granted in years -1 and -2 combined before IPO (LnCount-1&-2), and dummy variable Q1StATPCite takes a value of one for firms with more than 1 (median value) strong ATP and non-zero (positive) number of citations per patent filed for and eventually granted in years -1 and -2 combined before IPO (LnCite-1&-2). We then regress IPO firm valuation proxies on these dummy variables (either Q1StATPCount or Q1StATPCite) and other control variables.[29]

We expect positive coefficients for Q1StATPCount and Q1StATPCite if the joint effect of pre-IPO

[29] In untabulated results, we have also conducted this analysis using the total number of ATPs instead of strong ATPs. However, we found that the joint effect of pre-IPO innovativeness and the total number of ATPs on IPO firm valuations was insignificant.

innovation and anti-takeover protection on IPO firm valuation is positive. Regressions 1 through 3 in Table 8 present the results of our estimation using Q1StATPCount as the main independent variable and regressions 4 through 6 present our results using Q1StATPCite as the main independent variable. Q1StATPCount has positive and significant coefficient estimates in regressions using QFTD and QIM as dependent variables; Q1StATPCite have positive and significant coefficient estimates in all regressions. These results indicate that pre-IPO innovativeness and the number of strong ATPs in a firm's corporate charter together have a significantly positive joint effect on IPO firm valuation in the immediate secondary market (QFTD or QIM), as well as in the IPO (QOP) market if pre-IPO innovativeness is measured by the quality of innovation. Thus, firms with both greater pre-IPO innovativeness and greater number of strong ATPs tend to receive the highest valuations in the IPO and immediate secondary market compared to the other firms in our sample. This finding provides support for the long-term value creation hypothesis **H5A** and contradicts the management entrenchment hypothesis **H5B**.

5.4 Identification: Using Exogenous Variation in Examiners' Approval Rates as an Instrumental Variable

It may be argued that our baseline results may suffer from omitted variable bias. For example, higher-quality firms may be more likely to have both greater pre-IPO innovation productivity and a larger number of ATPs (and stronger ATPs) in their corporate charters at IPO. To identify the causal effect of pre-IPO innovativeness of private firms on ATPs in their corporate charters at IPO, we make use of the quasi-random assignment of patent applications to examiners with different approval rates that are exogenous to application quality and use patent examiners' leniency as an instrumental variable for firms' pre-IPO innovativeness.

5.4.1 The Patent Examination Process

The patent examination process starts with the filing of a patent application to the USPTO, which forwards the newly filed application to a relevant art unit for examination.[30] A patent application is assigned to an examiner within each art unit based on its filing date: an application with the earliest

[30]There are nine patent examination group centers each consisting of several art units examining patents in the relevant field.

filing date is assigned to the first available examiner. Patent examiners are specialized technology experts with relevant training and experience in various science and engineering backgrounds related to different types of inventions, who vary in their propensity to approve applications: some are stricter than others (see, e.g., Maestas, Mullen, and Strand (2013), Farre-Mensa, Hegde, and Ljungqvist (2019), and Sampat and Williams (2019)). We make use of this quasi-random assignment of applications to examiners with different levels of leniency (approval rates) within each art unit to identify the causal effect of the pre-IPO innovativeness of private firms on the number and strength of ATPs in their corporate charters.

5.4.2 Measuring Patent Examiner Leniency

We first measure the application-level examiner leniency for any newly filed application by computing the approval rate of that examiner among all patent applications he/she has examined prior to that application. Specifically, we follow Farre-Mensa, Hegde, and Ljungqvist (2019) to calculate the approval rate of examiner j in art unit a who reviews patent application i filed at date t as follows:

$$ExaminerApprovalRate_{i,j,t,a} = \frac{\#Granted_{j,t,a}}{\#Reviewed_{j,t,a}},$$

where $\#Reviewed_{j,t,a}$ and $\#Granted_{j,t,a}$ are the numbers of patents examiner j has reviewed and granted prior to date t, respectively.[31]

We then measure the firm-level examiner leniency by averaging approval rates of all examiners who have examined all patent applications of a given firm in years -1 and -2 prior to that firm's IPO. For example, the firm-level examiner leniency for firm k in year -1 prior to firm k's IPO is calculated as follows:

$$ExaminerLeniency_{k,y-1} = \frac{1}{N}\sum_{i=1}^{N} ExaminerApprovalRate_{i,j,k,y-1},$$

where $ExaminerApprovalRate_{i,j,k,y-1}$ is the approval rate of examiner j who reviews patent application i filed by firm k in year $y-1$, and N is the total number of patent applications filed by firm k in year $y-1$ that were eventually granted.

[31] Following Farre-Mensa, Hegde, and Ljungqvist (2019), we also exclude the patent application i in both the numerator and the denominator since it has not been reviewed prior to date t and exclude firms whose first patent application is assigned to an examiner with fewer than 10 prior reviews. All results in our IV analyses are robust to using alternative cutoffs.

We use the firm-level examiner leniency as an instrument for our innovation output variables described in subsection 4.5 (i.e., LnCount-1, LnCount-2, LnCount-1&-2, LnCite-1, LnCite-2, and LnCite-1&-2). We expect that the firm-level examiner leniency will strongly predict the number of patents and the number of citations per patent that each firm is likely to have (see, e.g., Farre-Mensa, Hegde, and Ljungqvist (2019), and Sampat and Williams (2019)). Further, our instrumental variable should satisfy the exclusion restriction (the requirement for our instrumental variable not to be correlated with the dependent variables in our regressions) since applications are assigned to each examiner randomly regardless of their quality.

5.4.3 Identification Results

We first present our instrumental variable analysis on the effect of pre-IPO innovation on the number of ATPs (and the number of strong ATPs) in Table 9 and on the likelihood of including individual ATPs in Table 10. In our first-stage regressions, we regress our pre-IPO innovation measures (either LnCount-1, LnCount-2, LnCount-1&-2, LnCite-1, LnCite-2, or LnCite-1&-2) on an instrumental variable constructed over the same period (as described in the previous subsection) with the same set of control variables and fixed effects as described in subsection 5.1. Consistent with the previous literature, both Tables 9 and 10 show that our instrumental variables are positively and significantly correlated with our pre-IPO innovation measures.[32] Our second-stage regressions in both Tables 9 and 10 show that the coefficient estimates of predicted values of our pre-IPO innovation measures from all first-stage regressions have similar magnitudes and statistical significance as those from our baseline regressions reported in Tables 4 and 5. These results suggest that, private firms' pre-IPO innovativeness has a positive effect on the likelihood of including a greater number of ATPs and a greater number of stronger ATPs in their corporate charters at IPO, as well as a positive effect on the likelihood of including such ATPs as staggered board, restrictions on action by written consent, supermajority required to amend charter or bylaws, unequal voting rights, and prohibition of cumulative voting. These findings from our IV analysis provide further support for our long-term value

[32]We also report the F-statistics of the weak instruments test (or the test of excluded instruments) for each first-stage regression in Tables 9 and 10. This test is used to determine whether instrumental variables used in first-stage regressions are strong. In their survey of the literature on weak instruments, Stock, Wright, and Yogo (2002) develop benchmarks for the necessary magnitude of the F-statistic. They indicate that if the number of instruments is equal to one, then the critical value of the F-statistic is 8.96. Given that the F-statistics reported for the first-stage regressions in Tables 9 and 10 are all well above the critical value of 8.96, the null hypothesis that our instruments are weak is strongly rejected.

creation hypotheses **H1A** and **H2A**.

Next, we present our instrumental variable analysis on the joint effect of pre-IPO innovation and management quality on ATPs in Table 11. In our first-stage regressions, we regress the dummy variables for quadrant 1 as described in subsection 5.2 (which take a value of 1 for firms with high management quality within the group of firms with either non-zero number of patents [Q1CountMQF in Panel A of Table 11] or non-zero number of citations per patent [Q1CiteMQF in Panel B of Table 11] pre-IPO, and 0 for the remaining firms in our sample) on our instrumental variable constructed using data from years -1 and -2 combined prior to IPO as described in subsection 5.4.2. We also include the same set of control variables and fixed effects as described in subsection 5.1. Table 11 shows that our instrumental variables are positively and significantly correlated with the dummy variables for quadrant 1 (Q1CountMQF and Q1CiteMQF) and the F-statistics of the weak instruments test are well above 8.96. Our second-stage regressions in Table 11 show that the coefficient estimates of predicted values of quadrant 1 dummies from all first-stage regressions (Q1CountMQFHat and Q1CiteMQFHat) have similar magnitudes and statistical significance as those from our baseline regressions reported in Table 7. These results suggest that the joint effect of pre-IPO innovation and management quality on ATPs in a firm's corporate charter at IPO is causal and provide further support for our long-term value creation hypotheses **H3A** and **H4A**.

Lastly, we present our instrumental variable analysis on the joint effect of pre-IPO innovation and strong ATPs on IPO firm valuation in Table 12. In our first-stage regressions, we regress dummy variables for firms in quadrant 1 with non-zero pre-IPO innovation output and the above median number of strong ATPs (Q1StATPCount and Q1StATPCite as described in subsection 5.3) on our instrumental variable constructed using data from years -1 and -2 combined prior to IPO as described in subsection 5.4.2. We also include the same set of control variables and fixed effects as described in subsection 5.1. Table 12 shows that our instrumental variables are significantly positively correlated with Q1StATPCount and Q1StATPCite and the F-statistics of the weak instruments test are well above 8.96. Our second-stage regressions in Table 12 show that the coefficient estimates of predicted values of Q1StATPCount and Q1StATPCite from all first-stage regressions have similar magnitudes and statistical significance as those from our baseline regressions reported in Table 8. These results suggest that the positive effect of greater pre-IPO innovativeness and greater number of strong ATPs on firm's immediate post-IPO secondary market valuation is causal. These

identification results provide further support for our long-term value creation hypothesis **H5A**.

5.5 Relationship between ATPs and Post-IPO Innovation

In this subsection we study the effect of ATPs in IPO firms' corporate charters at the time of going public on post-IPO innovation productivity. Our long-term value creation hypothesis predicts that firms with a greater number of (stronger) ATPs in their corporate charters will produce more innovation in the years after going public. Our management entrenchment hypothesis predicts the opposite.

We study the relationship between ATPs and post-IPO innovation by regressing the quantity and quality of a firm's post-IPO innovation output on the total number of ATPs or the number of strong ATPs in its corporate charter at IPO, pre-IPO innovativeness (measured by LnCount-1&-2 or LnCite-1&-2 depending on whether our dependent variables measure the quantity or the quality of post-IPO innovation, respectively), and other controls. In particular our dependent variables in these regressions are the numbers of patents produced in years 1 and 2 after IPO (LnCount1 and LnCount2, respectively), the total number of patents produced in years 1 and 2 combined after IPO (LnCount1&2), the numbers of citations per patent produced in years 1 and 2 after IPO (LnCite1 and LnCite2, respectively), and the number of citations per patent produced in years 1 and 2 combined after IPO (LnCite1&2).

We control for a firm's pre-IPO innovativeness in our regressions in order to be able to determine the marginal effect of a firm's anti-takeover protection at IPO on its post-IPO innovation output given the general innovation productivity of the firm. We have demonstrated in subsection 5.1 that firms which are more innovative in pre-IPO years are likely to include more (stronger) ATPs in their corporate charters at the time of IPO; and we expect such firms to be more innovative in post-IPO years as well. We control for a firm's pre-IPO innovativeness in our regressions to make sure that the number of (strong) ATPs in a firm's corporate charter at IPO does not merely pick up the effect of pre-IPO innovation productivity but rather has a significant impact on post-IPO innovation productivity on its own.

The results of our regressions are reported in Table 13. We find that the total number of ATPs in a firm's corporate charter does not significantly affect post-IPO innovation; the coefficient estimates of the total number of ATPs are not statistically significant in regressions 1 through 6. However,

Table 13 also shows that the number of strong ATPs in a firm's corporate charter has a significantly positive effect on the quantity of innovation produced in both years 1 and 2 after IPO as well as on the quantity of innovation produced in years 1 and 2 combined after IPO.[33] These findings provide support for the long-term value creation hypothesis **H6A** and contradict the management entrenchment hypothesis **H6B**.

6 Conclusion

We make use of hand-collected data from IPO prospectuses on the ATPs in the corporate charters of a large sample of venture-backed private firms, as well as hand-collected data on measures of the quality of their top management teams ("management quality") to analyze the effect of pre-IPO innovativeness and the top management quality of these firms on the number and strength of ATPs included in their corporate charters at IPO. We test two opposing hypotheses: the "long-term value creation" hypothesis, which predicts that more innovative private firms and those with higher top management quality will include a larger number of (and stronger) ATPs in their corporate charters; and the "management entrenchment" hypothesis, which makes the opposite prediction.

