Inventor CEOs and Financing of Innovation: Evidence from IPOs

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This version: July 30, 2022

*Corresponding author: We thank the participants of the seminars at Hong Kong Polytechnic University and New York University Abu Dhabi, and at the 2021 meetings of the European Financial Management Association, Financial Management Association, and Entrepreneurial Finance Association for their helpful comments. We acknowledge research funding support from Zayed University.

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Abstract

We examine the role of inventor CEOs—those with personal hands-on experience of innovation—in the financing of innovation. Using a sample of technology initial public offerings (IPOs) in the US, we document that inventor CEOs are associated with lower underpricing at the time of the IPOs. Inventor CEOs also appear more capable of taking their firms public during "cold" IPO market periods when financing conditions are more difficult. Further, inventor-led firms appear to invest the IPO proceeds more productively, as reflected in the firms' superior innovation outcomes in the post-IPO period. The stock market fails to fully understand these relationships, and IPOs led by inventor CEOs produce large positive abnormal returns in the three years following the offering. Analyses based on regulatory changes and a founder-only sample suggest that these relationships are causal. Our findings are consistent with inventor CEOs facilitating the financing of innovation for startup firms either by more credibly communicating the intrinsic value of the firms' innovation to external investors or by mitigating the agency problems associated with the firms' R&D investments.

Keywords: Financing of innovation, Initial public offering, Innovation, Inventor CEO, Post-IPO stock returns, Underpricing

JEL classification: G32, O31, and G12

1. Introduction

Economists have long recognized the difficulty of financing innovation, especially among young startup firms.[1] The difficulty arises from the obscurity of R&D investment. Unlike other investments, innovative projects often generate assets that are intangible, idiosyncratic to the firm, and tacit rather than codified. Their payoffs are often uncertain and do not follow a well-specified distribution (Scherer, 1998). External financiers, therefore, find it difficult to distinguish between good and bad projects and face the classic "lemons" problem (Leland and Pyle, 1977). Consequently, they tend to be reluctant to finance innovation, raising the cost of capital for innovative projects. In extreme situations where the uncertainty is too great and financiers' risk aversion is high, external financing for young firms' R&D projects can dry up entirely (Hall, 2010; Hall and Lerner, 2010; Nanda and Rhodes-Kropf, 2016). A sizable body of literature in economics and finance has explored the mechanisms that can help overcome this financing challenge, including the presence of venture capitalists (VCs), government interventions, stock market sentiment, and sell-side analysts.[2]

In this study, we examine the role of inventor CEOs—those with personal hands-on involvement in innovation—in the financing of innovation. Inventor CEOs have become a prominent feature of many large technology companies in recent decades.[3] While researchers widely recognize the importance of the CEO's personal attributes for firm performance, they have

[1] This literature dates back to the classic works of Schumpeter (1942), Nelson (1959), and Arrow (1962) and articulates two major difficulties in financing innovation in a competitive market economy. One, to the extent that it is difficult to keep the knowledge created from innovation secret, innovators will not be able to fully benefit from it, leading to underinvestment in innovation. Second, when the innovator and financier are different entities, the information asymmetry between them can create a large wedge between the rate of return required by the entrepreneur innovator and that required by the financier, making it difficult or costly to finance investments in innovation using capital from external sources. It is this latter market failure that our paper addresses. For excellent reviews of the literature in this area, we refer the readers to Hall (2010) Hall and Lerner (2010).

[2] Gompers (1995), Kortum and Lerner (2000), Hellmann and Puri (2000), and Megginson and Weiss (1991) explore the role of venture capitalists in resolving uncertainty for the financiers for early-stage technology companies. Lerner (1999, 2013) and Ferrucci, Guida, and Meliciani (2021) examine the importance of government-funded schemes in easing the financing constraints of technology startups. Perez (2002), Brown, Fazzari, and Petersen (2009), Nanda and Rhodes-Kropf (2013, 2016), and Dang and Xu (2018) show that "hot" periods and/or bullish sentiment in the stock market reduce investors' risk aversion and significantly ease the financing constraints for R&D in general, and riskier R&D in particular. Goldman and Peress (2019) find that information gathering and generation by sell-side analysts help inform the financiers and facilitate innovation financing.

[3] Examples include Elon Musk of Tesla, Jeffrey P. Bezos of Amazon, Lawrence Edward Page and Sergey Brin of Google, Brian M. Krzanich and Leslie L. Vadasz of Intel, and Steven A. Ballmer of Microsoft. Bostan and Mian (2019) report that the share of companies led by inventor CEOs exceeds 25% of the market capitalization of firms listed on NYSE in 2017.

only recently begun to explore the influence of inventor CEOs on firm outcomes. Bostan and Mian (2019) and Islam and Zein (2020) find that inventor CEOs spend more on R&D and enhance a firm's innovation, especially risky breakthrough innovation. They argue that inventor CEOs' innovation experience endows them with valuable insights that translate into a superior ability to understand and manage innovation-intensive projects, including those involving risky breakthrough innovation. In contrast, Byun, Fuller, and Lin (2021) find that inventor CEOs are associated with lower efficiency of R&D investments, greater cash holdings, and reduced leverage; they interpret this as evidence of inventor CEOs exacerbating agency problems in a firm.

These studies suggest opposing hypotheses on the role of inventor CEOs in the financing of innovative firms. If inventor CEOs possess valuable insights and superior knowledge on the firm's innovation capital (Islam and Zein, 2020), they can better communicate its value to external financiers and reduce the firm's valuation uncertainty. Such an effect would be reinforced further if their personal affinity to innovation helps address investors' concerns about the classic moral hazard problem of firms' underinvestment in risky innovation (Rothwell, 1997; Bostan and Mian, 2019; Islam and Zein, 2020). Inventor CEOs, therefore, facilitate the financing of innovation. In contrast, if inventor CEOs exacerbate agency costs in a firm, for example, by overinvesting in pet innovation projects (Byun, Fuller and Lin, 2021) or by being narcissistic, they may be associated with greater uncertainty for investors and, hence, make it more difficult to finance innovation.

To empirically discriminate between these competing hypotheses, we examine the initial public offerings (IPOs) of technology firms. IPOs provide a natural setting to examine the role of inventor CEOs in innovation financing because these often involve small startups, for which financing constraints linked to asymmetric information matter more (Brown and Petersen 2009; Brown, Fazzari, and Petersen, 2009; Hall and Lerner, 2010). Mature firms, in contrast, are not only less reliant on external finance (owing to the availability of internal cash flows), but also have a longer history that signals their quality and helps reduce information uncertainty.[4]

To assess the role of inventor CEOs in the financing of innovative firms, we examine IPO underpricing, often viewed as the discount the firm has to offer investors as a compensation for

[4] IPO firms are also more suited to study the influence of the personal traits of CEOs because they tend to be growing firms and the CEO's influence is shown to be more pronounced in growth firms (Bennedsen, Perez, and Wolfenzon, 2020).

the lemons problem. Prior studies demonstrate that underpricing varies with the uncertainty surrounding the valuation of an IPO (Ritter, 1984; Rock, 1986; Lowry, Officer, and Schwert, 2010). If inventor CEOs reduce (increase) information asymmetry and facilitate (hinder) financing, we expect firms led by inventor CEOs to experience lower (higher) underpricing at the time of their IPOs than firms led by non-inventor CEOs would. In addition, we examine a firm's ability to go public in unfavorable financing environments. In the time series, this means going public during "cold" IPO markets or "off-the-wave" periods, when investors are considerably more risk-averse and financing dries up for startups (Chemmanur and He, 2011). If inventor CEOs facilitate (hinder) financing, firms led by them are more likely than non-inventor-led firms to go public during off-wave periods.

We assemble a novel hand-collected data set that tracks the patenting history of CEOs who were at the helm of US high-technology firms at the time of their IPOs during 1992–2010. Following the literature, CEOs who possess at least one patent in their own name at the time of the IPO are designated "inventor CEOs." The technology sector accounted for more than half of all IPOs in the US during our sample period, and inventor CEOs led about 19% of such IPOs.[5]

We find that inventor CEOs are associated with significantly less underpricing of IPOs relative to others, after controlling for other known determinants of underpricing. Specifically, the CEO's inventor status is associated with approximately 4% less underpricing, which is about one-fifth of the average underpricing of 20% in our sample (excluding the Internet bubble period). We also explore how the effects of inventor CEOs on underpricing vary in the cross-section because their ability to better explain the nature and valuation of their firms' innovation is expected to be especially useful when firms are more R&D-intensive and/or possess harder-to-value innovation capital. Consistent with this expectation, we find that the negative association between inventor CEOs and underpricing is more pronounced among firms with greater R&D intensity and smaller size. Among the firms with above-median R&D intensity in our sample, the economic significance of the association between underpricing and inventor CEO becomes striking: underpricing is about 11% lower for inventor-led firms than for non-inventor-led firms. We further find that inventor-

[5] Many inventor CEOs who led their companies' IPOs in our sample went on to become prominent in their industries. They include Jeffrey P. Bezos of Amazon.com, Elon Musk of Tesla, Jen-Hsun Huang of Nvidia Corp, Reed Hastings of Netflix Inc., Colin M. Angle of iRobot Corp, and Michael Chasen of Blackboard Inc.

led firms are relatively more likely to complete their IPO during "off-wave" periods, when financing conditions are more challenging. They also tend to be more R&D-intensive and smaller at the time of the IPO. Collectively, this evidence is consistent with inventor CEOs significantly facilitating the financing of technology firms at the time of their IPO.