Our results are summarized as follows. First, firms that are more innovative pre-IPO (as measured by either the quantity or the quality of innovation) are likely to have a larger number of ATPs and stronger ATPs in their corporate charters at IPO. Second, the number and strength of ATPs in a firm's corporate charter is also increasing in the quality of its top management team. Third, the joint effect of pre-IPO innovativeness and top management quality on the number and strength of ATPs in a firm's corporate charter at IPO is also positive. In other words, when we divide our sample into four quadrants: high versus low pre-IPO innovativeness and high versus low top management quality, we find that firms belonging to the first quadrant (high pre-IPO innovativeness and high top management quality) have the largest number of (and stronger) ATPs in their corporate charters compared to the average for firms in the other three quadrants. We also find that the above relationships hold for several of the individual (and strongest) firm-level ATPs that we study in this paper. In particular, we find that pre-IPO innovativeness and top management quality are positively and significantly related to the prevalence of staggered boards, poison pills, and supermajority required

[33] In untabulated results, we have also conducted this analysis using the total number of ATPs instead of strong ATPs. However, we found that the effect of the total number of ATPs on post-IPO innovation was insignificant.

to amend charters or by laws, which are likely to greatly reduce takeover probability. Fourth, we use an instrumental variable analysis by exploiting the quasi-random assignment of patent applications to examiners with different grant rates to show that the above results are causal. Finally, the IPO market rewards firms with a combination of greater pre-IPO innovation productivity and stronger ATPs with higher IPO valuations than the average for all other firms in our sample. Overall, our findings support the notion that, rather than purely entrenching firm management, ATPs play a positive role by providing them insulation from takeovers and thereby enabling them to undertake more innovative long-term projects and bring them to fruition.

Overall, the findings of our empirical analysis suggest that more innovative private firms choose to have a larger number of (and stronger) ATPs in their corporate charters so as to provide some insulation for top management from the effects of takeovers, motivating them to undertake innovative long-term projects without interference from the market for corporate control. Consistent with the long-term value creation hypothesis, this relationship is stronger in firms with higher management quality. The results from the second part of our analysis also suggest that, consistent with their motivation for including a larger number (and stronger) of ATPs in their corporate charters, namely, to lengthen corporate investment horizons once their firm is public, firms that include a larger number of strong ATPs in their corporate charters are able to achieve significantly higher innovation productivity (at least in terms of the number of patents produced) in the years immediately post-IPO, even after controlling for their pre-IPO innovation productivity.

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Table 1: **Summary statistics of firm-level ATPs**

The sample consists of 2,692 VC-backed IPOs conducted between 1993 and 2015. Each provision is described in detail in Appendix A. Strong ATPs are staggered boards, poison pills, supermajority required to approve mergers, supermajority required to amend charter and bylaws, and unequal voting rights.

	N	Min.	Mean	Median	Max.	S.D.
1. Anti-greenmail provision	2,692	0	0.001	0	1	0.039
2. Blank check preferred stock	2,692	0	0.980	1	1	0.140
3. Staggered boards	2,692	0	0.659	1	1	0.474
4. Fair price provision	2,692	0	0.019	0	1	0.138
5. Poison pills	2,692	0	0.033	0	1	0.180
6. Stakeholder clause	2,692	0	0.023	0	1	0.149
Shareholder meeting restrictions						
7. Meetings called only by directors or executives	2,692	0	0.721	1	1	0.449
8. Supermajority required to call special meetings	2,692	0	0.009	0	1	0.096
9. Advanced notice requirement	2,692	0	0.675	1	1	0.469
10. Restrictions on action by written consent	2,692	0	0.692	1	1	0.462
Supermajority vote requirements						
11. Supermajority required to approve mergers	2,692	0	0.065	0	1	0.247
12. Supermajority required to replace directors	2,692	0	0.254	0	1	0.436
13. Supermajority required to amend charter or bylaws	2,692	0	0.495	0	1	0.500
14. Unequal voting rights	2,692	0	0.071	0	1	0.257
Miscellaneous ATPs						
15. Directors can be removed only for cause	2,692	0	0.422	0	1	0.494
16. Merger must be approved by inside directors	2,692	0	0.017	0	1	0.131
17. Restrictions on transfer of common stock	2,692	0	0.043	0	1	0.202
18. Restrictions on votes each shareholder may cast	2,692	0	0.004	0	1	0.061
19. Prohibition of cumulative voting for election of directors	2,692	0	0.779	1	1	0.415
Total number of ATPs	2,692	0	5.964	6	13	2.628
Number of strong ATPs	2,692	0	1.324	1	5	0.957

Table 2: **Selected statistics related to a common factor analysis of eight measures of management quality and reputation**

The sample consists of 2,692 VC-backed IPOs conducted between 1993 and 2015. MQFactor is the management quality factor score obtained using common factor analysis on the firm-size-, firm-age-, and industry-dummies-adjusted TSize, MBA, PriorExp, LawAcc, CPA, Core, Comp, and Board. TSize is the size of a firm's management team, defined as the number of executive officers with a rank of vice president or higher. MBA is the number of management team members with MBA degrees. PriorExp is the number of management team members who have served as executive officers and/or vice presidents at other firms prior to joining the IPO firm. Core is the number of management team members who have core functional expertise, namely, holding positions in operations and production, sales and marketing, research and development, and finance. LawAcc is the number of management team members who have previously been partners in law or accounting firms. CPA is the number of management team members who are Certified Public Accountants. Comp is the natural logarithm of the total compensation (salary plus bonus) of management team members in the fiscal year preceding the IPO. Board is the number of other companies' boards that management team members sit on.

Panel A. Estimated communalities of eight management quality measures

Common factor	TSize	MBA	PriorExp	Core	LawAcc	CPA	Comp	Board	Total
MQFactor	0.5113	0.1026	0.0347	0.2386	0.2076	0.0214	0.0356	0.0100	1.1617

Panel B. Eigenvalues of the reduced correlation matrices

Common factor	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8
MQFactor	1.8263	0.3102	0.1282	0.0479	-0.0590	-0.1066	-0.1556	-0.2227

Panel C. Correlations between the common factor and eight management quality measures

Common factor	TSize	MBA	PriorExp	Core	LawAcc	CPA	Comp	Board
MQFactor	0.9457	0.4446	0.1788	0.7701	0.7427	0.1096	0.2264	0.0614

Panel D. Descriptive statistics of the common factor extracted from eight management quality measures

Common factor	Maximum	Third quartile	Median	First quartile	Minimum	Mean
MQFactor	4.5134	0.4873	-0.0987	-0.6200	-2.1607	0.0000

Table 3: **Summary statistics of innovation, management quality, and other control variables**

The sample consists of 2,692 VC-backed IPOs conducted between 1993 and 2015. LnCount-1 and LnCount-2 are the natural logarithms of one plus the number of patents a firm files for and is eventually granted in years -1 and -2 prior to IPO, respectively. LnCount-1&-2 is the natural logarithm of one plus the number of patents a firm files for and is eventually granted in years -1 and -2 combined prior to IPO. LnCite -1 and LnCite -2 are the natural logarithms of one plus the number of citations per patent a firm files for and is eventually granted in years -1 and -2 prior to IPO, respectively. LnCite-1&-2 is the natural logarithm of one plus the number of citations per patent a firm files for and is eventually granted in years -1 and -2 combined prior to IPO. LnCount1 and LnCount2 are the natural logarithms of one plus the number of patents a firm files for and is eventually granted in years 1 and 2 after IPO, respectively. LnCount1&2 is the natural logarithm of one plus the number of patents a firm files for and is eventually granted in years 1 and 2 combined after IPO. LnCite1 and LnCite2 are the natural logarithms of one plus the number of citations per patent a firm files for and is eventually granted in years 1 and 2 after IPO, respectively. LnCite1&2 is the natural logarithm of one plus the number of citations per patent a firm files for and is eventually granted in years 1 and 2 combined after IPO. MQFactor is the management quality factor score obtained using common factor analysis on the firm-size-, firm-age-, and industry-dummies-adjusted TSize, MBA, PriorExp, LawAcc, CPA, Core, Comp, and Board. TSize is the size of a firm's management team, defined as the number of executive officers with a rank of vice president or higher. PMBA is the percentage of a firm's management team with MBA degrees. PPriorExp is the percentage of a firm's management team who have served as executive officers and/or vice presidents prior to joining the IPO firm. PCore is the percentage of a firm's management team who have core functional expertise, namely, holding positions in operations and production, sales and marketing, research and development, and finance. PLawAcc is the percentage of a firm's management team who have previously been partners in law or accounting firms. PCPA is the percentage of a firm's management team who are Certified Public Accountants. PComp is the natural logarithm of the average compensation (salary plus bonus) of management team members in the fiscal year preceding the IPO. Board is the number of other companies' boards that management team members sit on. Tenure is the average number of years a firm's management team members have been with the firm. TenHet is the coefficient of variation of management team members' tenures. LnAssets is the natural logarithm of the book value of assets immediately prior to IPO. LnAge is the natural logarithm of one plus firm age. OutDir is the proportion of outside directors in the board of directors. InsideOwn is the proportion of voting power owned by firm officers and directors immediately after IPO. CEO/Chair is a dummy equal to 1 if a CEO is also a Chairman of the board of directors. CapEx/Assets is the ratio of capital expenditures to assets in the fiscal year prior to IPO. R&D/Assets is the ratio of R&D expenses to assets in the fiscal year prior to IPO. ROA is the ratio of net income to assets in the fiscal year prior to IPO. All four accounting variables (i.e., LnAssets, CapEx/Assets, R&D/Assets, and ROA) are winsorized at the 1% and 99% levels.

	N	Min.	Mean	Median	Max.	S.D.
Innovation variables						
LnCount-1	2,692	0	0.447	0	6.242	0.807
LnCount-2	2,692	0	0.362	0	5.989	0.714
LnCount-1&-2	2,692	0	0.610	0	6.816	0.974
LnCite-1	2,692	0	1.038	0	7.162	1.768
LnCite-2	2,692	0	0.917	0	7.377	1.726
LnCite-1&-2	2,692	0	1.412	0	7.877	2.084
LnCount1	2,692	0	0.511	0	5.903	0.900
LnCount2	2,692	0	0.483	0	5.999	0.906
LnCount1&2	2,692	0	0.713	0	6.612	1.130
LnCite1	2,692	0	0.967	0	6.466	1.641
LnCite2	2,692	0	0.883	0	6.929	1.597
LnCite1&2	2,692	0	1.299	0	7.366	1.935
Management quality variables						
MQFactor	2,692	-2.161	0	-0.099	4.513	0.884
TSize	2,692	1	6.813	6	20	2.557
PMBA	2,692	0	0.181	0.143	1	0.196
PPriorExp	2,692	0	0.610	0.625	1	0.268
PCore	2,692	0	0.575	0.600	1	0.197
PLawAcc	2,692	0	0.030	0	1	0.080
PCPA	2,692	0	0.070	0	1	0.106
PComp	2,692	9.433	12.336	12.272	15.660	0.587
Board	2,692	0	0.584	0	10	1.135
Tenure	2,692	1	4.660	3.625	30	3.458
TenHet	2,692	0	0.668	0.587	16.408	0.722

Control variables						
LnAssets	2,692	13.964	17.628	17.298	22.321	1.649
LnAge	2,692	0	2.173	2.079	5.094	0.804
OutDir	2,692	0	0.731	0.750	1	0.166
InsideOwn	2,692	0	0.417	0.437	1	0.216
CEO/Chair	2,692	0	0.502	1	1	0.500
CapEx/Assets	2,665	0	0.081	0.051	0.514	0.094
R&D/Assets	2,671	0	0.257	0.137	2.232	0.381
ROA	2,647	-4.387	-0.369	-0.101	0.401	0.735

Table 4: **Relationship between pre-IPO innovation and ATPs in IPO firms' corporate charters**

The sample consists of 2,692 VC-backed IPOs conducted between 1993 and 2015. Dependent variable ATP is the total number of firm-level ATPs in a firm's corporate charter (1 through 19 in Appendix A) at IPO. Strong ATP is the number of five strong ATPs in a firm's corporate charter at IPO: staggered boards, poison pills, supermajority required to approve mergers, supermajority required to amend charter or bylaws, and unequal voting rights. Descriptions of individual ATPs are in Appendix A. LnCount-1 and LnCount-2 are the natural logarithms of one plus the number of patents a firm files for and is eventually granted in years -1 and -2 prior to IPO, respectively. LnCount-1&-2 is the natural logarithm of one plus the number of patents a firm files for and is eventually granted in years -1 and -2 combined prior to IPO. LnCite -1 and LnCite -2 are the natural logarithms of one plus the number of citations per patent a firm files for and is eventually granted in years -1 and -2 prior to IPO, respectively. LnCite-1&-2 is the natural logarithm of one plus the number of citations per patent a firm files for and is eventually granted in years -1 and -2 combined prior to IPO. LnAssets is the natural logarithm of the book value of assets immediately prior to IPO. LnAge is the natural logarithm of one plus firm age. OutDir is the proportion of outside directors in the board of directors. InsideOwn is the proportion of voting power owned by firm officers and directors immediately after IPO. CEO/Chair is a dummy equal to 1 if a CEO is also a Chairman of the board of directors. CapEx/Assets is the ratio of capital expenditures to assets in the fiscal year prior to IPO. R&D/Assets is the ratio of R&D expenses to assets in the fiscal year prior to IPO. ROA is the ratio of net income to assets in the fiscal year prior to IPO. All regressions include 4-digit SIC industry code dummies, year dummies, and state dummies. All regressions are Poisson regressions with standard errors clustered at state level. All four accounting variables (i.e., LnAssets, CapEx/Assets, R&D/Assets, and ROA) are winsorized at the 1% and 99% levels. z-statistics are in parentheses. ***, ** and * indicate significance at the 1%, 5%, and 10% level, respectively.

Panel A: Relationship between the quantity of pre-IPO innovation and ATPs in IPO firms' corporate charters

Dependent Variable	ATP	Strong ATP	ATP	Strong ATP	ATP	Strong ATP
	(1)	(2)	(3)	(4)	(5)	(6)
LnCount-1	0.023***	0.052***				
	(4.98)	(5.90)				
LnCount-2			0.028***	0.057***		
			(3.39)	(4.64)		
LnCount-1&-2					0.023***	0.047***
					(4.68)	(6.20)
LnAssets	0.016**	0.043***	0.016**	0.044***	0.016**	0.044***
	(2.39)	(4.18)	(2.44)	(4.32)	(2.39)	(4.20)
LnAge	0.008	0.022	0.007	0.020	0.008	0.022
	(0.76)	(1.18)	(0.64)	(1.04)	(0.73)	(1.15)
OutDir	0.119**	0.153	0.118**	0.152	0.118**	0.152
	(2.15)	(1.32)	(2.18)	(1.34)	(2.15)	(1.32)
InsideOwn	-0.006	-0.011	-0.005	-0.009	-0.005	-0.011
	(-0.19)	(-0.26)	(-0.17)	(-0.21)	(-0.18)	(-0.24)
CEO/Chair	0.031***	0.039**	0.031***	0.040**	0.031***	0.039**
	(2.80)	(1.97)	(2.81)	(2.05)	(2.80)	(1.99)
CapEx/Assets	0.171*	0.335**	0.176**	0.348**	0.170*	0.337**
	(1.94)	(2.23)	(1.97)	(2.29)	(1.92)	(2.23)
R&D/Assets	-0.007	-0.070	-0.006	-0.065	-0.010	-0.073
	(-0.27)	(-1.12)	(-0.23)	(-1.06)	(-0.35)	(-1.18)
ROA	0.009	-0.013	0.010	-0.010	0.009	-0.013
	(0.73)	(-0.52)	(0.81)	(-0.40)	(0.69)	(-0.51)
Constant	1.309***	-0.613**	1.290***	-0.657***	1.295***	-0.647***
	(11.49)	(-2.51)	(11.43)	(-2.69)	(11.52)	(-2.68)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2618	2618	2618	2618	2618	2618

Panel B: Relationship between the quality of pre-IPO innovation and ATPs in IPO firms' corporate charters

Dependent Variable	ATP	Strong ATP	ATP	Strong ATP	ATP	Strong ATP
	(1)	(2)	(3)	(4)	(5)	(6)
LnCite-1	0.005	0.024***				
	(1.31)	(3.44)				
LnCite-2			0.005	0.017**		
			(1.33)	(2.06)		
LnCite-1&-2					0.006*	0.019**
					(1.70)	(2.28)
LnAssets	0.017***	0.046***	0.017***	0.046***	0.017***	0.046***
	(2.71)	(4.65)	(2.71)	(4.78)	(2.71)	(4.73)
LnAge	0.008	0.023	0.008	0.022	0.008	0.023
	(0.77)	(1.27)	(0.73)	(1.17)	(0.79)	(1.27)
OutDir	0.118**	0.150	0.119**	0.154	0.118**	0.152
	(2.15)	(1.29)	(2.17)	(1.34)	(2.15)	(1.30)
InsideOwn	-0.004	-0.005	-0.004	-0.005	-0.003	-0.005
	(-0.13)	(-0.11)	(-0.12)	(-0.12)	(-0.11)	(-0.10)
CEO/Chair	0.032***	0.041**	0.032***	0.043**	0.032***	0.041**
	(2.86)	(2.06)	(2.84)	(2.18)	(2.84)	(2.08)
CapEx/Assets	0.185**	0.356**	0.187**	0.371**	0.185**	0.362**
	(2.09)	(2.38)	(2.15)	(2.50)	(2.09)	(2.42)
R&D/Assets	-0.001	-0.062	-0.002	-0.061	-0.003	-0.064
	(-0.03)	(-1.04)	(-0.08)	(-1.03)	(-0.11)	(-1.10)
ROA	0.012	-0.008	0.012	-0.007	0.012	-0.007
	(0.95)	(-0.30)	(0.97)	(-0.27)	(0.93)	(-0.29)
Constant	1.300***	-0.649**	1.299***	-0.650**	1.295***	-0.664**
	(10.92)	(-2.48)	(11.01)	(-2.48)	(10.95)	(-2.51)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2618	2618	2618	2618	2618	2618

Table 5: **Relationship between pre-IPO innovation and firm-level individual ATPs in IPO firms' corporate charters**

The sample consists of 2,692 VC-backed IPOs conducted between 1993 and 2015. Dependent variables are dummy variables taking a value of one if a firm has a particular individual firm-level ATP in its corporate charter at the time of IPO, and zero otherwise. Descriptions of individual ATPs are in Appendix A. LnCount-1&-2 is the natural logarithm of one plus the number of patents a firm files for and is eventually granted in years -1 and -2 combined prior to IPO. LnCite-1&-2 is the natural logarithm of one plus the number of citations per patent a firm files for and is eventually granted in years -1 and -2 combined prior to IPO. LnAssets is the natural logarithm of the book value of assets immediately prior to IPO. LnAge is the natural logarithm of one plus firm age. OutDir is the proportion of outside directors in the board of directors. InsideOwn is the proportion of voting power owned by firm officers and directors immediately after IPO. CEO/Chair is a dummy equal to 1 if a CEO is also a Chairman of the board of directors. CapEx/Assets is the ratio of capital expenditures to assets in the fiscal year prior to IPO. R&D/Assets is the ratio of R&D expenses to assets in the fiscal year prior to IPO. ROA is the ratio of net income to assets in the fiscal year prior to IPO. All regressions include 4-digit SIC industry code dummies, year dummies, and state dummies. All regressions are probit regressions with standard errors clustered at state level. All four accounting variables (i.e., LnAssets, CapEx/Assets, R&D/Assets, and ROA) are winsorized at the 1% and 99% levels. z-statistics are in parentheses. ***, ** and * indicate significance at the 1%, 5%, and 10% level, respectively.

Panel A: Relationship between the quantity of pre-IPO innovation and firm-level individual ATPs in IPO firms' corporate charters

Dependent Variable	Staggered board	Poison pill	Restrictions on action by written consent	Supermajority required to approve mergers	Supermajority required to replace directors	Supermajority required to amend charter or bylaws	Unequal voting rights	Prohibition of cumulative voting
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
LnCount-1&-2	0.068***	0.154**	0.148***	-0.108*	0.016	0.097***	0.136***	0.096***
	(2.99)	(2.44)	(4.92)	(-1.65)	(0.64)	(3.80)	(3.64)	(2.88)
LnAssets	0.010	0.250***	-0.011	0.118***	0.029	0.029	0.368***	-0.047
	(0.51)	(4.19)	(-0.47)	(3.67)	(0.86)	(0.97)	(6.63)	(-1.46)
LnAge	-0.087**	0.135	0.007	0.064	-0.015	0.077	0.131	0.054
	(-2.43)	(1.26)	(0.12)	(0.80)	(-0.37)	(1.47)	(1.48)	(1.19)
OutDir	0.281	0.483	0.852***	-0.307	0.412	0.394*	0.199	0.349**
	(1.21)	(1.08)	(4.30)	(-0.79)	(1.48)	(1.94)	(0.46)	(2.46)
InsideOwn	-0.097	-0.458	-0.106	-0.194	-0.064	0.028	0.821***	0.039
	(-0.67)	(-1.56)	(-0.57)	(-0.74)	(-0.46)	(0.24)	(2.93)	(0.23)
CEO/Chair	0.069*	0.080	0.024	0.137	0.155***	0.024	0.186	-0.004
	(1.75)	(0.77)	(0.40)	(1.47)	(3.82)	(0.46)	(1.60)	(-0.06)
CapEx/Assets	0.736**	0.484	0.138	1.536***	0.370	-0.136	1.637***	-0.156
	(2.32)	(1.34)	(0.47)	(2.90)	(0.70)	(-0.26)	(3.73)	(-0.27)
R&D/Assets	-0.054	-0.484**	-0.020	-0.660***	0.073	-0.028	0.178	-0.164
	(-0.37)	(-2.12)	(-0.16)	(-2.78)	(0.62)	(-0.27)	(0.82)	(-1.21)
ROA	0.052	-0.246**	0.042	-0.138	0.037	0.026	-0.047	-0.001
	(0.94)	(-2.16)	(0.48)	(-1.23)	(0.45)	(0.44)	(-0.43)	(-0.02)
Constant	-0.154	-5.447***	-0.791	-3.645***	-2.674***	-0.299	-8.933***	0.492
	(-0.26)	(-4.54)	(-1.33)	(-3.32)	(-3.42)	(-0.82)	(-10.47)	(0.84)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2351	1243	2341	1891	2273	2407	1789	2232

Panel B: Relationship between the quality of pre-IPO innovation and firm-level individual ATPs in IPO firms' corporate charters

Dependent Variable	Staggered board	Poison pill	Restrictions on action by written consent	Supermajority required to approve mergers	Supermajority required to replace directors	Supermajority required to amend charter or bylaws	Unequal voting rights	Prohibition of cumulative voting
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
LnCite-1&-2	0.033**	0.034*	0.046***	-0.072*	-0.009	0.049***	0.037***	0.024*
	(2.45)	(1.92)	(4.31)	(-1.78)	(-0.49)	(3.50)	(2.75)	(1.69)
LnAssets	0.013	0.258***	-0.007	0.118***	0.029	0.033	0.377***	-0.044
	(0.65)	(4.08)	(-0.29)	(3.71)	(0.90)	(1.12)	(6.43)	(-1.36)
LnAge	-0.086**	0.132	0.008	0.063	-0.016	0.081	0.127	0.054
	(-2.42)	(1.25)	(0.14)	(0.79)	(-0.40)	(1.56)	(1.43)	(1.19)
OutDir	0.280	0.495	0.847***	-0.301	0.413	0.394*	0.194	0.352**
	(1.19)	(1.12)	(4.26)	(-0.79)	(1.50)	(1.90)	(0.46)	(2.49)
InsideOwn	-0.089	-0.457	-0.091	-0.200	-0.068	0.040	0.830***	0.044
	(-0.62)	(-1.52)	(-0.49)	(-0.77)	(-0.48)	(0.35)	(3.01)	(0.26)
CEO/Chair	0.069*	0.080	0.022	0.133	0.156***	0.025	0.205*	-0.005
	(1.72)	(0.78)	(0.36)	(1.46)	(3.85)	(0.47)	(1.81)	(-0.07)
CapEx/Assets	0.750**	0.535	0.161	1.521***	0.391	-0.104	1.715***	-0.125
	(2.36)	(1.54)	(0.55)	(2.98)	(0.73)	(-0.20)	(3.91)	(-0.22)
R&D/Assets	-0.047	-0.402*	0.006	-0.651***	0.085	-0.021	0.236	-0.144
	(-0.34)	(-1.83)	(0.05)	(-2.64)	(0.72)	(-0.20)	(1.05)	(-1.06)
ROA	0.059	-0.221**	0.051	-0.150	0.041	0.035	-0.025	0.007
	(1.09)	(-2.00)	(0.59)	(-1.35)	(0.49)	(0.58)	(-0.23)	(0.11)
Constant	-0.221	-5.600***	-0.884	-3.590***	-2.683***	-0.396	-9.080***	0.420
	(-0.37)	(-4.43)	(-1.47)	(-3.32)	(-3.42)	(-1.11)	(-10.87)	(0.72)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2351	1243	2341	1891	2273	2407	1789	2232

Table 6: **Relationship between management quality and ATPs in IPO firms' corporate charters**

The sample consists of 2,692 VC-backed IPOs conducted between 1993 and 2015. In regression 1 dependent variable ATP is the total number of firm-level ATPs in a firm's corporate charter at IPO. In regression 2 dependent variable Strong ATP is the number of five strong ATPs in a firm's corporate charter at IPO: staggered boards, poison pills, supermajority required to approve mergers, supermajority required to amend charter or bylaws, and unequal voting rights. In regressions 3 through 10 dependent variables are dummy variables taking a value of one if a firm has a particular individual firm-level ATP in its corporate charter at the time of IPO, and zero otherwise. Descriptions of individual ATPs are in Appendix A. MQFactor is the management quality factor score obtained using common factor analysis on the firm-size-, firm-age-, and industry-dummies-adjusted TSize, MBA, PriorExp, LawAcc, CPA, Core, Comp, and Board. Tenure is the average number of years a firm's management team members have been with the firm. TenHet is the coefficient of variation of management team members' tenures. LnAssets is the natural logarithm of the book value of assets immediately prior to IPO. LnAge is the natural logarithm of one plus firm age. OutDir is the proportion of outside directors in the board of directors. InsideOwn is the proportion of voting power owned by firm officers and directors immediately after IPO. CEO/Chair is a dummy equal to 1 if a CEO is also a Chairman of the board of directors. CapEx/Assets is the ratio of capital expenditures to assets in the fiscal year prior to IPO. R&D/Assets is the ratio of R&D expenses to assets in the fiscal year prior to IPO. ROA is the ratio of net income to assets in the fiscal year prior to IPO. All regressions include 4-digit SIC industry code dummies, year dummies, and state dummies. Regressions 1 and 2 are Poisson regressions and regressions 3 through 10 are probit regressions with standard errors clustered at state level. All four accounting variables (i.e., LnAssets, CapEx/Assets, R&D/Assets, and ROA) are winsorized at the 1% and 99% levels. z-statistics are in parentheses. ***, ** and * indicate significance at the 1%, 5%, and 10% level, respectively.