To the extent that inventor CEOs allow firms to overcome financing constraints, they would have greater flexibility in the *timing* of the IPO to suit the financing needs of their firms' R&D, rather than being dictated by financial market conditions; this can lead to better innovation outcomes post-IPO (Chemmanur and He, 2011). Technology firms can especially benefit from this because R&D projects are often non-deferrable, and any delay could lead to a loss of competitive advantage and poor innovation performance (Li, 2011). Consistent with this prediction, we find that in the three years after the IPO, firms led by inventor CEOs produce a higher number of patents compared to firms led by non-inventor CEOs. We also find that inventor-led firms produce more risky and ground-breaking innovations in the post-IPO period, as evidenced by their greater propensity to produce patents cited in the 99^{th} and 95^{th} percentiles of the citation distribution within their technology class year. This is consistent with inventor CEOs channeling more of the IPO proceeds to risky breakthrough innovation projects.

Finally, we examine abnormal stock returns in the three-year post-IPO period to assess whether the stock market fully understands the positive influence of inventor CEOs on the success of a firm's IPO. Using a calendar-time portfolio approach and the Fama-French three-factor model, we find that the average abnormal stock return during the three-year post-IPO period for inventor-led firms is 0.96% per month (12.15% annualized). The magnitude of this return is striking given the evidence in the literature of an insignificant or negative abnormal return for a typical US IPO (Ritter and Welch, 2002).

The correlations between inventor CEOs and IPO outcomes can be interpreted in at least two ways. One interpretation, based on the notion of optimal firm–CEO matching, is that firms with higher innovation potential choose to hire inventor CEOs because they have the relevant skill set to effectively communicate this potential to investors and guide the firm in its transition from a private to a public entity. An alternative causal interpretation is that inventor CEOs' personal hands-on involvement with firms' innovation endows them with specialized knowledge, which

enables them to communicate the value of firms' innovation capital to outsiders more credibly and better manage the growth of this capital during the firms' transition. Notably, both interpretations imply that inventor CEOs possess a unique skill set to manage technology firms' transitions to public entities. Therefore, we believe that the correlations we document are informative in and of themselves.

Nevertheless, to explore causal interpretation, we conduct two additional analyses. First, we use Germaise's (2011) findings that a state-level increase in the enforceability of non-competition agreements significantly enhances the difficulty of matching firms and CEOs. If the effects of inventor CEOs on IPO outcomes are primarily driven by firm–CEO matching, then these effects should become weaker with higher enforceability of non-competition agreements. We investigate this possibility but find no empirical support. Second, we examine a subset of firms whose CEOs are founders. The presence of a founder CEO mitigates the concern that the CEO was appointed around the time of the IPO to manage firm transition. Within this founder-only sample, we continue to find results similar to those of our overall sample, suggesting that optimal matching between firms and CEOs is unlikely to be the primary factor that drives our results.

Our study contributes to three distinct streams of literature. First, we contribute to the literature on innovation financing by identifying CEOs' personal hands-on innovation experience as a novel, within-firm human capital that facilitates innovation financing. Second, our findings add to the recent debate on whether inventor CEOs positively or negatively contribute to firm outcomes. Extant studies assess the role of inventor CEOs by examining innovation outcomes and agency costs in mature listed firms and find mixed results (Islam and Zein, 2020; Byun, Fuller, and Lin, 2021). In contrast, we focus on the role of inventor CEOs in financing innovation in young startup firms and find their unequivocally positive influence. In fact—perhaps owing to our focus on newly listed firms—which tend to be opaque, we also uncover unique evidence that inventor CEOs are associated with large positive abnormal returns for firms in the three-year post-IPO period. This finding suggests that the stock market fails to fully recognize the role that inventor CEOs play in the financing and management of innovation in newly listed firms. Finally, we contribute to IPO literature by documenting evidence that inventor CEOs influence IPO outcomes. While this literature has examined the determinants of IPO underpricing and long-term performance, including the role of VCs, underwriters, and analysts (see Ritter and Welch, 2002,

for a review paper), attempts to link within-firm human capital to IPO outcomes have been limited, with few notable exceptions.[6] The effects of inventor CEOs that we document are more encompassing than many previously documented determinants of IPO success, as they are discernible both at the time of IPO and during the post-IPO period. Our evidence that a subset of technological IPOs earn large positive abnormal returns in the post-IPO period is unique to the present study, as extant studies typically document zero or negative long-term average returns for IPOs.

While we emphasize the importance of our findings, we acknowledge at the outset that we did not consider the characteristics of other members of the top management teams in our analysis. This is because of data limitations, which tend to be more restrictive for the IPO sample than for large listed companies. Other members of the management team might also influence at least some of the IPO outcomes we study. Sundaramurthy, Pukthuanthong, and Kor (2014), for instance, use a sample of 360 biotechnology IPOs to show that the characteristics of other members of the management team can interact with CEO characteristics to influence IPO underpricing.

The remainder of this paper is organized as follows. Section 2 reviews the relevant literature and develops the hypotheses. Section 3 describes the procedure followed to assemble our dataset and construct the variables, and Section 4 reports the results. Section 5 presents analyses that address endogeneity concerns, and Section 6 concludes the paper.

2. Related Literature and Hypotheses

A. Role of Inventor CEOs in Facilitating IPO Financing

Sundaramurthy, Pukthuanthong, and Kor (2014) show that the personal characteristics of the CEO, such as industry and board experience, influence IPO underpricing. Therefore, a CEO's prior experience with innovation may also be relevant to IPO pricing and other IPO outcomes.

[6] Chemmanur and Paeglis (2005) document that IPOs with superior management teams experience better outcomes. Their work analyzes aggregated attributes of the management team as a whole and IPOs in general. They do not focus on CEOs or study outcomes specific to technology IPOs, such as their ability to go public in off-the-wave periods and the success of their post-IPO innovation. Sundaramurthy, Pukthuanthong, and Kor (2014) examine the effect of CEOs' board and industry experience and educational background on IPO underpricing. We control for these variables in our analyses. Gao and Jain (2012) examine the relationship between the founder status of CEOs and post-IPO stock returns. We control for the effect of founder CEOs in all our analyses.

Specifically, the CEO's personal involvement in the innovation process can influence the success of an IPO of a technology firm through two distinct channels. The first is a communications channel in which the inventor CEO affects the firm's ability to communicate the value of its innovation capital credibly and effectively to outside investors. Second, there is an agency cost channel in which the inventor CEO influences agency costs and moral hazard problems inside the firm. For each channel, theoretical arguments can go both ways as to whether inventor CEOs help or hinder financing, as discussed below.

The communication channel matters because, in the case of high-technology IPOs, personal communication by CEOs can be an important source of information for investors. During the common practice of "book building," which typically lasts around four weeks, the top management of the issuer joins underwriters to go on a "road show" to market the company to prospective buyers. During this, investors have an opportunity to hear about the firm's operations, valuation, and future plans directly from the CEO and other top management. A CEO with superior knowledge can discuss the firm's valuation and intricacies more credibly with outside investors and respond to investor queries. Even though the US Securities and Exchange Commission (SEC) regulations require that management and underwriters can only discuss information already in the IPO prospectus during the roadshow process, there can be a large grey area in such communication. Although a project is noted and discussed in the prospectus, the way a project's prospects, challenges, and opportunities are discussed and the questions and concerns answered in a face-to-face discussion can arguably provide additional clues, clarity, or reassurance to investors.

Personal communication by top management can prove especially useful, because other avenues for sharing insights about a firm's innovation capital with potential investors may be limited. Being young, startups do not have the time to develop a reputation that would allow them to adequately signal their quality. Reducing information asymmetry via full disclosure in the prospectus may also be impossible because of the fear of imitation by competitors (Bhattacharya and Ritter, 1983). Finally, even though asymmetric information problems can sometimes be mitigated by specialized venture capital funds because of their role as informed monitors of early-stage technology startups, experienced VCs often develop a reputation for honoring non-disclosure agreements that enable them to gather better information about proposed projects (Hall, 2010).