Dependent Variable	ATP	Strong ATP	Staggered board	Poison pill	Restrictions on action by written consent	Supermajority required to approve mergers	Supermajority required to replace directors	Supermajority required to amend charter or bylaws	Unequal voting rights	Prohibition of cumulative voting
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
MQFactor	0.028***	0.054***	0.088**	0.119	0.124**	0.034	0.089***	0.151***	-0.051	0.085**
	(4.01)	(4.31)	(2.13)	(1.41)	(2.47)	(0.54)	(3.43)	(5.05)	(-0.88)	(2.35)
Tenure	0.002	-0.002	-0.021	-0.005	-0.009	-0.013	0.016	-0.004	0.023	0.036**
	(0.60)	(-0.30)	(-1.39)	(-0.19)	(-0.61)	(-0.70)	(1.16)	(-0.21)	(0.96)	(2.01)
TenHet	0.019**	0.029***	0.055*	0.046	0.029	0.092	0.022	0.036	-0.028	-0.014
	(2.25)	(2.66)	(1.72)	(0.37)	(0.99)	(1.52)	(0.57)	(0.86)	(-0.42)	(-0.42)
LnAssets	0.013**	0.039***	0.001	0.240***	-0.027	0.107***	0.014	0.011	0.385***	-0.060*
	(2.03)	(4.15)	(0.06)	(3.65)	(-1.13)	(2.90)	(0.43)	(0.36)	(6.14)	(-1.91)
LnAge	0.001	0.020	-0.058	0.138	0.017	0.075	-0.048	0.082	0.084	-0.010
	(0.05)	(0.77)	(-1.17)	(1.25)	(0.34)	(0.80)	(-1.03)	(1.36)	(0.95)	(-0.21)
OutDir	0.129**	0.167	0.291	0.504	0.871***	-0.276	0.434	0.419**	0.205	0.396***
	(2.49)	(1.54)	(1.32)	(1.11)	(4.82)	(-0.70)	(1.57)	(2.07)	(0.49)	(2.63)
InsideOwn	-0.010	-0.013	-0.093	-0.478	-0.104	-0.215	-0.086	0.016	0.807***	0.022
	(-0.32)	(-0.28)	(-0.62)	(-1.58)	(-0.54)	(-0.82)	(-0.61)	(0.12)	(2.85)	(0.13)
CEO/Chair	0.029**	0.038*	0.072*	0.076	0.020	0.125	0.146***	0.022	0.214**	-0.010
	(2.55)	(1.91)	(1.79)	(0.77)	(0.34)	(1.30)	(3.46)	(0.41)	(1.99)	(-0.15)
CapEx/Assets	0.172**	0.345**	0.701**	0.455	0.109	1.460***	0.339	-0.175	1.785***	-0.148
	(2.03)	(2.44)	(2.14)	(1.26)	(0.41)	(2.95)	(0.65)	(-0.33)	(4.16)	(-0.27)
R&D/Assets	0.004	-0.045	-0.021	-0.363*	0.041	-0.737***	0.085	0.019	0.275	-0.107
	(0.15)	(-0.72)	(-0.14)	(-1.73)	(0.32)	(-3.06)	(0.75)	(0.17)	(1.23)	(-0.77)
ROA	0.016	0.001	0.074	-0.210**	0.062	-0.137	0.044	0.052	-0.036	0.010
	(1.23)	(0.05)	(1.45)	(-1.99)	(0.71)	(-1.22)	(0.56)	(0.87)	(-0.32)	(0.15)
Constant	1.375***	-0.481*	0.050	-5.229***	-0.512	-3.419***	-2.399***	0.036	-9.277***	0.609
	(11.39)	(-1.75)	(0.08)	(-4.07)	(-0.94)	(-3.03)	(-3.12)	(0.09)	(-11.27)	(1.05)

Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2618	2618	2351	1243	2341	1891	2273	2407	1789	2232

Table 7: **Relationship between pre-IPO innovation, management quality, and ATPs in IPO firms' corporate charters**

The sample consists of 2,692 VC-backed IPOs conducted between 1993 and 2015. In regression 1 dependent variable ATP is the total number of firm-level ATPs in a firm's corporate charter at IPO. In regression 2 dependent variable Strong ATP is the number of five strong ATPs in a firm's corporate charter at IPO: staggered boards, poison pills, supermajority required to approve mergers, supermajority required to amend charter and bylaws, and unequal voting rights. In regressions 3 through 10 dependent variables are dummy variables taking a value of one if a firm has a particular individual firm-level ATP in its corporate charter at the time of IPO, and zero otherwise. Descriptions of individual ATPs are in Appendix A. Q1CountMQF is a dummy equal to 1 for firms with above median MQFactor within the group of firms with non-zero number of patents a firm files for and is eventually granted in years -1 and -2 combined prior to IPO, and zero otherwise. MQFactor is the management quality factor score obtained using common factor analysis on the firm-size-, firm-age-, and industry-dummies-adjusted TSize, MBA, PriorExp, LawAcc, CPA, Core, Comp, and Board. Q1CiteMQF is a dummy variable equal to 1 for firms with above median MQFactor within the group of firms with non-zero number of citations per patent a firm files for and is eventually granted in years -1 and -2 combined prior to IPO, and zero otherwise. MQFactor is the management quality factor score obtained using common factor analysis on the firm-size-, firm-age-, and industry-dummies-adjusted TSize, MBA, PriorExp, LawAcc, CPA, Core, Comp, and Board. Tenure is the average number of years a firm's management team members have been with the firm. TenHet is the coefficient of variation of management team members' tenures. LnAssets is the natural logarithm of the book value of assets immediately prior to IPO. LnAge is the natural logarithm of one plus firm age. OutDir is the proportion of outside directors in the board of directors. InsideOwn is the proportion of voting power owned by firm officers and directors immediately after IPO. CEO/Chair is a dummy equal to 1 if a CEO is also a Chairman of the board of directors. CapEx/Assets is the ratio of capital expenditures to assets in the fiscal year prior to IPO. R&D/Assets is the ratio of R&D expenses to assets in the fiscal year prior to IPO. ROA is the ratio of net income to assets in the fiscal year prior to IPO. All regressions include 4-digit SIC industry code dummies, year dummies, and state dummies. Regressions 1 and 2 are Poisson regressions and regressions 3 through 10 are probit regressions with standard errors clustered at state level. All four accounting variables (i.e., LnAssets, CapEx/Assets, R&D/Assets, and ROA) are winsorized at the 1% and 99% levels. z-statistics are in parentheses. ***, ** and * indicate significance at the 1%, 5%, and 10% level, respectively.

Panel A: Relationship between the quantity of pre-IPO innovation, management quality, and ATPs in IPO firms' corporate charters

Dependent Variable	ATP	Strong ATP	Staggered board	Poison pill	Restrictions on action by written consent	Supermajority required to approve mergers	Supermajority required to replace directors	Supermajority required to amend charter or bylaws	Unequal voting rights	Prohibition of cumulative voting
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Q1CountMQF	0.043***	0.109***	0.157*	0.265*	0.183**	-0.311**	0.188***	0.299***	0.062	0.134
	(2.71)	(4.33)	(1.92)	(1.82)	(2.12)	(-2.10)	(2.62)	(4.61)	(0.50)	(0.85)
Tenure	0.001	-0.003	-0.024	-0.007	-0.013	-0.017	0.013	-0.007	0.025	0.033*
	(0.32)	(-0.56)	(-1.48)	(-0.26)	(-0.81)	(-0.88)	(1.00)	(-0.42)	(1.09)	(1.86)
TenHet	0.020**	0.029***	0.054	0.051	0.031	0.095	0.021	0.037	-0.033	-0.013
	(2.32)	(2.70)	(1.64)	(0.41)	(1.09)	(1.57)	(0.56)	(0.90)	(-0.49)	(-0.38)
LnAssets	0.016**	0.045***	0.011	0.252***	-0.009	0.122***	0.024	0.026	0.378***	-0.048
	(2.58)	(4.52)	(0.51)	(4.02)	(-0.36)	(3.89)	(0.73)	(0.82)	(6.12)	(-1.54)
LnAge	0.002	0.023	-0.055	0.133	0.022	0.080	-0.045	0.086	0.082	-0.007
	(0.13)	(0.90)	(-1.16)	(1.21)	(0.43)	(0.84)	(-0.99)	(1.46)	(0.88)	(-0.15)
OutDir	0.130**	0.167	0.298	0.510	0.865***	-0.264	0.439	0.428**	0.196	0.389***
	(2.46)	(1.47)	(1.28)	(1.10)	(4.76)	(-0.66)	(1.55)	(1.99)	(0.47)	(2.65)
InsideOwn	-0.011	-0.016	-0.093	-0.450	-0.102	-0.195	-0.090	0.018	0.809***	0.022
	(-0.36)	(-0.34)	(-0.63)	(-1.50)	(-0.55)	(-0.75)	(-0.64)	(0.14)	(2.86)	(0.13)
CEO/Chair	0.030***	0.039*	0.071*	0.068	0.021	0.147	0.147***	0.019	0.206*	-0.010
	(2.67)	(1.94)	(1.72)	(0.66)	(0.34)	(1.61)	(3.49)	(0.35)	(1.92)	(-0.15)
CapEx/Assets	0.178**	0.347**	0.724**	0.458	0.152	1.522***	0.351	-0.134	1.749***	-0.104
	(2.02)	(2.36)	(2.22)	(1.29)	(0.51)	(3.00)	(0.69)	(-0.26)	(3.97)	(-0.19)

R&D/Assets	-0.004	-0.067	-0.046	-0.417*	0.011	-0.685***	0.055	-0.029	0.263	-0.131
	(-0.15)	(-1.07)	(-0.33)	(-1.96)	(0.08)	(-2.86)	(0.47)	(-0.27)	(1.13)	(-0.94)
ROA	0.013	-0.006	0.067	-0.228**	0.053	-0.141	0.034	0.038	-0.034	0.003
	(0.96)	(-0.22)	(1.29)	(-2.07)	(0.60)	(-1.20)	(0.43)	(0.63)	(-0.30)	(0.04)
Constant	1.319***	-0.575**	-0.148	-5.503***	-0.841	-3.736***	-2.627***	-0.310	-9.130***	0.406
	(10.91)	(-2.26)	(-0.25)	(-4.36)	(-1.39)	(-3.53)	(-3.32)	(-0.83)	(-11.46)	(0.71)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2618	2618	2351	1243	2341	1891	2273	2407	1789	2232

Panel B: Relationship between the quality of pre-IPO innovation, management quality, and ATPs in IPO firms' corporate charters

Dependent Variable	ATP	Strong ATP	Staggered board	Poison pill	Restrictions on action by written consent	Supermajority required to approve mergers	Supermajority required to replace directors	Supermajority required to amend charter or bylaws	Unequal voting rights	Prohibition of cumulative voting
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Q1CiteMQF	0.043***	0.112***	0.149*	0.268*	0.166*	-0.335**	0.184***	0.297***	0.109	0.110
	(2.68)	(4.19)	(1.80)	(1.84)	(1.92)	(-2.21)	(2.61)	(4.76)	(0.98)	(0.72)
Tenure	0.001	-0.003	-0.023	-0.007	-0.013	-0.017	0.013	-0.007	0.026	0.033*
	(0.34)	(-0.52)	(-1.46)	(-0.26)	(-0.82)	(-0.93)	(1.02)	(-0.38)	(1.12)	(1.84)
TenHet	0.019**	0.029***	0.054	0.051	0.031	0.096	0.021	0.037	-0.036	-0.013
	(2.31)	(2.67)	(1.64)	(0.41)	(1.09)	(1.57)	(0.55)	(0.88)	(-0.52)	(-0.37)
LnAssets	0.016**	0.044***	0.011	0.252***	-0.009	0.123***	0.024	0.026	0.377***	-0.048
	(2.56)	(4.51)	(0.51)	(4.02)	(-0.34)	(3.90)	(0.72)	(0.84)	(6.13)	(-1.52)
LnAge	0.002	0.023	-0.055	0.133	0.021	0.081	-0.045	0.085	0.082	-0.007
	(0.13)	(0.90)	(-1.17)	(1.21)	(0.42)	(0.85)	(-0.99)	(1.45)	(0.89)	(-0.15)
OutDir	0.131**	0.171	0.299	0.510	0.865***	-0.271	0.443	0.430**	0.202	0.391***
	(2.48)	(1.50)	(1.29)	(1.10)	(4.77)	(-0.68)	(1.57)	(2.02)	(0.48)	(2.63)
InsideOwn	-0.010	-0.015	-0.091	-0.449	-0.101	-0.193	-0.086	0.020	0.808***	0.023
	(-0.34)	(-0.32)	(-0.62)	(-1.49)	(-0.54)	(-0.74)	(-0.61)	(0.16)	(2.86)	(0.13)
CEO/Chair	0.030***	0.040**	0.071*	0.068	0.021	0.146	0.148***	0.020	0.204*	-0.009
	(2.71)	(1.98)	(1.72)	(0.65)	(0.36)	(1.60)	(3.53)	(0.38)	(1.88)	(-0.14)
CapEx/Assets	0.178**	0.348**	0.726**	0.456	0.157	1.525***	0.354	-0.131	1.741***	-0.103
	(2.03)	(2.36)	(2.23)	(1.29)	(0.53)	(3.00)	(0.69)	(-0.26)	(3.94)	(-0.19)
R&D/Assets	-0.004	-0.065	-0.044	-0.418*	0.014	-0.686***	0.056	-0.027	0.258	-0.127
	(-0.13)	(-1.06)	(-0.32)	(-1.96)	(0.10)	(-2.87)	(0.48)	(-0.26)	(1.12)	(-0.92)
ROA	0.013	-0.005	0.067	-0.228**	0.053	-0.141	0.035	0.039	-0.034	0.003
	(0.98)	(-0.20)	(1.29)	(-2.07)	(0.61)	(-1.20)	(0.44)	(0.64)	(-0.31)	(0.04)
Constant	1.318***	-0.577**	-0.151	-5.505***	-0.842	-3.743***	-2.627***	-0.319	-9.122***	0.403
	(10.97)	(-2.28)	(-0.26)	(-4.36)	(-1.40)	(-3.53)	(-3.34)	(-0.86)	(-11.45)	(0.71)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2618	2618	2351	1243	2341	1891	2273	2407	1789	2232