CEOs' personal involvement in the innovation process allows them to communicate the value of the firms' innovation capital more credibly to outside investors. They can better address investor queries about the intricacies, risks, and prospects of ongoing innovation. The literature on learning-by-doing suggests that inventor CEOs' hands-on experience endows them with unique insights into the complexities of a firm's technology and prospects that cannot otherwise be gained (Arrow, 1962; Irwin and Klenow, 1994; Thompson, 2010; Islam and Zein, 2020). Inventor CEOs may also know more about the firm's innovation capital because their presence makes the upward transfer of knowledge from the lower levels of the innovation process more efficient (Grant, 1996). Conversely, inventor CEOs' personal involvement with R&D might make them more fixated on technicalities and less aware of the latest customer and market needs (Rothwell, 1977) and, hence, less suitable for marketing their firms to underwriters and institutional investors. For instance, VCs sometimes replace technical founders with professional management teams for similar reasons (Hellmann and Puri, 2002). Thus, theories offer contrasting predictions on whether CEOs' personal hands-on experience of innovation positively or negatively influences their ability to credibly communicate the value of the firm's innovation to outsiders. If the effect is positive (negative), that is, if the inventor CEO is more (less) effective in explaining firm valuation, investors in inventor-led IPOs would face less (more) valuation uncertainty.

The second channel through which inventor CEOs matter for technology IPOs is that they can exacerbate or mitigate agency costs and moral hazard problems in the firm. In addition to generic agency costs such as spending on personal benefits, two specific moral hazard problems affect innovative firms (Hall, 2010; Hall and Lerner, 2010). The first is an underinvestment problem in which managers, who have short horizons and are more risk-averse than shareholders, underinvest in risky innovation because its benefits accrue in the long term and increase the idiosyncratic risk of the firm, especially in the short term. Second, an overinvestment problem occurs when too much is invested in negative-NPV innovation projects, either because the managers or entrepreneurs are overconfident or because they benefit disproportionately from the upside potential in the case of success, but do not fully share the investment costs with the

financiers in the case of failure (Cornelli and Yosha, 2003).[7] The arguments in Rothwell (1997), Islam and Zein (2020), and Bostan and Mian (2019) suggest that inventor CEOs reduce the moral hazard problem of underinvestment in risky innovation because of their personal affinity to innovation and long-term orientation.[8] In contrast, Byun, Fuller, and Lin (2021) suggest that inventor CEOs may exacerbate the moral hazard problem of overinvestment in innovation owing to their overconfidence and/or narcissism, especially regarding the projects they are personally involved with. If inventor CEOs mitigate (exacerbate) the moral hazard problem of underinvestment (overinvestment) in risky innovation, it would reduce (increase) the uncertainty for external financiers, lower (increase) the returns they require, and facilitate (hinder) the financing of the firm's IPO.

To empirically disentangle the opposing hypotheses, we compare the underpricing of IPOs led by inventor and non-inventor CEOs. Underpricing is the difference between the price at which a share is offered to investors and the price at which the share is traded on the first trading day. It is proverbially called "money left on the table" for investors, or discounts offered to them, to persuade them to invest in an IPO. Several theoretical models propose that underpricing is an efficient response to the complexity of the valuation investors face when investing in the equity of private companies that have uncertain prospects and are difficult to value (Beatty and Ritter, 1986; Rock, 1986; Benveniste and Spindt, 1989). Empirical work has largely supported this idea by demonstrating that IPOs characterized by greater uncertainty experience greater underpricing (see, for example, Ritter and Welch, 2002; Lowry, Officer, and Schwert, 2010). Therefore, we posit that if inventor CEOs reduce (increase) valuation uncertainty for their firms, either by communicating their value more (less) credibly or by mitigating (exacerbating) concerns about moral hazard, IPOs led by them would experience lower (greater) underpricing.

To further explore the importance of inventor CEOs in IPO financing, we examine inventor CEOs' ability to take their firms public in more challenging financing environments. We identify

[7] One manifestation of the overinvestment problem is the continuation of the project by managers/entrepreneurs that investors would like to terminate (Admati and Pfleiderer, 1994; Cornelli and Yosha, 2003). Controlling for the overinvestment problem through higher leverage (that limits free cash flows) is typically not an option for young innovative firms, because the assets they hold are intangible, largely embedded in human capital and not redeployable.
[8] Rothwell (1997) further argues that personal enthusiasm for R&D and intrinsic motivation encourage inventor CEOs to nurture an innovation-centric culture that encourages risk-taking and experimentation across various layers of the organization, which can bring about superior innovation investments in the post-IPO period.

difficult financing environments along two dimensions. Across time, it is commonly known that during "cold" or "off-the-wave" IPO periods, financing for new firms largely dries up owing to the heightened risk aversion of investors (e.g., Ritter, 1984; Chemmanur and He, 2011). In the cross-section, we posit that it is generally more difficult to go public when a firm is more R&D-intensive and smaller (Hall, 2010; Hall and Lerner, 2010). As Hall (2010) notes, in addition to lacking a history of earnings and cash flows, such firms may not possess patents, and even if they do, it is not immediately clear whether those patents can be converted into commercial success. If the presence of inventor CEOs at the helm makes it easier (difficult) for technology firms to raise financing, we would expect that more (fewer) inventor-led firms can go public during "cold" periods and when they are more R&D-intensive and smaller.

B. Inventor CEOs and Post-IPO Innovation

To the extent that inventor CEOs help overcome (exacerbate) the constraints imposed by an unfavorable financing environment, the IPO timing may be more (less) related to the capital requirements of the firm's ongoing R&D projects rather than to the conditions in financial markets; this would lead to the investment of the financing proceeds in more attractive projects, resulting in better innovation outcomes. Chemmanur and He (2011) develop a theory of the timing of a firm's decision to go public and IPO waves based on product-market considerations. They demonstrate that firms that can go public when their competitors cannot—say, during off-wave periods—gain a competitive advantage and show superior productivity in the post-IPO period. Their results are driven by two factors. First, access to public finances allow firms to raise funds at lower costs than private sources. Second, going public allows a firm to gain a competitive advantage for reasons such as additional credibility with customers and suppliers, being able to hire high-quality employees as a public firm, rewarding them more efficiently using stock and stock options, and being able to take over related firms in the same industry (holding patents for introducing various product innovations) using their own (publicly traded) stock.

Competitive advantage associated with superior timing is likely to be more effective for technology firms. First, unlike other capital expenditures, the R&D investment timing tends to be much less flexible, often determined by science and/or competitive pressure (Li, 2011). If a firm cannot raise sufficient funds to conduct the required tests, it must suspend the project, significantly

reducing a firm's value by preventing the resolution of technical uncertainty and increasing the likelihood that competitors conclude an R&D project before it can. Consequently, being able to appropriately time IPO financing can be a competitive advantage for a firm, with its R&D investments leading to better innovation performance in the post-IPO period. Second, Bernstein (2015) shows that firms going public experience an exodus of skilled scientists but offset it by acquiring innovation externally. Superior timing of going public affords a competitive advantage to an innovative technology firm on two fronts: it is in a better position to retain skilled scientists by offering them stocks and options, while using publicly traded shares to acquire companies like itself.

Apart from the financing channels, the literature suggests other reasons why inventor CEOs matter for a firm's innovation performance in the post-IPO period. Islam and Zein (2020) advance arguments and provide supporting evidence that inventor CEOs possess a superior ability to evaluate, select, and execute innovation-intensive investment projects among mature listed firms. In such case, this advantage could lead to even more discernible differences in the innovation outcomes of newly listed firms in the post-IPO period. The amount of newly raised capital that needs to be invested, relative to the firm's existing capital base, tends to be significantly large for newly listed firms. Choosing the right R&D investments for IPO proceeds and managing such investments tend to be a dynamic process that resembles the management of real options, because the nature of uncertainty about innovation continually changes in the early years (Hall, 2010). Inventor CEOs' superior knowledge may provide firms with an edge in managing these real options.[9] Conversely, as noted earlier, it can be argued that inventor CEOs' personal involvement in firm innovation may exacerbate the well-known moral hazard problem, whereby inventor-led new listings overinvest their newly raised capital in innovation, especially in projects that CEOs are personally associated with to satisfy their egos rather than in commercially desirable ones. This can make the post-IPO performance of inventor-led firms worse than that of other firms.

To disentangle the opposing effects of inventor CEOs on post-IPO innovation, we utilize several measures of innovation success commonly used in the literature, including the number of total patents the firm generates and the number of the breakthrough patents that fall among the top

[9] Echoing this logic, Bennedsen, Perez, and Wolfenzon (2020) find evidence that a CEO's personal effects are stronger for growing firms.

1% and top 5% of patents in their respective technology classes and years. We compare the change in these measures for inventor-led IPOs in the post-IPO period with the corresponding change for non-inventor-led IPOs, after controlling for other known determinants of innovation.

C. Inventor CEOs and Post-IPO Stock Returns

Our last hypothesis revolves around the abnormal stock returns generated by inventor CEOs' IPOs in the three-year period following the IPO. If the stock market fails to fully understand how an inventor CEO influences IPO outcomes and future firm innovation, the firm's shares will be mispriced at the time of listing, and we expect them to generate abnormal stock returns in the post-IPO period. Prior work suggests that the stock market does not always understand the factors that drive future firm innovation; hence, the factors that predict innovation also predict future stock returns. Hirshleifer, Hsu, and Li (2013) find that a firm's innovative efficiency, defined as patents or citations scaled by R&D expenditures, predicts higher future innovation as well as positive future stock returns. In a subsequent paper, Hirshleifer, Hsu, and Li (2018) identify innovation originality as another variable that predicts both future firm innovation and stock returns. Likewise, Cohen et al. (2013) develop simple measures of a firm's past success in innovation and show that they predict both future innovation and stock returns.[10]

Inventor-CEO IPOs may generate positive abnormal stock returns for another reason. Several authors (e.g., Duffie, Gârleanu, and Pedersen, 2002; Chen, Hong, and Stein, 2002) have developed models showing that the long-term underperformance of IPOs is due to heterogeneous expectations among investors about the firm's future cash flows and that short-selling the shares of newly public firms is costly. Chemmanur and Paeglis (2005) use Miller's (1977) argument to point out that if a company's management can reduce information asymmetry around the time of an IPO, there would be less dispersion of firm valuation among investors; this should reduce the overvaluation of the firm during its IPO, leading to better post-IPO returns than those on other IPOs. Using the same reasoning, if inventor CEOs help reduce information uncertainty, their firms would experience less overvaluation at the time of the IPO relative to other IPOs and less negative abnormal returns after the IPO. One way to disentangle these two channels is to examine the sign

[10] Unlike the predictors in these prior studies, which are all constructed from firms' past innovation history, the predictor we employ is a personal trait of the CEO.

and magnitude of abnormal returns for inventor-led IPOs. The first explanation predicts positive abnormal stock returns, whereas the second predicts returns superior to those of non-inventor-led IPOs. Therefore, we examine the abnormal returns for inventor-led IPOs both in absolute terms and relative to those of non-inventor-led IPOs.

3. Data

A. Sample Selection

We extract a sample of all IPOs in the US between 1992 and 2010 from the Securities Data Company (SDC) Global New Issues database. We choose 1992 as the start of this sample period because information about the CEOs of newly listed firms, which we collect from several datasets such as Execucomp, Thomson Insider, Compustat Capital IQ, and BoardEx, is not easily available for earlier periods. The sample period ends in 2010 because the US patent inventor database from Li et al. (2014), used to identify CEOs' inventor status, ended in 2010. In line with prior literature, we exclude IPOs with an offer price of less than $5, and exclude IPOs of financial institutions and utility firms, spin-offs from parents, depository shares, limited partnerships, and unit offerings. This yielded 3,908 observations, of which we retain 2,286 firms labeled as "high-technology" by the SDC Global New Issues database. We limit our analyses to technology firms, as in Islam and Zein (2020), because the bulk of innovation takes place in such firms, where most of the top executives with technical backgrounds are also found. After restricting the sample to IPOs with financial and stock price data from Compustat and the Centre for Research in Security Prices (CRSP), we obtain 1,569 observations.

Next, we search for the names and identities of CEOs for each IPOs. We start with the Execucomp database, which identifies the CEO for each firm every year and provides information on when the CEO took on the role. If an IPO firm from our sample exists in the Execucomp dataset, we use CEO employment period information and IPO date to identify the CEO at the time of the IPO. For the remaining IPOs, we manually obtain the CEOs' names using the SEC's Electronic Data Gathering, Analysis, and Retrieval (EDGAR) website that provides company filings, including Form S-1 for the registration of securities under the Securities Act of 1933.

B. Classifying Inventor CEOs

After finding the CEO name at the time of the IPO, we use the Inventor Database created by Li et al. (2014) to obtain information on whether the CEO is an inventor. The database eliminates ambiguities related to inventors and provides unique inventor and assignee firm IDs for each patent granted by US Patents and Trademark Office. Using this database, we obtain the affiliations of inventors, co-inventors, addresses, and zip codes, as well as the patents granted to these inventors over the years. Unfortunately, the identities of inventors cannot be automatically matched with those of CEOs, as the inventor database does not share a common identifier with any of the databases used to collect their names. Therefore, we follow a matching process akin to Islam and Zein (2020) and Bostan and Mian (2019) to match the names of CEOs with those of inventors. Specifically, the first and last names of inventors and the company names in the inventor database are matched with the CEO names in a step-wise procedure that starts with a fuzzy text-matching algorithm, followed by an examination of the biographies of the CEOs in the Capital IQ Professional Database and ends with searches in other sources including company web pages, Bloomberg, LinkedIn, DataStream, and more general Google searches. This elaborate process allows us to classify the CEOs of 1,458 high-technology IPOs as inventors or non-inventors. The requirement to obtain other CEO characteristics as controls (explained below) further limits the sample to 1,377 IPOs for 1992–2010. Among them, 263 had inventor CEOs—a CEO is an inventor if they have at least one patent registered in their name as an inventor at the time of the IPO.

Table 1 shows the distribution of inventor-led IPOs. Panel A reports the annual distribution. The percentage of inventor-led IPOs varies across years and ranges from 0% to 34%, with a mean of 19%. This percentage is almost the same as that reported by Islam and Zein (2020), which indicates that the preponderance of inventor CEOs among IPOs is no different from that among listed firms. Panel B reports the distribution by Fama-French 12-industry groups. Most of the high-tech IPOs belong to the business equipment and healthcare industries. The former includes sectors such as software, semiconductors, and related devices, whereas the latter includes pharmaceutical preparations, surgical and medical instruments, and apparatuses. Panel C shows that of the 263 CEOs identified as inventors, 58 had one patent, 38 had two, and the rest had more than two patents registered in their names at the time of the IPO. Panel D reports the distribution of future citations received for patents registered in the name of inventor CEOs; the median number of citations per CEO is 161.

C. Outcome Variables

To study the role of inventor CEOs in IPO, we examine several IPO outcomes. We follow the literature and measure IPO underpricing as the percentage of the first-day return, calculated as the closing price on the first day of trading less the offer price and then divided by the offer price. We also identify "off-the-wave" IPO periods and run probit regressions to see if the probability of an IPO during such periods, varies with inventor CEOs. Following Chemmanur and He (2011) to identify these periods, we first compute the three-month moving averages of IPO volume in a particular Fama-French 49 industry for each month. Then, we define "hot periods" as those in which the moving average falls into the top quartile of that industry's IPO months. Next, we define IPO waves as all sequences of consecutive "hot periods" that begin and end with a nonzero number of issuances to ensure that only consecutive months with sustained IPO activity are labeled as part of the wave (Chemmanur and He, 2011). The months that are not part of the wave are classified as "off-the-wave" periods. We also consider two firm characteristics at IPO as the outcome variables: R&D intensity measured as R&D expenditure divided by total assets, and firm size measured as the natural log of the book value of assets.

Next, we compare the post-IPO innovations for the three years for inventor and non-inventor CEOs. To assess firm-level innovation, we employ several measures commonly used in innovation literature. The two most common are the number of patents the firm generates and the total number of future citations, excluding self-citations (Hall, Jaffe, and Trajtenberg, 2005). We also examine the number of breakthrough patents the firms generates, which we alternatively define as those that fall among the top 1% or top 5% of the distribution of future citations in their technological class (Balsmeier, Fleming, and Manso, 2017).[11] We further study the measures of *originality* and *generality* of patents (Trajtenberg, Henderson, and Jaffe, 1997; Hall, Jaffe, and Trajtenberg, 2001). The originality measure examines backward citations made by the firm in its patents, and is computed as one minus the Herfindahl index of the citations made by the patents that a firm applied for in a given year across two-digit technological classes. A high value indicates that the cited patents belong to a wide set of technological classes. The generality measure reflects forward citations received by patents, and is computed as one minus the Herfindahl index of the citations received by the patents that a firm applied for in a given year across two-digit

[11] We detail these measures in Appendix A.

technological classes. A high value indicates that a firm's patents are cited by subsequent patents in a wide range of fields. The information on patents and citations for constructing innovation measures is from the 2010 version of the patent database compiled by Kogan, Papanikolaou, Seru, and Stoffman (2017).[12,13]

Finally, we analyze abnormal stock market returns during the three-year period following the IPO, using the calendar-time portfolio strategy. We construct portfolios for each month based on the IPOs launched over the preceding 36 months separately for inventor- and non-inventor-led IPOs. We compute the returns on the portfolio for each month by equally weighting the returns on the individual stocks. This yields a monthly time series of returns for inventor- and non-inventor-led IPOs. We estimate the Fama-French three-factor model and include the lagged values of the factors, as in Ritter and Welch (2002). The intercepts of the model represent the monthly abnormal stock returns for inventor- and non-inventor-led IPOs.