Table 8: **Relationship between the number of strong ATPs in IPO firms' corporate charters, pre-IPO innovation, and IPO firm valuation**

The sample consists of 2,692 venture-backed IPOs conducted between 1993 and 2015. Dependent variables QOP, QFTD, and QIM are three definitions of Tobin's Q. Tobin's Q is the ratio of the market value of assets to the book value of assets, where the market value of assets is equal to the book value of assets minus the book value of common equity plus the number of shares outstanding times the market price (either IPO offer price (for QOP), first trading day closing price (for QFTD), or the closing price at the end of the issue month (for QIM)). Q1StATPCount is a dummy variable equal to 1 for firms with above median number of Strong ATPs and non-zero number of patents filed for and eventually granted in years 1 and 2 combined before IPO. Q1StATPCite is a dummy variable equal to 1 for firms above median number of Strong ATPs and non-zero number of citations per patent filed for and eventually granted in years 1 and 2 combined before IPO. MQFactor is the management quality factor score obtained using common factor analysis on the firm-size-, firm-age-, and industry-dummies-adjusted TSize, MBA, PriorExp, LawAcc, CPA, Core, Comp, and Board. Tenure is the average number of years a firm's management team members have been with the firm. TenHet is the coefficient of variation of management team members' tenures. LnAssets is the natural logarithm of the book value of assets immediately prior to IPO. LnAge is the natural logarithm of one plus firm age. OutDir is the proportion of outside directors in the board of directors. InsideOwn is the proportion of voting power owned by firm officers and directors immediately after IPO. CEO/Chair is an indicator variable equal to one if a CEO is also a Chairman of the board of directors, and zero otherwise. CapEx/Assets is the ratio of capital expenditures to assets in the fiscal year prior to IPO. R&D/Assets is the ratio of R&D expenses to assets in the fiscal year prior to IPO. ROA is the ratio of net income to assets in the fiscal year prior to IPO. All regressions include 4-digit SIC industry code dummies, year dummies, and state dummies. All regressions are OLS regressions with standard errors clustered at state level. All four accounting variables (i.e., LnAssets, CapEx/Assets, R&D/Assets, and ROA) and dependent variables are winsorized at the 1% and 99% levels. t-statistics are in parentheses. ***, ** and * indicate significance at the 1%, 5%, and 10% level, respectively.

Dependent Variable	QOP	QFTD	QIM	QOP	QFTD	QIM
	(1)	(2)	(3)	(4)	(5)	(6)
Q1StATPCount	0.812**	1.568*	1.419**			
	(2.38)	(1.97)	(2.30)			
Q1StATPCite				0.879**	1.758**	1.573**
				(2.35)	(2.02)	(2.36)
MQFactor	0.107***	0.260*	0.202	0.106***	0.259*	0.201
	(3.16)	(1.92)	(1.34)	(3.16)	(1.92)	(1.33)
Tenure	-0.016	-0.031	-0.020	-0.016	-0.031	-0.020
	(-0.99)	(-1.37)	(-0.85)	(-0.98)	(-1.35)	(-0.84)
TenHet	0.099	0.030	0.008	0.099	0.029	0.007
	(1.14)	(0.36)	(0.08)	(1.13)	(0.35)	(0.07)
LnAssets	-0.309***	-0.325***	-0.349***	-0.310***	-0.327***	-0.351***
	(-8.23)	(-4.52)	(-4.42)	(-8.25)	(-4.59)	(-4.47)
LnAge	-0.038	-0.307**	-0.285**	-0.038	-0.307**	-0.285**
	(-0.51)	(-2.17)	(-2.13)	(-0.50)	(-2.16)	(-2.12)
OutDir	-0.374	-0.565	-0.427	-0.374	-0.564	-0.426
	(-1.09)	(-1.41)	(-1.07)	(-1.09)	(-1.40)	(-1.07)
InsideOwn	0.877***	1.814***	1.870***	0.881***	1.822***	1.878***
	(2.70)	(2.97)	(2.90)	(2.71)	(2.98)	(2.91)
CEO/Chair	0.051	0.027	0.050	0.050	0.024	0.048
	(0.57)	(0.18)	(0.26)	(0.57)	(0.16)	(0.24)
CapEx/Assets	1.345*	2.523**	3.926***	1.346*	2.524**	3.925***
	(1.99)	(2.28)	(3.37)	(2.00)	(2.28)	(3.37)
R&D/Assets	0.326	0.412	0.794	0.329	0.418	0.800
	(1.15)	(1.00)	(1.44)	(1.16)	(1.01)	(1.45)
ROA	0.002	0.059	0.312	0.003	0.062	0.315
	(0.01)	(0.21)	(0.97)	(0.02)	(0.21)	(0.97)
Constant	20.086***	7.119***	20.450***	20.099***	7.147***	20.481***
	(25.05)	(4.79)	(16.54)	(25.08)	(4.85)	(16.67)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.277	0.313	0.315	0.277	0.314	0.315
Observations	2578	2548	2517	2578	2548	2517

Table 9: **Relationship between pre-IPO innovation and ATPs in IPO firms' corporate charters (IV results)**

The sample consists of 2,692 VC-backed IPOs conducted between 1993 and 2015. In first-stage regressions, ExmLeniency-1 (-2, -1&-2) is the average approval rate of examiners who examine firms' patent applications in year -1 (year -2, years -1 and -2 combined) prior to IPO. In second-stage regressions, LnCountHat-1 (-2, -1&-2) is the predicted value of LnCount-1 (-2, -1&-2) from first-stage regressions; LnCiteHat-1 (-2, -1&-2) is the predicted value of LnCite-1 (-2, -1&-2) from first-stage regressions. LnCount-1 and LnCount-2 are the natural logarithms of one plus the number of patents a firm files for and is eventually granted in years -1 and -2 prior to IPO, respectively. LnCount-1&-2 is the natural logarithm of one plus the number of patents a firm files for and is eventually granted in years -1 and -2 combined prior to IPO. LnCite -1 and LnCite -2 are the natural logarithms of one plus the number of citations per patent a firm files for and is eventually granted in years -1 and -2 prior to IPO, respectively. LnCite -1&-2 is the natural logarithm of one plus the number of citations per patent a firm files for and is eventually granted in years -1 and -2 combined prior to IPO. In second-stage regressions, dependent variable ATP is the total number of firm-level ATPs in a firm's corporate charter (1 through 19 in Appendix A) at IPO. Strong ATP is the number of five strong ATPs in a firm's corporate charter at IPO: staggered boards, poison pills, supermajority required to approve mergers, supermajority required to amend charter or bylaws, and unequal voting rights. Descriptions of individual ATPs are in Appendix A. LnAssets is the natural logarithm of the book value of assets immediately prior to IPO. LnAge is the natural logarithm of one plus firm age. OutDir is the proportion of outside directors in the board of directors. InsideOwn is the proportion of voting power owned by firm officers and directors immediately after IPO. CEO/Chair is a dummy equal to 1 if a CEO is also a Chairman of the board of directors. CapEx/Assets is the ratio of capital expenditures to assets in the fiscal year prior to IPO. R&D/Assets is the ratio of R&D expenses to assets in the fiscal year prior to IPO. ROA is the ratio of net income to assets in the fiscal year prior to IPO. All regressions include 4-digit SIC industry code dummies, year dummies, and state dummies. All four accounting variables (i.e., LnAssets, CapEx/Assets, R&D/Assets, and ROA) are winsorized at the 1% and 99% levels. *t*-statistics are in parentheses. ***, ** and * indicate significance at the 1%, 5%, and 10% level, respectively.

Panel A: Relationship between the quantity of pre-IPO innovation and ATPs in IPO firms' corporate charters

Dependent Variable	LnCount-1	ATP	Strong ATP	LnCount-2	ATP	Strong ATP	LnCount-1&-2	ATP	Strong ATP
	1st stage	2nd stage	2nd stage	1st stage	2nd stage	2nd stage	1st stage	2nd stage	2nd stage
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ExmLeniency-1	1.728***								
	(57.58)								
LnCountHat-1		0.128*	0.091***						
		(1.74)	(3.04)						
ExmLeniency-2				1.640***					
				(59.62)					
LnCountHat-2					0.221***	0.098***			
					(2.74)	(2.99)			
ExmLeniency-1&-2							1.900***		
							(52.32)		
LnCountHat-1&-2								0.190***	0.088***
								(2.90)	(3.31)
LnAssets	0.047***	0.107***	0.064***	0.024***	0.099**	0.062***	0.053***	0.106***	0.064***
	(5.17)	(2.75)	(4.03)	(3.03)	(2.56)	(3.96)	(4.68)	(2.74)	(4.05)
LnAge	-0.010	0.028	0.024	0.012	0.038	0.027	-0.002	0.028	0.024
	(-0.68)	(0.44)	(0.90)	(0.88)	(0.60)	(1.02)	(-0.13)	(0.44)	(0.92)
OutDir	-0.094	0.677**	0.204*	0.039	0.668**	0.194*	-0.038	0.662**	0.197*
	(-1.45)	(2.45)	(1.82)	(0.67)	(2.41)	(1.73)	(-0.47)	(2.39)	(1.76)
InsideOwn	0.081*	-0.027	-0.009	0.076*	-0.027	-0.013	0.071	-0.031	-0.013
	(1.66)	(-0.13)	(-0.11)	(1.78)	(-0.13)	(-0.15)	(1.19)	(-0.15)	(-0.15)
CEO/Chair	0.031	0.170**	0.046	0.027	0.158*	0.047	0.023	0.177**	0.050

	(1.53)	(1.99)	(1.33)	(1.54)	(1.86)	(1.37)	(0.91)	(2.08)	(1.45)
CapEx/Assets	0.278**	1.098**	0.460**	0.270**	1.054**	0.465**	0.390***	1.088**	0.469**
	(2.29)	(2.13)	(2.19)	(2.54)	(2.06)	(2.24)	(2.61)	(2.11)	(2.25)
R&D/Assets	0.097**	-0.027	-0.092	0.002	-0.063	-0.089	0.126**	-0.088	-0.102
	(2.09)	(-0.14)	(-1.14)	(0.05)	(-0.32)	(-1.11)	(2.19)	(-0.44)	(-1.27)
ROA	0.050**	0.059	-0.019	0.017	0.068	-0.009	0.067**	0.050	-0.017
	(2.19)	(0.61)	(-0.49)	(0.84)	(0.70)	(-0.22)	(2.40)	(0.51)	(-0.44)
Constant	-0.669	3.870*	0.323	-0.067	3.815*	0.291	-0.416	3.781*	0.280
	(-1.29)	(1.76)	(0.36)	(-0.15)	(1.73)	(0.33)	(-0.65)	(1.72)	(0.31)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2		0.450	0.323		0.454	0.324		0.451	0.322
Observations	2589	2589	2589	2586	2586	2586	2587	2587	2587
F Statistic	3315.03			3554.93			2737.88		

Panel B: Relationship between the quality of pre-IPO innovation and ATPs in IPO firms' corporate charters

Dependent Variable	LnCite-1	ATP	Strong ATP	LnCite-2	ATP	Strong ATP	LnCite-1&-2	ATP	Strong ATP
	1st stage	2nd stage	2nd stage	1st stage	2nd stage	2nd stage	1st stage	2nd stage	2nd stage
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ExmLeniency-1	4.328***								
	(88.90)								
LnCiteHat-1		0.051*	0.036***						
		(1.73)	(3.04)						
ExmLeniency-2				4.401***					
				(87.81)					
LnCiteHat-2					0.082***	0.036***			
					(2.74)	(2.99)			
ExmLeniency-1&-2							4.876***		
							(88.30)		
LnCiteHat-1&-2								0.074***	0.034***
								(2.89)	(3.31)
LnAssets	0.024	0.112***	0.067***	0.009	0.104***	0.064***	0.033*	0.114***	0.067***
	(1.61)	(2.88)	(4.27)	(0.62)	(2.68)	(4.10)	(1.91)	(2.94)	(4.29)
LnAge	-0.049**	0.029	0.024	-0.041*	0.044	0.029	-0.057**	0.032	0.026
	(-1.99)	(0.46)	(0.94)	(-1.68)	(0.69)	(1.12)	(-2.00)	(0.50)	(0.98)
OutDir	-0.102	0.671**	0.199*	-0.104	0.685**	0.202*	-0.113	0.664**	0.198*
	(-0.96)	(2.42)	(1.78)	(-0.99)	(2.47)	(1.79)	(-0.92)	(2.40)	(1.76)
InsideOwn	-0.105	-0.011	0.002	-0.015	-0.009	-0.005	-0.132	-0.007	-0.002
	(-1.33)	(-0.05)	(0.02)	(-0.20)	(-0.04)	(-0.06)	(-1.45)	(-0.04)	(-0.02)
CEO/Chair	0.013	0.173**	0.048	-0.009	0.165*	0.050	0.009	0.180**	0.052
	(0.41)	(2.03)	(1.40)	(-0.28)	(1.94)	(1.46)	(0.25)	(2.12)	(1.50)
CapEx/Assets	-0.183	1.143**	0.492**	0.010	1.113**	0.491**	-0.099	1.169**	0.507**
	(-0.93)	(2.22)	(2.36)	(0.05)	(2.17)	(2.37)	(-0.44)	(2.28)	(2.44)
R&D/Assets	-0.147*	-0.007	-0.078	-0.002	-0.063	-0.089	-0.057	-0.060	-0.089
	(-1.94)	(-0.04)	(-0.97)	(-0.02)	(-0.32)	(-1.10)	(-0.65)	(-0.30)	(-1.11)
ROA	-0.120***	0.072	-0.011	-0.048	0.075	-0.005	-0.087**	0.069	-0.008
	(-3.25)	(0.74)	(-0.27)	(-1.33)	(0.78)	(-0.13)	(-2.05)	(0.72)	(-0.21)
Constant	-0.592	3.815*	0.284	-0.948	3.879*	0.319	-0.749	3.758*	0.269
	(-0.70)	(1.73)	(0.32)	(-1.13)	(1.76)	(0.36)	(-0.77)	(1.71)	(0.30)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2		0.449	0.323		0.452	0.323		0.450	0.321
Observations	2589	2589	2589	2586	2586	2586	2587	2587	2587
F Statistic	7903.53			7710.84			7797.64		

Table 10: **Relationship between pre-IPO innovation and firm-level individual ATPs in IPO firms' corporate charters (IV results)**

The sample consists of 2,692 VC-backed IPOs conducted between 1993 and 2015. In first-stage regressions, ExmLeniency-1&-2 is the average approval rate of examiners who examine firms' patent applications in years -1 and -2 combined prior to IPO. In second-stage regressions, LnCountHat-1&-2 is the predicted value of LnCount-1&-2 from first-stage regressions; LnCiteHat-1&-2 is the predicted value of LnCite-1&-2 from first-stage regressions. LnCount-1&-2 is the natural logarithm of one plus the number of patents a firm files for and is eventually granted in years -1 and -2 combined prior to IPO. LnCite-1&-2 is the natural logarithm of one plus the number of citations per patent a firm files for and is eventually granted in years -1 and -2 combined prior to IPO. Dependent variables, in second-stage regressions, are dummy variables taking a value of one if a firm has a particular individual firm-level ATP in its corporate charter at the time of IPO, and zero otherwise. Descriptions of individual ATPs are in Appendix A. LnAssets is the natural logarithm of the book value of assets immediately prior to IPO. LnAge is the natural logarithm of one plus firm age. OutDir is the proportion of outside directors in the board of directors. InsideOwn is the proportion of voting power owned by firm officers and directors immediately after IPO. CEO/Chair is a dummy equal to 1 if a CEO is also a Chairman of the board of directors. CapEx/Assets is the ratio of capital expenditures to assets in the fiscal year prior to IPO. R&D/Assets is the ratio of R&D expenses to assets in the fiscal year prior to IPO. ROA is the ratio of net income to assets in the fiscal year prior to IPO. All regressions include 4-digit SIC industry code dummies, year dummies, and state dummies. All four accounting variables (i.e., LnAssets, CapEx/Assets, R&D/Assets, and ROA) are winsorized at the 1% and 99% levels. t-statistics are in parentheses. ***, ** and * indicate significance at the 1%, 5%, and 10% level, respectively.

Panel A: Relationship between the quantity of pre-IPO innovation and firm-level individual ATPs in IPO firms' corporate charters

Dependent Variable	LnCount-1&-2	Staggered board	Poison pill	Restrictions on action by written consent	Supermajority required to approve mergers	Supermajority required to replace directors	Supermajority required to amend charter or bylaws	Unequal voting rights	Prohibition of cumulative voting
	1st stage	2nd stage	2nd stage	2nd stage	2nd stage	2nd stage	2nd stage	2nd stage	2nd stage
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(10)
ExmLeniency-1&-2	1.900***								
	(52.32)								
LnCountHat-1&-2		0.042***	-0.001	0.035***	-0.012*	0.006	0.045***	0.015**	0.030**
		(3.11)	(-0.20)	(2.88)	(-1.71)	(0.50)	(3.22)	(2.04)	(2.46)
LnAssets	0.053***	-0.000	0.011***	-0.005	0.010**	0.006	0.006	0.038***	-0.011
	(4.68)	(-0.04)	(3.41)	(-0.72)	(2.34)	(0.80)	(0.69)	(8.80)	(-1.55)
LnAge	-0.002	-0.022*	0.009*	0.005	0.005	-0.005	0.022	0.010	0.011
	(-0.13)	(-1.66)	(1.71)	(0.40)	(0.66)	(-0.45)	(1.60)	(1.44)	(0.93)
OutDir	-0.038	0.071	0.031	0.220***	-0.029	0.086	0.116**	0.008	0.075
	(-0.47)	(1.25)	(1.37)	(4.27)	(-0.96)	(1.62)	(1.97)	(0.27)	(1.46)
InsideOwn	0.071	-0.026	-0.027	-0.019	-0.032	-0.028	-0.009	0.081***	0.020
	(1.19)	(-0.62)	(-1.62)	(-0.51)	(-1.41)	(-0.72)	(-0.20)	(3.57)	(0.52)
CEO/Chair	0.023	0.019	0.004	0.007	0.008	0.034**	0.007	0.012	0.001
	(0.91)	(1.09)	(0.58)	(0.43)	(0.84)	(2.11)	(0.40)	(1.29)	(0.07)
CapEx/Assets	0.390***	0.196*	0.032	0.030	0.131**	0.086	-0.050	0.160***	-0.067
	(2.61)	(1.86)	(0.75)	(0.31)	(2.35)	(0.88)	(-0.45)	(2.81)	(-0.70)
R&D/Assets	0.126**	-0.035	-0.011	-0.018	-0.044**	0.022	-0.023	0.011	-0.041
	(2.19)	(-0.86)	(-0.69)	(-0.50)	(-2.02)	(0.58)	(-0.54)	(0.49)	(-1.12)
ROA	0.067**	0.010	-0.004	0.004	-0.014	0.013	0.005	-0.013	-0.006

	(2.40)	(0.49)	(-0.55)	(0.22)	(-1.33)	(0.70)	(0.23)	(-1.25)	(-0.33)
Constant	-0.416	0.578	0.006	0.316	-0.081	0.768*	0.654	-0.876***	0.790*
	(-0.65)	(1.28)	(0.03)	(0.77)	(-0.34)	(1.83)	(1.40)	(-3.61)	(1.93)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2		0.293	0.204	0.384	0.268	0.282	0.317	0.296	0.234
Observations	2587	2587	2587	2587	2587	2587	2587	2587	2587
F Statistic	2737.88								

Panel B: Relationship between the quality of pre-IPO innovation and firm-level individual ATPs in IPO firms' corporate charters

Dependent Variable	LnCite-1&-2	Staggered board	Poison pill	Restrictions on action by written consent	Supermajority required to approve mergers	Supermajority required to replace directors	Supermajority required to amend charter or bylaws	Unequal voting rights	Prohibition of cumulative voting
	1st stage	2nd stage	2nd stage	2nd stage	2nd stage	2nd stage	2nd stage	2nd stage	2nd stage
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(10)
ExmLeniency-1&-2	4.876***								
	(88.30)								
LnCiteHat-1&-2		0.016***	-0.000	0.014***	-0.005*	0.002	0.018***	0.006**	0.012**
		(3.11)	(-0.20)	(2.88)	(-1.71)	(0.50)	(3.22)	(2.04)	(2.46)
LnAssets	0.033*	0.001	0.011***	-0.004	0.009**	0.006	0.008	0.038***	-0.010
	(1.91)	(0.17)	(3.41)	(-0.53)	(2.23)	(0.84)	(0.91)	(8.96)	(-1.39)
LnAge	-0.057**	-0.021	0.009*	0.005	0.004	-0.005	0.023*	0.010	0.012
	(-2.00)	(-1.60)	(1.70)	(0.46)	(0.63)	(-0.44)	(1.67)	(1.48)	(0.97)
OutDir	-0.113	0.071	0.031	0.220***	-0.029	0.086	0.116**	0.008	0.076
	(-0.92)	(1.25)	(1.37)	(4.27)	(-0.96)	(1.62)	(1.97)	(0.27)	(1.47)
InsideOwn	-0.132	-0.021	-0.027	-0.015	-0.033	-0.028	-0.003	0.083***	0.024
	(-1.45)	(-0.49)	(-1.63)	(-0.39)	(-1.48)	(-0.70)	(-0.08)	(3.65)	(0.62)
CEO/Chair	0.009	0.020	0.004	0.007	0.008	0.034**	0.008	0.012	0.002
	(0.25)	(1.14)	(0.58)	(0.47)	(0.81)	(2.11)	(0.45)	(1.32)	(0.10)
CapEx/Assets	-0.099	0.214**	0.031	0.045	0.126**	0.089	-0.030	0.166***	-0.054
	(-0.44)	(2.04)	(0.75)	(0.47)	(2.26)	(0.91)	(-0.28)	(2.93)	(-0.57)
R&D/Assets	-0.057	-0.029	-0.011	-0.013	-0.046**	0.023	-0.016	0.013	-0.037
	(-0.65)	(-0.72)	(-0.71)	(-0.36)	(-2.12)	(0.61)	(-0.39)	(0.60)	(-1.00)
ROA	-0.087**	0.014	-0.004	0.007	-0.015	0.014	0.009	-0.012	-0.003
	(-2.05)	(0.70)	(-0.57)	(0.42)	(-1.45)	(0.74)	(0.45)	(-1.11)	(-0.16)
Constant	-0.749	0.573	0.006	0.312	-0.080	0.767*	0.648	-0.878***	0.786*
	(-0.77)	(1.27)	(0.03)	(0.76)	(-0.33)	(1.83)	(1.38)	(-3.61)	(1.92)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2		0.294	0.204	0.384	0.268	0.282	0.318	0.295	0.233
Observations	2587	2587	2587	2587	2587	2587	2587	2587	2587
F Statistic	7797.64								

Table 11: **Relationship between pre-IPO innovation, management quality, and ATPs in IPO firms' corporate charters (IV results)**

The sample consists of 2,692 VC-backed IPOs conducted between 1993 and 2015. In first-stage regressions, ExmLeniency-1&-2 is the average approval rate of examiners who examine firms' patent applications in years -1 and -2 combined prior to IPO. In second-stage regressions, Q1CountMQFHat is the predicted value of Q1CountMQF from first-stage regressions; Q1CiteMQFHat is the predicted value of Q1CiteMQF from first-stage regressions. Q1CountMQF is a dummy equal to 1 for firms with above median MQFactor within the group of firms with non-zero number of patents a firm files for and is eventually granted in years -1 and -2 combined prior to IPO, and zero otherwise. MQFactor is the management quality factor score obtained using common factor analysis on the firm-size-, firm-age-, and industry-dummies-adjusted TSize, MBA, PriorExp, LawAcc, CPA, Core, Comp, and Board. Q1CiteMQF is a dummy variable equal to 1 for firms with above median MQFactor within the group of firms with non-zero number of citations per patent a firm files for and is eventually granted in years -1 and -2 combined prior to IPO, and zero otherwise. MQFactor is the management quality factor score obtained using common factor analysis on the firm-size-, firm-age-, and industry-dummies-adjusted TSize, MBA, PriorExp, LawAcc, CPA, Core, Comp, and Board. In second-stage regression (2), dependent variable ATP is the total number of firm-level ATPs in a firm's corporate charter at IPO. In second-stage regression (3), dependent variable Strong ATP is the number of five strong ATPs in a firm's corporate charter at IPO: staggered boards, poison pills, supermajority required to approve mergers, supermajority required to amend charter and bylaws, and unequal voting rights. In second-stage regressions (4) through (11), dependent variables are dummy variables taking a value of one if a firm has a particular individual firm-level ATP in its corporate charter at the time of IPO, and zero otherwise. Descriptions of individual ATPs are in Appendix A. Tenure is the average number of years a firm's management team members have been with the firm. TenHet is the coefficient of variation of management team members' tenures. LnAssets is the natural logarithm of the book value of assets immediately prior to IPO. LnAge is the natural logarithm of one plus firm age. OutDir is the proportion of outside directors in the board of directors. InsideOwn is the proportion of voting power owned by firm officers and directors immediately after IPO. CEO/Chair is a dummy equal to 1 if a CEO is also a Chairman of the board of directors. CapEx/Assets is the ratio of capital expenditures to assets in the fiscal year prior to IPO. R&D/Assets is the ratio of R&D expenses to assets in the fiscal year prior to IPO. ROA is the ratio of net income to assets in the fiscal year prior to IPO. All regressions include 4-digit SIC industry code dummies, year dummies, and state dummies. All four accounting variables (i.e., LnAssets, CapEx/Assets, R&D/Assets, and ROA) are winsorized at the 1% and 99% levels. *t*-statistics are in parentheses. ***, ** and * indicate significance at the 1%, 5%, and 10% level, respectively.