D. Control Variables

We include a large number of CEO attributes as controls in our multivariate regressions to mitigate the concern that a CEO's inventor experience is picking up the effect of other correlated CEO attributes. First, we include an indicator variable for founder CEOs because many inventor CEOs also tend to be founders and they influence firm innovation (Lee, Kim, and Bae, 2020). Second, we include an indicator variable that accounts for the PhD qualification of the CEO because such qualifications have been shown to influence IPO pricing and innovation outcomes (Sundaramurthy, Pukthuanthong, and Kor, 2014; Chemmanur, Kong, Krishnan, and Yu, 2019; He and Hirshleifer, 2020). We further control for CEO age, experience as a board member of companies, and experience in a related industry (at the same two-digit SIC level) as these characteristics are known to affect IPO and firm outcomes (Faleye, Kovacs, and Venkateswaran, 2014; Sundaramurthy, Pukthuanthong, and Kor, 2014). Finally, we control for the general

[12] The data are from https://sites.google.com/site/patentdataproject/Home.

[13] The number of citations received by the patents carries a similar well-known truncation problem. As granted patents keep receiving citations many years into the future, the later it is in the sample period, the shorter is the time period during which a patent can obtain citations. This results in fewer citations of the patents with later application dates. We corrected this truncation problem using the commonly-adopted fixed-effect method described in Hall, Jaffe, and Trajtenberg (2001). Citations received for each patent are divided by the average number of citations received in the patent's technological field and in the application year to remove all fixed effects of year and technological field.

managerial skills using the measure constructed by Custodio, Ferreira, and Matos (2019); we compute a generality index for each CEO based on the principal component analysis of five variables related to the employment history of the CEOs: number of positions held in public companies, number of firms in which they have worked, number of industries in which they have worked, an indicator variable if the CEO also holds the same position in another company, and an indicator variable if the CEO has worked in a conglomerate. The details of how these variables were constructed and the sources of the data used are provided in Appendix A.

We also include the standard firm-and deal-level controls identified in the prior IPO literature. Firm-level controls include the firm's size, R&D intensity, return on assets (ROA), and age at the time of the IPO, which is defined simply as the natural logarithm of (one plus) the number of years since it was founded. We obtain data on firms' incorporation dates from Jay Ritter's website. We include a dummy variable to indicate whether the IPO is backed by a VC (Megginson and Weiss, 1991), a dummy variable to indicate whether the IPO is underwritten by a reputable underwriter (Loughran and Ritter, 2004), an indicator variable that depicts if the IPO is issued during "hot" IPO market period (Chemmanur and He, 2011), and an indicator for the Internet bubble period from September 1998 to August 2000 (Ritter and Welch, 2002). Finally, we include the natural log of one plus the total number of patents that the firm has at the time of the IPO. The inclusion of this variable is meant to control for the differences across IPOs in their innovation intensities, which can affect the information uncertainty surrounding an IPO and hence its underpricing.

E. Summary Statistics

Table 2 reports the summary statistics for the key variables. The mean (median) underpricing is 34% (16%) during our sample period; however, the underpricing experienced a large spike during the Internet bubble period of the late 1990s. Ritter and Welch (2002), for example, document that relative to the average underpricing of 19% for their overall sample period of 1980–2001, the average underpricing was 72% and 56% in 1999 and 2000, respectively. Therefore, we report the underpricing during the bubble and non-bubble periods separately. The numbers are very similar to those in Ritter and Welch (2002): the mean (median) underpricing is 19% (11%) in the non-bubble period and increases to 73% (47%) during the bubble.

Approximately 19% of the firms in our sample have inventor CEOs, 48% have founder CEOs, and 16% have CEOs with PhD qualifications at the time of IPO. The average age of the CEO is 48 years. As all firms in our sample are identified as "high-technology" by the SDC dataset, they are highly R&D-intensive. An average firm in our sample invests 26% of the book value of its assets in annual R&D expenditures. On average, these firms hold about four patents in their name at the time of the IPO. The average firm age was 9 years. These firms are typically not profitable; the mean (median) ROA is –25.36% (–2.95%). This lack of profitability is not unique to the technology firms in our sample; Loughran and McDonald (2013) report that only around 37% of IPOs in their sample have positive earnings.

4. Results

A. Univariate Comparison of the Characteristics of IPOs Led by Inventor and Non-Inventor CEOs

We begin our analysis by comparing the characteristics of the inventor CEO IPOs with those of non-inventor CEO IPOs. Table 3 reports the mean and median of the key variables and the univariate tests of the differences. Several differences are discernible from Panel A. First, the average underpricing of IPOs led by inventor CEOs is smaller (29%) relative to those led by non-inventor CEOs (36%). Interestingly, the difference in underpricing disappears during the Internet bubble, consistent with the notion that underpricing is driven more by investors' behavioral biases and less by the availability of information about firm fundamentals during this period (Ritter and Welch, 2002). After excluding the bubble period, the average underpricings of IPOs led by inventor and non-inventor CEOs are 15% and 20%, respectively, and the difference is statistically significant.

Second, the higher mean and median for the off-the-wave variable for inventor-led IPOs indicates that a greater proportion of inventor-led firms go public during difficult financing conditions than non-inventor-led firms. Third, looking at CEO characteristics, many more inventor CEOs are founders and PhD-holders than non-inventor CEOs. This finding reminds us of controlling for these characteristics when examining the relationship between IPO outcomes and inventor CEOs.

Fourth, IPOs led by inventor CEOs seem significantly more innovation-intensive than those led by non-inventor CEOs. The average spending on R&D as a percentage of total assets is 37% for inventor-led IPOs and 23% for other IPOs, suggesting that the former have a greater propensity to allocate resources to innovation than the latter. The mean (median) number of patents at the time of IPO is 9.31 (4) for inventor-led firms compared to 3.12 (0) for non-inventor-led firms. Interestingly, these differences between the innovation intensities of inventor- and non-inventor-led firms are significantly starker than those reported by Islam and Zein (2020) for mature listed firms, suggesting that the personal involvement of CEOs in innovation might matter more for young startup firms than for mature listed firms.

Finally, inventor CEOs seem to be able to take startup firms to the stock market at an early stage in their life cycle. Panel A in Table 2 shows that firms led by inventor CEOs are significantly smaller and considerably less profitable than those led by non-inventor CEOs. These differences between the characteristics of investor- and non-inventor-led IPOs are consistent with the idea that inventor CEOs convey the value of their firms' innovation to outside financiers more credibly, which enables them to successfully take firms public early on in their life cycle.

Because inventor-led IPOs are relatively more innovation-intensive and smaller, our earlier observation that such firms have lower underpricing in Panel A becomes even more striking. Higher R&D intensity and smaller size are traits often associated with greater risk and uncertainty and, hence, greater underpricing. For instance, Lowry, Officer, and Schwert (2010) find that technology firms experience greater underpricing than other firms, and Liu and Ritter (2011) find that underpricing is substantially higher for smaller firms. That the presence of inventor CEOs at the helm is associated with less underpricing, despite the firms being apparently riskier, is consistent with the hypothesis that inventor CEOs can reduce the uncertainty of their firms' innovation for external financiers.

Panel B of Table 3 reports the differences in the post-IPO innovation performance. Inventor-led IPOs fare better across almost all innovation dimensions. These firms had a greater number of total patents and citations, including radical patents, than non-inventor-led IPOs. They also scored better in terms of the generality and originality of their patents. Overall, the univariate results in Table 3 provide initial evidence that inventor CEOs play a useful role in facilitating

access to external funds for technology startups. Next, we formally test our hypotheses in multivariate settings.

B. Inventor CEOs and IPO Underpricing

To formally assess the implications of the inventor status on IPO underpricing, we estimate ordinary least squares regressions in which we regress underpricing on the indicator variable for inventor CEOs and a set of controls, as specified below.

$$Underpricing_i = \alpha_0 + \beta\ Inventor\ CEO_i + c'controls_i + Industry\ FE + Year\ FE + \varepsilon_i \quad (1)$$

Subscript *i* indicates the IPO firm. We suppress the time subscript because all variables are measured at the time of the IPO. We also include industry fixed effects based on 49 Fama–French (1997) industries and year fixed effects in most specifications.[14] To account for error dependencies across industries and years, the standard errors are adjusted for two-dimensional clustering at the industry and year levels.