Panel A: Relationship between the quantity of pre-IPO innovation, management quality, and ATPs in IPO firms' corporate charters

Dependent Variable	Q1Count-MQF	ATP	Strong ATP	Staggered board	Poison pill	Restrictions on action by written consent	Supermajority required to approve mergers	Supermajority required to replace directors	Supermajority required to amend charter or bylaws	Unequal voting rights	Prohibition of cumulative voting
	1st stage	2nd stage	2nd stage	2nd stage	2nd stage	2nd stage	2nd stage	2nd stage	2nd stage	2nd stage	2nd stage
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
ExmLeniency-1&-2	0.612***										
	(31.72)										
Q1CountMQFHat		0.589***	0.271***	0.128***	-0.003	0.108***	-0.039*	0.020	0.139***	0.046**	0.096**
		(2.89)	(3.27)	(3.06)	(-0.19)	(2.85)	(-1.74)	(0.51)	(3.20)	(2.05)	(2.52)
Tenure	-0.004	0.003	-0.005	-0.005	0.000	-0.002	-0.001	0.002	-0.001	0.001	0.008**
	(-1.59)	(0.19)	(-0.77)	(-1.27)	(0.35)	(-0.67)	(-0.76)	(0.52)	(-0.35)	(0.69)	(2.43)
TenHet	0.016*	0.095	0.036	0.015	-0.000	0.005	0.013*	0.006	0.014	-0.005	-0.005
	(1.69)	(1.55)	(1.44)	(1.20)	(-0.00)	(0.46)	(1.89)	(0.50)	(1.04)	(-0.78)	(-0.41)
LnAssets	0.025***	0.102***	0.062***	-0.001	0.011***	-0.006	0.010**	0.006	0.005	0.037***	-0.013*
	(4.23)	(2.62)	(3.94)	(-0.10)	(3.39)	(-0.80)	(2.46)	(0.77)	(0.59)	(8.60)	(-1.74)
LnAge	-0.009	0.004	0.029	-0.015	0.008	0.009	0.004	-0.010	0.023	0.009	-0.003
	(-0.76)	(0.06)	(0.96)	(-0.96)	(1.29)	(0.67)	(0.47)	(-0.72)	(1.43)	(1.14)	(-0.19)
OutDir	-0.070	0.752***	0.227**	0.082	0.031	0.227***	-0.026	0.092*	0.130**	0.010	0.086*
	(-1.62)	(2.69)	(2.01)	(1.44)	(1.37)	(4.36)	(-0.86)	(1.72)	(2.19)	(0.31)	(1.66)
InsideOwn	0.030	-0.057	-0.018	-0.027	-0.028	-0.020	-0.033	-0.031	-0.012	0.081***	0.014
	(0.95)	(-0.28)	(-0.21)	(-0.63)	(-1.63)	(-0.51)	(-1.46)	(-0.79)	(-0.27)	(3.54)	(0.37)

CEO/Chair	0.023*	0.165*	0.046	0.018	0.004	0.005	0.008	0.033**	0.005	0.011	-0.002
	(1.75)	(1.93)	(1.34)	(1.01)	(0.57)	(0.34)	(0.90)	(2.05)	(0.28)	(1.19)	(-0.11)
CapEx/Assets	0.092	1.097**	0.472**	0.197*	0.032	0.032	0.128**	0.087	-0.047	0.162***	-0.061
	(1.16)	(2.13)	(2.26)	(1.87)	(0.76)	(0.33)	(2.29)	(0.88)	(-0.43)	(2.85)	(-0.63)
R&D/Assets	0.045	-0.084	-0.102	-0.035	-0.011	-0.019	-0.043**	0.023	-0.023	0.010	-0.041
	(1.47)	(-0.42)	(-1.26)	(-0.87)	(-0.69)	(-0.50)	(-1.98)	(0.59)	(-0.54)	(0.48)	(-1.10)
ROA	-0.004	0.069	-0.007	0.015	-0.005	0.007	-0.014	0.013	0.009	-0.013	-0.005
	(-0.24)	(0.71)	(-0.19)	(0.74)	(-0.58)	(0.42)	(-1.35)	(0.72)	(0.45)	(-1.18)	(-0.29)
Constant	-0.760**	4.132*	0.469	0.674	0.002	0.393	-0.102	0.774*	0.746	-0.851***	0.822**
	(-2.23)	(1.87)	(0.52)	(1.49)	(0.01)	(0.96)	(-0.43)	(1.84)	(1.59)	(-3.49)	(2.00)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2		0.450	0.321	0.292	0.204	0.381	0.268	0.283	0.319	0.292	0.232
Observations	2587	2587	2587	2587	2587	2587	2587	2587	2587	2587	2587
F Statistic	1006.40										

Panel B: Relationship between the quality of pre-IPO innovation, management quality, and ATPs in IPO firms' corporate charters

Dependent Variable	Q1Cite-MQF	ATP	Strong ATP	Staggered board	Poison pill	Restrictions on action by written consent	Supermajority required to approve mergers	Supermajority required to replace directors	Supermajority required to amend charter or bylaws	Unequal voting rights	Prohibition of cumulative voting
	1st stage	2nd stage	2nd stage	2nd stage	2nd stage	2nd stage	2nd stage	2nd stage	2nd stage	2nd stage	2nd stage
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
ExmLeniency-1&-2	0.599***										
	(31.31)										
Q1CiteMQFHat		0.602***	0.277***	0.131***	-0.003	0.111***	-0.039*	0.020	0.142***	0.047**	0.098**
		(2.89)	(3.27)	(3.06)	(-0.19)	(2.85)	(-1.74)	(0.51)	(3.20)	(2.05)	(2.52)
Tenure	-0.006**	0.004	-0.005	-0.004	0.000	-0.002	-0.001	0.002	-0.001	0.001	0.008**
	(-2.13)	(0.24)	(-0.71)	(-1.21)	(0.35)	(-0.62)	(-0.79)	(0.53)	(-0.29)	(0.72)	(2.47)
TenHet	0.018*	0.094	0.035	0.015	-0.000	0.005	0.013*	0.006	0.013	-0.005	-0.005
	(1.91)	(1.53)	(1.42)	(1.17)	(-0.00)	(0.44)	(1.90)	(0.49)	(1.01)	(-0.79)	(-0.43)
LnAssets	0.026***	0.101***	0.062***	-0.001	0.011***	-0.006	0.010**	0.006	0.005	0.037***	-0.013*
	(4.39)	(2.59)	(3.92)	(-0.12)	(3.38)	(-0.82)	(2.47)	(0.76)	(0.56)	(8.58)	(-1.76)
LnAge	-0.008	0.004	0.029	-0.015	0.008	0.009	0.004	-0.010	0.023	0.009	-0.003
	(-0.68)	(0.05)	(0.96)	(-0.97)	(1.29)	(0.66)	(0.48)	(-0.72)	(1.43)	(1.14)	(-0.20)
OutDir	-0.084**	0.761***	0.232**	0.084	0.031	0.229***	-0.027	0.092*	0.133**	0.010	0.088*
	(-1.97)	(2.72)	(2.04)	(1.47)	(1.37)	(4.39)	(-0.88)	(1.73)	(2.23)	(0.34)	(1.69)
InsideOwn	0.017	-0.050	-0.015	-0.025	-0.028	-0.018	-0.033	-0.031	-0.010	0.081***	0.016
	(0.54)	(-0.24)	(-0.17)	(-0.59)	(-1.64)	(-0.47)	(-1.48)	(-0.78)	(-0.23)	(3.57)	(0.40)
CEO/Chair	0.018	0.168**	0.048	0.018	0.004	0.006	0.008	0.033**	0.006	0.011	-0.001
	(1.36)	(1.97)	(1.38)	(1.04)	(0.57)	(0.38)	(0.88)	(2.06)	(0.32)	(1.22)	(-0.08)
CapEx/Assets	0.081	1.102**	0.474**	0.198*	0.032	0.033	0.128**	0.087	-0.046	0.162***	-0.060
	(1.03)	(2.14)	(2.27)	(1.88)	(0.76)	(0.34)	(2.29)	(0.89)	(-0.42)	(2.86)	(-0.63)
R&D/Assets	0.039	-0.081	-0.100	-0.035	-0.011	-0.018	-0.043**	0.023	-0.022	0.011	-0.041
	(1.29)	(-0.41)	(-1.24)	(-0.85)	(-0.69)	(-0.49)	(-1.99)	(0.60)	(-0.52)	(0.49)	(-1.09)
ROA	-0.007	0.071	-0.006	0.015	-0.005	0.008	-0.014	0.013	0.010	-0.012	-0.005
	(-0.46)	(0.73)	(-0.17)	(0.76)	(-0.58)	(0.44)	(-1.36)	(0.73)	(0.48)	(-1.16)	(-0.28)
Constant	-0.731**	4.125*	0.465	0.673	0.002	0.392	-0.102	0.773*	0.744	-0.851***	0.821**
	(-2.16)	(1.87)	(0.52)	(1.49)	(0.01)	(0.95)	(-0.42)	(1.84)	(1.59)	(-3.49)	(2.00)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2		0.450	0.321	0.292	0.204	0.381	0.268	0.283	0.319	0.292	0.231
Observations	2587	2587	2587	2587	2587	2587	2587	2587	2587	2587	2587
F Statistic	980.21										

Table 12: **Relationship between the number of strong ATPs in IPO firms' corporate charters, pre-IPO innovation, and IPO firm valuation (IV results)**

The sample consists of 2,692 venture-backed IPOs conducted between 1993 and 2015. In first-stage regressions, ExmLeniency-1&-2 is the average approval rate of examiners who examine firms' patent applications in years -1 and -2 combined prior to IPO. In second-stage regressions, Q1StATPCountHat is the predicted value of Q1StATPCount from first-stage regressions; Q1StATPCiteHat is the predicted value of Q1StATPCite from first-stage regressions. Q1StATPCount is a dummy variable equal to 1 for firms with above median number of Strong ATPs and non-zero number of patents filed for and eventually granted in years 1 and 2 combined before IPO. Q1StATPCite is a dummy variable equal to 1 for firms above median number of Strong ATPs and non-zero number of citations per patent filed for and eventually granted in years 1 and 2 combined before IPO. In second-stage regressions, dependent variables QOP, QFTD, and QIM are three definitions of Tobin's Q. Tobin's Q is the ratio of the market value of assets to the book value of assets, where the market value of assets is equal to the book value of assets minus the book value of common equity plus the number of shares outstanding times the market price (either IPO offer price (for QOP), first trading day closing price (for QFTD), or the closing price at the end of the issue month (for QIM)). MQFactor is the management quality factor score obtained using common factor analysis on the firm-size-, firm-age-, and industry-dummies-adjusted TSize, MBA, PriorExp, LawAcc, CPA, Core, Comp, and Board. Tenure is the average number of years a firm's management team members have been with the firm. TenHet is the coefficient of variation of management team members' tenures. LnAssets is the natural logarithm of the book value of assets immediately prior to IPO. LnAge is the natural logarithm of one plus firm age. OutDir is the proportion of outside directors in the board of directors. InsideOwn is the proportion of voting power owned by firm officers and directors immediately after IPO. CEO/Chair is an indicator variable equal to one if a CEO is also a Chairman of the board of directors, and zero otherwise. CapEx/Assets is the ratio of capital expenditures to assets in the fiscal year prior to IPO. R&D/Assets is the ratio of R&D expenses to assets in the fiscal year prior to IPO. ROA is the ratio of net income to assets in the fiscal year prior to IPO. All regressions include 4-digit SIC industry code dummies, year dummies, and state dummies. All four accounting variables (i.e., LnAssets, CapEx/Assets, R&D/Assets, and ROA) and dependent variables are winsorized at the 1% and 99% levels. t-statistics are in parentheses. ***, ** and * indicate significance at the 1%, 5%, and 10% level, respectively.