Table 4 reports the results. The coefficient estimates on the inventor CEO indicator in the first two columns, which report the results for the full sample, are negative and statistically significant, suggesting that inventor-led IPOs are associated with less underpricing. In Column (1), which includes year and industry fixed effects, the coefficient estimate of –3.82 (*t*-statistic = 2.44) implies that IPOs led by inventor CEOs experience 3.82% less underpricing than those by non-inventor CEOs. When we replace the year fixed effects in Column (2) with a dummy to account for the higher underpricing during the Internet bubble, the coefficient estimate increases to –4.71 (*t*-statistic = 2.60). This represents more than one quarter of the unconditional mean underpricing of the 18.76% reported for the non-bubble period (Table 2). The economic magnitude of the association between inventor CEOs and underpricing is, therefore, large and meaningful.[15]

[14] Because of the inclusion of fixed effects, we do not report intercepts of the regressions.

[15] An alternative explanation of the negative relationship between inventor CEOs and underpricing might be that they own more shares and thus have an incentive to bargain harder with the underwriters (Liu and Ritter, 2011). However, it is difficult to test this explanation directly because measuring the ownership of inventor CEOs is complicated by the existence of stock options and restricted stock units for both CEOs and other employees. Additionally, this explanation does not address why inventor CEOs are also associated with other timing-related measures of the IPO success or explain our evidence on post-IPO innovation and post-IPO stock returns.

If the negative relationship between inventor CEOs and IPOs' underpricing is due to the former's superior ability to resolve information asymmetry regarding a firm's innovation capital, one would expect the relationship to vary systematically in the cross-section. It would be stronger (more negative) for firms that are more R&D-intensive because firms with high R&D intensity are usually those with greater innovation capital. Likewise, the relationships may be stronger for smaller firms because the innovation capital of such firms may be harder to value; hence, inventor CEOs' presence and communication would assume a relatively greater importance. To test these predictions, we sort our sample firms into two groups for each of these two characteristics—the ratio of R&D expenditure to total assets and size—using their median values, and estimate the underpricing regression separately for the sub-samples. The results reported in Table 4 confirm the strong cross-sectional variation in the main findings. The negative relationship between the inventor CEO dummy and underpricing is concentrated and pronounced among firms that have greater R&D intensity and are smaller in size. The estimated coefficient of the inventor CEO dummy implies that among more R&D-intensive firms and smaller firms, IPOs led by inventor CEOs experience 11% and 7% less underpricing, respectively, than those by non-inventor CEOs.

Among the control variables, those that depict other CEO characteristics are insignificant except for CEO age, whose coefficient is negative and marginally statistically significant, suggesting that older CEOs are associated with lower underpricing. One reason could be that older CEOs have established a reputation and history that helps certify the quality of the firm. Among firm-level controls, firm age seems to be a key driver of underpricing in our sample, with smaller firms experiencing considerably larger underpricing. This is consistent with the results reported in previous studies, such as Chemmanur and Paeglis (2005) and Lowry, Officer, and Schwert (2010). We also find that the two variables we use to depict the innovation intensity of firms—R&D intensity and number of firm patents—have positive and somewhat significant coefficients, which is consistent with Lowry, Officer, and Schwert's (2010) finding that technology stocks experience greater underpricing.[16] The coefficient on indicator variable for *Top-Tier Underwriter* also shows up as positive and highly statistically significant, consistent with the evidence in Loughran and

[16] The coefficient estimate on R&D intensity appears unusually large for low R&D intensity firms in Column (3), Table 4. This is because firms included in this sample generally have close to zero R&D intensity, with a mean of 0.05. In untabulated results, when we remove R&D intensity as a control in Columns (3) and (4), our results remain qualitatively similar.

Ritter (2004) and Liu and Ritter (2011) that more reputable underwriters are associated with greater underpricing. They argue that IPO firms accept higher underpricing set by reputable underwriters to obtain favorable recommendations from the star analysts working at these underwriters, and because these underwriters allocate hot IPOs to personal brokerage accounts of the issuing firm decision-makers. Finally, we find that the "hot" periods and Internet bubble are associated with higher underpricing, consistent with the findings of Ritter and Welch (2002) and Chemmanur and He (2011).

In the untabulated results, we also examine whether inventor CEOs who are "serial innovation entrepreneurs" are different from those who only possess patents in the IPO firm. We split the inventor CEO dummy into two: one for CEOs who possess at least one prior patent in another firm in addition to holding patent(s) in the IPO firm and the other for CEOs who hold patent(s) only in the IPO firm. We find no discernible differences between the coefficient estimates of the two dummies in the underpricing regressions. This suggests that our results in Table 4 are driven by inventor CEOs' knowledge of firm-specific innovation and not by general innovation experience. We also experiment with splitting inventor CEO dummy into two, based on whether the IPO is backed by a VC or not, and find similar coefficient estimates for the two variables. This suggests that our results are not driven by "the certification effect" of VCs on inventor CEOs.[17] To conclude, the results indicate that inventor-led IPOs experience lower underpricing than non-inventor-led IPOs, and this relationship is stronger among firms that are more R&D-intensive and smaller in size.

C. Inventor CEOs and Financing in Difficult Conditions

An alternative way to examine whether inventor CEOs facilitate the financing of young technology companies is to see if inventor-led firms can successfully go public in difficult financing environments. Table 5 presents the results of the analysis. In Column (1), we report the results of a probit regression where the dependent variable is "off-the-wave," which equals one for the periods when no, or very few, firms go public and zero otherwise. These are the periods when

[17] It is worth noting that our evidence is based only on firms that successfully managed to complete their IPO. As startup firms that failed to reach the IPO stage are not included in our analyses, we do not know how successful inventor CEOs are in guiding their firms from inception to the IPO.

investors' risk aversion is high and new firms find it difficult to go public (Chemmanur and He, 2011). The estimated coefficient of the indicator variable for the inventor CEO is positive and statistically significant at the 10% level. The estimated coefficient of 0.098 (*z*-statistic = 1.91) implies that a firm's probability of going public in an off-the-wave period increases by 3.3% when led by an inventor CEO. This is economically significant when one considers that the unconditional probability of a firm going public during the off-wave period is 30% (see Table 2). This suggests that inventor-led firms are more likely than non-inventor-led firms to go public during cold IPO periods.[18]

The superior financing ability of inventor CEOs may also be reflected in the cross-section of their ability to successfully take public firms that are more R&D intensive and smaller, as such firms often find it more difficult to raise external financing (Hall and Lerner, 2010; Hall, 2010). To examine this, we run OLS regressions to regress these firm characteristics of IPO firms on the indicator variable for inventor CEOs and CEO- and deal-level controls. We remove firm-level controls from these regressions, as various firm characteristics, such as R&D intensity and profitability, or firm size and age, tend to be highly correlated. We study the association between inventor CEOs, R&D intensity, and firm size without stripping the effect of correlated firm characteristics. The extant literature on innovation that discusses the challenges of financing R&D-intensive and small firms (Hall, 2010; Hall and Lerner, 2010) uses these characteristics as all-encompassing representative characteristics that also capture related features, such as young age and the lack of profitability of these firms.

The last two columns in Table 5 present the results. The coefficient of the indicator variable for CEO is positive and statistically significant at the 10% level in the regression for R&D intensity, suggesting that inventor-led IPOs are more R&D intensive than non-inventor-led IPOs. The estimated coefficient implies that the R&D intensity of inventor-led IPOs is 6.5% higher than after controlling for all CEO and deal characteristics. Likewise, the coefficient of the indicator variable is negative in the regressions for *Size*, indicating that inventor-led IPOs are generally smaller. The average book value of the assets of inventor-led IPOs is approximately $11 million

[18] Among the controls, a CEO's general managerial skills (Custódio, Ferreira, and Matos, 2019) and board experience (Sundaramurthy, Pukthuanthong, and Kor (2014) are also associated with the propensity to go public in off-the-wave periods.

less than for non-inventor-led IPOs. These findings from the multivariate regressions echo those of our univariate analysis in Table 3, suggesting that inventor-led IPOs are more likely to possess characteristics that typically make external financing more difficult for the firm.

It is worth reiterating that our sample of firms are those that successfully managed to complete their IPO. Many technology startups fail to reach this stage because of their failure to garner enough interest from investors (Bernstein, 2015). The results in Table 5 suggest that inventor CEOs are more likely to be associated with technology IPOs that, on an a priori basis, may be expected to face greater financing difficulties. This evidence is consistent with the notion that inventor CEOs are better at communicating the value of their firms' innovation to external financiers or at reducing concerns about potential agency costs within the firm.

D. Inventor CEOs and Post-IPO Firm Innovation

To the extent that inventor CEOs allow greater flexibility to time the IPO according to the needs of a firm's R&D, rather than according to the conditions in financial markets, one might expect that the investment of the IPO proceeds would yield better innovation outcomes for inventor-led firms post IPO. To examine this, we regress measures of the innovation success of newly listed firms in the three years after the IPO on the indicator variable for inventor CEOs and a set of controls. As noted previously, we measure the success of a firm's innovation across several dimensions: the number of patents it generates, the number of future citations that patents receive, the number of breakthrough patents, and the generality and originality of the patents. We use the average of these variables over the post-IPO period because innovation is a long-term process and a newly listed firm's success or failure may not be appropriately judged based on data from a smaller timeframe.[19] We include the three-year average of the respective innovation variables before the IPO as an additional control. Thus, we investigate the change in the innovation output of the newly listed firm following the IPO and how this change is related to the presence of an inventor CEO at the top. It also helps account for firm fixed effects that might influence firm innovation output post-IPO.

[19] Even the process of obtaining a patent takes more than two years on average (Hall, Jaffe, and Trajtenberg, 2001).

Table 6 reports the results of the analysis. The coefficient estimates on the inventor CEO dummy are positive across all measures of innovation and statistically significant for most. The firms led by inventor CEOs generate a larger number of patents as well as citations for their patents. The economic magnitude of these effects is large. Firms led by inventor CEOs produce 1.3 more patents and receive 34.3 more citations than firms led by non-inventor CEOs, and when compared to the unconditional mean values of 2.0 and 84.5 at the time of IPO, respectively, as reported in Panel B of Table 2, the magnitudes of these coefficients appear economically meaningful. These findings are consistent with both the inventor CEOs' superior ability to time the firms' IPO and their general superiority in managing the firms' innovation.

Table 6 also reports results on the association between inventor CEOs and breakthrough innovation, often associated with greater risk-taking and experimentation (e.g., Balsmeier, Fleming, and Manso, 2017). The results indicate that inventor CEOs are indeed more likely to spur ground-breaking or disruptive innovations, as shown by their firms' greater propensity to produce patents cited in the 99^{th} and 95^{th} percentile of the citation distribution within their technology class year. Furthermore, the patents that these firms generate are more original in that the preceding patents they cite belonged to a wider set of technological classes. In all regressions, the lagged values of the dependent variable are highly significant, indicating the importance of controlling for past innovation in predicting future firm innovation. These results are consistent with inventor CEOs investing in the proceeds of an IPO in exploratory R&D, which produces more impactful innovation. Overall, Table 6 provides evidence that newly listed firms led by inventor CEOs experience considerably better innovation outcomes in the three years after the IPO than firms led by non-inventor CEOs.

E. Inventor CEOs and Post-IPO Agency Costs

While investigating the pros and cons of hiring inventor CEOs, Byun, Fuller, and Lin (2021) document, for listed firms in the US, certain characteristics and policies of such firms that they interpret as indicative of higher agency costs. These characteristics include greater spending, lower efficiency of R&D spending, higher cash holdings, and lower leverage. The first of these characteristics may suggest overspending on R&D, especially in projects in which inventor CEOs are personally involved. Higher cash holdings may point towards inventor CEOs keeping slack to

avoid external financing for their investments. Lower leverage is consistent with inventor CEOs who avoid monitoring and discipline imposed by creditors.

To investigate the extent to which such agency costs associated with inventor CEOs also plague young technology firms, we rerun analyses similar to those in Byun, Fuller, and Lin (2021) on our sample of newly listed firms. Over the three-year post-IPO period, we compute the average measures of various firm characteristics and regress them on the indicator variable for inventor CEO and controls (measured at the time of the IPO). Tables 7 and 8 present the results. In Table 7, the dependent variables are R&D expenditure, R&D expenditure scaled by total assets, cash holdings scaled by total assets, and total debt scaled by total assets. The inventor CEO variable is statistically significant only in Column (1), indicating that inventor CEOs spend more on R&D, consistent with Byun et al. (2021). However, this effect disappears when we scale R&D expenditure by total assets, as shown in Column (2). The coefficient on inventor CEO is also insignificant in Columns (3) and (4), suggesting that inventor CEOs are not associated with cash holdings and leverage among newly listed firms.

In Table 8, we replicate Byun, Fuller, and Lin (2021) to assess the efficiency of R&D expenditure. The dependent variables are now the various measures of a firm's innovation output, such as the number of patents or the number of total citations. The key explanatory variable is the interaction term between CEO and R&D intensity. Byun, Fuller and Lin (2021) find the coefficient of this to be negative in their sample and interpret it as evidence that inventor CEOs are negatively associated with the efficiency of a firm's R&D expenditure. The results in Table 8 indicate that same results do not hold in our sample. Overall, therefore, we fail to find evidence that inventor CEOs are associated with greater agency costs among newly listed technology firms. It is possible that agency costs are mitigated among young firms because CEOs in young firms has been in the job for fewer years and is hence less entrenched, and/or because these firms do not yet have bureaucratic structures to protect the personal ambitions of the CEO.

F. Inventor CEOs and Post-IPO Stock Returns

If the stock market does not fully understand the positive relationship between inventor CEOs and the future innovation of newly listed firms at the time of the IPO, one would expect that IPOs led by inventor CEOs experience superior abnormal stock returns during the three-year post-

IPO period. However, the measurement of long-term returns for IPOs is fraught with problems due to overlapping returns and because most IPO firms tend to be small growth firms with risk exposures different from those of a typical listed firm (Ritter and Welch, 2002). Therefore, we adopt the calendar–time portfolio approach and estimate abnormal returns using the Fama-French (1993) three-factor regression. Following Ritter and Welch (2002) and Chemmanur and Paeglis (2005), we include lagged values of the factors in the regressions. The intercept estimates are measures of monthly abnormal returns, with negative intercepts indicating underperformance and positive intercepts indicating outperformance.

We form calendar–time portfolios separately for IPOs led by inventor and non-inventor CEOs, and compute monthly abnormal returns for each. We also examine the difference between the abnormal returns of the two portfolios. The return evaluation period is from February 1992 to June 2013. We choose February 1992 as the start of the time frame because this is the first month following the first two inventor-led IPOs in our sample, launched in January 1992. We choose June 2013 as the upper frame because it covers the three-year period following the last inventor-led IPO in June 2010. As the number of stocks in the portfolio of inventor-led IPOs varies considerably over time, ranging from 1 to 78 per month, and as the beginning and ending months of the sample contain very few stocks, we follow Chemmanur and Paeglis (2005) and estimate the regressions using weighted least squares with weights based on the number of stocks in the monthly portfolio.

Table 9 reports the results of the analysis. The IPOs led by inventor CEOs experience abnormal stock returns of 0.96% per month (*t*-statistic = 2.55) in the three-year post-IPO period. This translates into 12.15% return on an annualized basis. This level of abnormal returns is striking, especially given the finding of negative or close-to-zero abnormal stock returns for an average IPO in the traditional IPO literature (Ritter and Welch, 2002). For the IPOs led by non-inventor CEOs, the average abnormal stock return is statistically insignificant at 0.15% per month, and similar to

the returns reported for IPOs in prior literature. The difference between the returns of inventor- and non-inventor-led IPOs is a large 1.81% per month (*t*-statistic = 5.71).[20]

The evidence that investors who buy IPOs of inventor-led technology firms experience economically large abnormal stock returns in the three-year post-IPO period is more consistent with the idea that the stock market fails to fully appreciate the positive relationship between inventor CEOs and future firm innovation post-IPO. This evidence seems inconsistent with the alternative explanation adapted from Chemmanur and Paeglis (2005), according to which, lower dispersion of opinions, and hence, lower overvaluation at the time of the IPO, cause investors to earn higher abnormal returns for inventor-led IPOs relative to non-inventor-led IPOs. Although this can explain the overperformance of inventor-led IPOs *relative to* non-inventor-led IPOs in the post-IPO period, it cannot explain their large positive abnormal returns.[21]

The coefficient estimates for the three Fama–French factors in Table 9 are also informative. For the portfolio containing inventor-led IPOs, the coefficient estimate on the *SML* factor (i.e., small minus large factor) is positive, consistent with IPO stocks being smaller in size than those typically listed on the exchange (Ritter and Welch, 2002). Interestingly, the coefficient estimate is larger than that for the portfolio containing non-inventor-led IPOs, which is consistent with the evidence in Table 3 that inventor-led IPOs are smaller than non-inventor-led IPOs. Likewise, the coefficient estimate on the *HML* factor (high book-to-market minus low book-to-market) is negative, consistent with IPO firms' tilt toward growth compared to an average listed firm (Ritter and Welch, 2002).

[20] Because we estimate Fama–French three factor regression in Table 6 using weighted least squares, the coefficient estimates in the last column, which reports the returns on a long–short portfolio that takes a long position in inventor-led IPOs and short position in non-inventor-led IPOs, are not simply the difference between the respective estimates in the first two columns.