Dependent Variable	Q1StATPCount	QOP	QFTD	QIM	Q1StATPCite	QOP	QFTD	QIM
	1st stage	2nd stage	2nd stage	2nd stage	1st stage	2nd stage	2nd stage	2nd stage
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ExmLeniency-1&-2	0.065***				0.060***			
	(7.68)				(7.23)			
Q1StATPCountHat		3.206	13.849***	14.179***				
		(1.50)	(3.24)	(3.23)				
Q1StATPCiteHat						3.501	15.154***	15.480***
						(1.50)	(3.22)	(3.21)
MQFactor	-0.003	0.116**	0.263**	0.208*	-0.002	0.114*	0.253**	0.200
	(-0.82)	(1.99)	(2.22)	(1.70)	(-0.63)	(1.96)	(2.13)	(1.63)
Tenure	0.000	-0.013	-0.026	-0.014	-0.000	-0.013	-0.024	-0.012
	(0.01)	(-0.69)	(-0.66)	(-0.33)	(-0.09)	(-0.67)	(-0.61)	(-0.28)
TenHet	0.000	0.101	0.037	0.013	0.001	0.099	0.029	0.004
	(0.07)	(1.49)	(0.27)	(0.09)	(0.21)	(1.46)	(0.21)	(0.03)
LnAssets	0.009***	-0.331***	-0.431***	-0.471***	0.009***	-0.334***	-0.445***	-0.484***
	(3.24)	(-7.01)	(-4.49)	(-4.68)	(3.38)	(-6.95)	(-4.52)	(-4.70)
LnAge	0.003	-0.046	-0.352**	-0.335*	0.002	-0.045	-0.348**	-0.331*
	(0.56)	(-0.55)	(-2.07)	(-1.90)	(0.48)	(-0.54)	(-2.03)	(-1.86)
OutDir	-0.013	-0.330	-0.269	-0.123	-0.012	-0.331	-0.266	-0.124
	(-0.71)	(-1.07)	(-0.43)	(-0.19)	(-0.66)	(-1.07)	(-0.42)	(-0.19)
InsideOwn	0.030**	0.805***	1.443***	1.468***	0.022*	0.823***	1.517***	1.550***
	(2.16)	(3.40)	(2.99)	(2.94)	(1.65)	(3.52)	(3.16)	(3.12)

CEO/Chair	0.015***	0.005	-0.163	-0.129	0.015***	0.001	-0.181	-0.149
	(2.63)	(0.05)	(-0.80)	(-0.61)	(2.69)	(0.01)	(-0.87)	(-0.70)
CapEx/Assets	0.047	1.231**	1.835	3.330***	0.043	1.232**	1.869	3.337***
	(1.35)	(2.11)	(1.54)	(2.73)	(1.26)	(2.12)	(1.56)	(2.71)
R&D/Assets	-0.012	0.333	0.427	0.791*	-0.015	0.345	0.483	0.850*
	(-0.88)	(1.50)	(0.94)	(1.70)	(-1.10)	(1.56)	(1.06)	(1.81)
ROA	-0.003	0.008	0.085	0.358	-0.004	0.012	0.107	0.381*
	(-0.50)	(0.07)	(0.38)	(1.56)	(-0.69)	(0.11)	(0.48)	(1.65)
Constant	-0.214	20.530***	9.428*	22.948***	-0.213	20.590***	9.621*	23.218***
	(-1.44)	(8.35)	(1.85)	(4.48)	(-1.48)	(8.35)	(1.87)	(4.49)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2		0.263	0.221	0.218		0.262	0.210	0.207
Observations	2547	2547	2517	2486	2547	2547	2517	2486
F Statistic	58.92				52.28			

Table 13: **Relationship between the number of (strong) ATPs in IPO firms' corporate charters and post-IPO innovation**

The sample consists of 2,692 VC-backed IPOs conducted between 1993 and 2015. Dependent variables LnCount1 and LnCount2 are the natural logarithms of one plus the number of patents a firm files for and is eventually granted in years 1 and 2 after IPO, respectively. LnCount1&2 is the natural logarithm of one plus the number of patents a firm files for and is eventually granted in years 1 and 2 combined after IPO. LnCite1 and LnCite2 are the natural logarithms of one plus the number of citations per patent a firm files for and is eventually granted in years 1 and 2 after IPO, respectively. LnCite1&2 is the natural logarithm of one plus the number of citations per patent a firm files for and is eventually granted in years 1 and 2 combined after IPO. Strong ATP is the number of five strong ATPs in a firm's corporate charter at IPO: staggered boards, poison pills, supermajority required to approve mergers, supermajority required to amend charter and bylaws, and unequal voting rights. Descriptions of individual ATPs are in Appendix A. LnCount-1&-2 is the natural logarithm of one plus the number of patents a firm files for and is eventually granted in years -1 and -2 combined prior to IPO. LnCite-1&-2 is the natural logarithm of one plus the number of citations per patent a firm files for and is eventually granted in years -1 and -2 combined prior to IPO. MQFactor is the management quality factor score. Tenure is the average number of years a firm's management team members have been with the firm. TenHet is the coefficient of variation of management team members' tenures. LnAssets is the natural logarithm of the book value of assets immediately prior to IPO. LnAge is the natural logarithm of one plus firm age. OutDir is the proportion of outside directors in the board of directors. InsideOwn is the proportion of voting power owned by firm officers and directors immediately after IPO. CEO/Chair is a dummy equal to 1 if a CEO is also a Chairman of the board of directors. CapEx/Assets is the ratio of capital expenditures to assets in the fiscal year prior to IPO. R&D/Assets is the ratio of R&D expenses to assets in the fiscal year prior to IPO. ROA is the ratio of net income to assets in the fiscal year prior to IPO. All regressions include 4-digit SIC industry code dummies, year dummies, and state dummies. All regressions are OLS regressions with standard errors clustered at state level. All four accounting variables (i.e., LnAssets, CapEx/Assets, R&D/Assets, and ROA) are winsorized at the 1% and 99% levels. t-statistics are in parentheses. ***, ** and * indicate significance at the 1%, 5%, and 10% level, respectively.

	LnCount1	LnCount2	LnCount1&2	LnCite1	LnCite2	LnCite1&2
	(1)	(2)	(3)	(4)	(5)	(6)
Strong ATP	0.023**	0.023**	0.029**	0.033	0.005	0.015
	(2.30)	(2.50)	(2.51)	(0.96)	(0.21)	(0.55)
LnCite-1&-2				0.398***	0.356***	0.486***
				(33.95)	(25.16)	(38.31)
LnCount-1&-2	0.670***	0.618***	0.818***			
	(25.64)	(14.04)	(25.06)			
MQFactor	-0.022**	-0.009	-0.012	0.019	0.020	0.042
	(-2.18)	(-0.77)	(-0.90)	(0.71)	(0.61)	(1.25)
Tenure	-0.012***	-0.012**	-0.016***	-0.011	-0.013*	-0.015*
	(-3.75)	(-2.30)	(-3.57)	(-1.26)	(-1.73)	(-1.79)
TenHet	-0.000	0.000	0.004	-0.015	-0.022	-0.029
	(-0.00)	(0.03)	(0.18)	(-0.41)	(-0.56)	(-0.67)
LnAssets	0.037*	0.039**	0.032	0.039	0.033	0.014
	(1.75)	(2.29)	(1.43)	(1.46)	(1.25)	(0.42)
LnAge	-0.032**	-0.035***	-0.040**	-0.051	-0.021	-0.012
	(-2.07)	(-3.18)	(-2.26)	(-1.50)	(-0.85)	(-0.30)
OutDir	-0.187**	-0.126*	-0.168*	-0.074	-0.047	-0.057
	(-2.30)	(-1.96)	(-1.88)	(-0.45)	(-0.33)	(-0.28)
InsideOwn	0.099	0.186**	0.156	0.123	0.215***	0.143
	(1.40)	(2.57)	(1.63)	(1.44)	(2.78)	(1.56)
CEO/Chair	0.056***	0.024	0.039**	-0.006	0.059*	0.049
	(3.46)	(1.63)	(2.40)	(-0.14)	(1.73)	(0.98)
CapEx/Assets	0.442**	0.262	0.521**	0.946**	0.557**	1.176***
	(2.67)	(1.17)	(2.32)	(2.63)	(2.18)	(2.82)
R&D/Assets	0.116**	0.130***	0.177***	0.303***	0.278**	0.253*
	(2.26)	(3.29)	(3.19)	(3.22)	(2.52)	(1.74)
ROA	0.086***	0.102***	0.130***	0.162***	0.174**	0.196***
	(3.48)	(3.46)	(4.04)	(3.44)	(2.26)	(2.70)
Constant	-0.877**	0.135	0.036	0.621*	-1.346***	0.640

	(-2.53)	(0.49)	(0.11)	(1.83)	(-3.02)	(1.15)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.655	0.587	0.668	0.460	0.439	0.515
Observations	2618	2618	2618	2618	2618	2618

Appendix A: Descriptions of firm-level ATPs[34]

Provision	Description
1. Anti-greenmail provision	Greenmail refers to targeted stock repurchases by management, usually at a substantial premium over market value, of company shares from groups or individuals seeking control of company. Anti-greenmail provisions prohibit managers from entering into such arrangements with bidders, unless they are approved by shareholders or the same repurchase offer is made to all shareholders.
2. Blank check preferred stock	This is preferred stock which is authorized but not issued. It gives a company's board of directors power to issue shares of preferred stock at its discretion and determine its voting, distribution, conversion, and other rights at the time of the issue. Blank check preferred stock can be placed with friendly parties to deter potential takeover bids by diluting bidders' equity and voting positions. It can be also used to establish poison pills.
3. Staggered (classified) board	A staggered board is a board of directors which is usually divided into three classes, with each class serving a three-year term, and each class being elected in different years. Classifying the board makes it more difficult to change the control of the company through proxy contests since only a minority of directors is elected each year. A bidder who has the voting control of the company will be unable to gain the control of the board in a single election and would need up to two years for that.
4. Fair price provision	This provision is usually adopted to defend against two-tiered front-end-loaded tender offers when the bidder first buys a controlling block of shares and then offers lower price to remaining shareholders. This usually forces the target shareholders to tender their shares in the first stage regardless of the price offered, since the second stage price is going to be lower. Fair price provisions usually require the bidders to pay the remaining shareholders the same price as was paid to acquire the controlling block in the first stage. The bidder may avoid such pricing requirements if the offer is approved typically by the supermajority of disinterested shareholders or the board of directors.
5. Poison pills	Also known as shareholder rights plans, poison pills are financial instruments in a form of rights or warrants issued to shareholders that trade with common shares. When triggered by a hostile takeover attempt poison pills detach, trade separately, and become valuable. Poison pills can dilute a bidder's equity holdings and voting interests in a target company by giving a right to common shareholders to buy additional shares of the target company at a steep discount or they can dilute a bidder's equity holdings in a merged company by giving a right to target firm shareholders to buy discounted shares of post-merger company.
6. Stakeholder clause	This provision permits directors, when evaluating takeover bids, to consider the interests of constituencies other than shareholders such as employees, creditors, suppliers, customers, surrounding communities, and others. Stakeholder clause provides target firm directors with legal basis to take actions that could be value-decreasing to shareholders, for example, turn down attractive takeover bids.
Shareholder meeting restrictions	

[34] As noted in Chemmanur, Paeglis, and Simonyan (2011), the descriptions of ten firm-level ATPs in Appendix A were taken from Field and Karpoff (2002) and the descriptions of the remaining nine firm-level ATPs were taken from numerous other sources.

7. Meetings called only by directors or executives	This provision does not allow common shareholders and authorizes only directors or executives to call special shareholder meetings to act on matters that arise between regularly scheduled meetings. It can deter potential takeovers by delaying removal of directors by a controlling bidder or by hindering the ability of common shareholders to vote on attractive bids.
8. Supermajority required to call special meetings	This provision allows common shareholders to call special shareholder meetings if they can get the consent of a shareholder or groups of shareholders holding a supermajority of outstanding shares.
9. Advanced notice requirement	This provision requires shareholders to give an advanced notice regarding the matters they intend to present at the shareholders' meeting. It usually specifies a "window" for the earliest and the latest dates for such submissions, e.g., no later than 60 days prior to the meeting with a submittal window of at least 60 days. Advance notice requirements can deter takeovers by prohibiting the shareholders to vote on matters regarding the takeover bids if a proper advance notice was not submitted.
10. Restrictions on action by written consent	An action by written consent is an event when an action is taken without a meeting of shareholders individually or collectively consent in writing to such action. A provision that limits the ability of shareholders to act by written consent, by prohibiting it or requiring unanimous/majority written consent, can delay takeovers by forcing a bidder to take an action at the next scheduled meeting.
Supermajority vote requirements	
11. Supermajority required to approve mergers	This provision requires the vote of a supermajority (usually, at least two-third and up to 90 percent) of shareholders to approve mergers, business combinations, or asset sales. Supermajority requirements are often unreachable either because they exceed the level of shareholder participation at a meeting or because of a large size of insider or ESOP share holdings.
12. Supermajority required to replace directors	This provision requires the vote of a supermajority of shareholders to replace directors and can deter takeovers by limiting the ability of a bidder to remove directors opposing the takeover.
13. Supermajority required to amend charter or bylaws	This provision requires the vote of a supermajority of shareholders to amend charter or bylaws and restricts the ability of shareholders to repeal other ATPs which are usually proposed as amendments to charter and bylaws.
14. Unequal voting rights	Unequal voting rights refer to a share structure with more than one class of common shares that have different voting rights. Usually insiders of a firm, such as managers and inside directors, hold a class of shares that gives them more than one vote per share compared to the class held by other shareholders with only one vote per share.
Miscellaneous ATPs	
15. Directors can be removed only for cause	According to this provision members of a board of directors can be removed only for cause which limits the ability of potential acquirers to remove directors opposing the takeover.
16. Merger must be approved by inside directors	This provision requires the approval of inside directors or directors not related to a potential bidder for a merger to take effect.
17. Restrictions on transfer of common stock	This type of provision puts various restrictions on transfer of common stock. For example, a provision like this may require principal shareholders to offer their shares first to other principal shareholders before selling them.

18. Restrictions on votes each shareholder may cast	This type of provision puts various restrictions on the votes each shareholder may cast. For example, shareholders who own more shares than a pre-specified threshold may cast only half of their votes.
19. Prohibition of cumulative voting for election of directors	Cumulative voting permits shareholders to put together (cumulate) all their votes for directors and distribute these votes among one, a few, or all directors when more than one director is nominated for election. Cumulative voting makes easy for minority shareholders to elect their own representatives and can be particularly important in proxy contests. Prohibition of cumulative voting limits the ability of bidders to elect their own representatives to the board of directors.