[21] Yet another explanation for a positive relation between a CEO characteristic and future stock return, which does not rely on market inefficiency, comes from Lilienfeld-Toal and Ruenzi (2014). They argue that market prices cannot fully reflect the future effort of a CEO, because they could otherwise profit from the price increase right away by selling their stocks without having to carry out value-increasing effort and bearing the associated personal costs. We believe this explanation is less relevant in our context not only because many of the inventor CEOs in our sample are also founders who typically remain with their firms for a long time, but also because of constraints, such as a post-IPO lock-up period, that limit the CEO's ability to dispose of their stake in the immediate aftermath of the IPO.

5. Addressing Endogeneity Concerns

A CEO may be selected because of the fit between individual and job requirements. A technology firm planning to go public may prefer to appoint an inventor CEO believing that the CEO would be better at managing the firm's transition from private to public entities. Therefore, our previous results may be driven by optimal CEO-firm matching. To extricate the confounding effect of such matching and focus on the causal interpretation, we conduct two additional analyses: a difference-in-difference (DID) analysis surrounding changes in regulations that affect the ease of hiring a CEO and an examination of the results in the founders-only sample.

A. Exogenous Changes in the Ease of Hiring CEOs

Germaise (2011) shows that the enforceability of non-competition agreements between employers and senior executives varies significantly across states in the US and in a few instances (discussed below) across time, and these changes significantly affect the ease with which firms can hire executives in the labor market. The author studies changes in enforceability by constructing a non-competition enforceability index for each state for 1992–2004. The index is based on factors such as the minimum compensation at which the agreements apply, and geographical and time restrictions in the implementation of the agreements. The index ranges from 0 to 12, with higher values indicating greater enforceability.[22] Although laws governing the enforcement of non-competition agreements are largely static, three states, Texas, Louisiana, and Florida, experienced significant shifts in the treatment of non-enforceability agreements during 1992–2004 owing to court rulings or new legislation.

We exploit these over-time changes in the enforceability index to design a DID test of the effect of inventor CEOs on IPO.[23] Germaise (2011) shows that greater enforceability is associated with greater difficulty in hiring senior executives for firms headquartered in that state. If our results are driven primarily by the matching between firms and CEOs, we expect this matching to be less effective after an increase in the enforceability index. Therefore, we should observe a weakening effect of inventor CEOs on IPOs after an increase in the enforceability index. To conduct this DID

[22] We refer the reader to pages 388–392 in Germaise (2011) for details on the construction of the index.
[23] Custodio, Ferreira, and Matos (2019) also use this index to address endogeneity concerns in their analysis.

analysis, we compare the changes in the effect of inventor CEOs on IPOs in a state that experiences an increase in enforceability with those in states that do not experience any such increase.

We obtain data on the state in which a firm is headquartered from the IPO prospectus. We exclude Louisiana and Texas from the analysis because of the paucity of IPOs surrounding the change in the index.[24] This leaves us with Florida, which experienced a change in the index from 7 to 9 in 1997, for which we have 43 IPOs in our sample. Of these, 22 are in the period before the index increase and the remaining, after. Therefore, in our DID analysis, we compare the change in the effect of inventor CEOs in Florida after 1997 with the change in all other states. We do so by re-estimating our regressions in Tables 4, 5, and 6 after adding additional variables. To illustrate this, we re-estimate our underpricing regression in Equation (1) by modifying it as follows.

$$Underpricing_{i,s} = \alpha_0 + \beta_1\, Inventor\ CEO_i + \beta_2\, Inventor\ CEO_i\ x\ After + \beta_3\, Inventor\ CEO_i\ x\ Treated + \beta_4\, Inventor\ CEO_i\ x\ After\ x\ Treated + c'controls_i + State\ FE + Industry\ FE + Year\ FE + \varepsilon_{i,s} \quad (2)$$

Subscript *i* continues to signify the IPO firm, and the newly added subscript *s* depicts the state in which the firm is headquartered. We create and introduce two new variables in Equation (2): *After*, which takes the value of one for 1997 and later and zero otherwise; and *Treated*, which takes the value of one for Florida and zero for all other states. The interaction of *After* with *Inventor CEO* captures over time changes in the relationship between the inventor CEO and underpricing after 1997, which are unrelated to changes in the enforceability index. Likewise, the interaction of *Treated* with *Inventor CEO* allows for a differential relationship between inventor CEO and underpricing in Florida relative to other states that are unrelated to changes in the index. Therefore, the key explanatory variable is the triple interaction term *Inventor CEO x After x Treated*. This DID estimator captures changes in the inventor CEO's effect on underpricing in Florida after an increase in enforceability relative to the changes in other states. If matching is responsible for the inventor CEO's effect on underpricing, this interaction variable would be positive and significant, indicating that the effect becomes weaker after matching became more difficult in Florida after 1997. The regression includes the state fixed effects, besides the industry and year fixed effects, to account for all the time-invariant factors that influence underpricing in specific states. *After* and

[24] For Louisiana, the index changes twice: from 1 to 0 in 2002 and then to 4 in 2004; the total number of IPOs during 1992–2004 is only 3. For Texas, the index drops from 5 to 3 in 1995. However, during the pre-change period of 1992–1994, there is only one IPO in Texas in our sample.

Treated are not included as stand-alone variables because of the inclusion of year and state fixed effects.

Table 10 reports the results. Panel A examines whether the effect of inventor CEO on IPO outcomes documented in Tables 4 and 5 varies with the changes in the enforceability index. In Column (1), the coefficient on the interaction term is statistically insignificant and a "wrong" sign, suggesting that the effect of inventor CEO on underpricing does not weaken after matching between firms and CEOs becomes more difficult. Columns (2) through (4) re-estimate our regressions in Table 5 after inclusion of the three additional interaction terms as in Equation (2). The focus again is on the triple interaction term. Across the last three columns, the coefficients on the triple interaction term are all statistically insignificant, indicating that the greater difficulty of matching does not significantly influence the effect of inventor CEO on the ability of their firms for go public in a more difficult financing environment. Panel B examines whether the relationship between inventor CEO on post-IPO innovation documented in Table 6 is affected by changes in the enforceability index. The coefficients on interaction terms again show up as insignificant. Overall, the results in Table 10 indicate that matching is unlikely to be the primary driving force behind the relationship between inventor CEOs and the success of their IPOs.

B. Results for Founder-Only Sample

The concern that a CEO with certain characteristics is hired around the IPO time to make the firm's public listing successful should be less of a concern for founder-led firms. Therefore, we identify a subset of firms in our sample led by founder CEOs and examine whether the IPOs led by inventor CEOs within this sub-sample continue to be associated with superior IPO outcomes. Table 11 replicates the previous results for the founder sample. Panel A shows the results in Tables 4 and 5, and panel B shows the results in Table 6. All regressions include the same controls as before, except for the indicator variable for the founder CEO, which is now dropped. The coefficients of the inventor CEO variable in both panels of Table 11 are generally comparable to those reported in earlier tables. In the founder-only sample, inventor CEOs continue to exhibit a negative association with underpricing, a positive association with the firm's ability to raise financing in difficult financing conditions, and a positive association with post-IPO

innovation. These findings mitigate the concern that our results are driven primarily by optimal matching between firms and CEOs at the time of the IPO.

6. Conclusion

Innovation is critical to economic growth. Economists have long been concerned about underinvestment in innovation because of the challenges of financing it, especially among young startup firms. The evidence we document indicates that inventor CEOs play an important role in overcoming this challenge. We find that firms led by inventor CEOs are associated with lower IPO underpricing, often viewed as a discount offered to investors to compensate for the risk they take in investing in risky ventures. We also find that inventor-led firms are better able to go public in difficult financing environments. Consistent with the belief that inventor CEOs are better able to overcome financing constraints and time their firms' IPO to cater to their R&D needs, we find that post-IPO innovation outcomes are significantly superior for inventor-led firms. The stock market seems unable to fully appreciate these relationships, because inventor-led firms generate large positive abnormal returns in the three-year period following the IPO.

This study represents the first attempt to examine the role of within-firm human capital in financing innovation. Our finding that inventor CEOs are better able to convince external financiers to invest in their firms could be explained by their ability to communicate the value of the firms' innovation capital more effectively and/or to lower outsiders' concerns about moral hazard problems related to the firms' investments in innovation. The evidence presented in this study is consistent with both these channels. We did not quantify the relative contribution of each channel in driving our results. We leave this to future research, which can also examine how other members of the top management team complement the influence of inventor CEOs.

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Table 1
Sample Distribution of Inventor CEOs

Panels A and B of this table provide a breakdown of the number of inventor CEOs, non-inventor CEOs, and the percentages of inventor CEOs, by year and industry groups, respectively. The sample is based on high-technology IPOs in the US during 1992–2010. Panels C and D report information about the strength of the innovation experience of inventor CEOs.

Panel A: Distribution of Inventor- and Non-Inventor-Led Technology IPOs by Year

Year	# of IPOs	IPOs with Non-Inventor CEO	IPOs with Inventor CEO	Percent of IPOs with Inventor CEO
1992	62	49	13	21%
1993	79	65	14	18%
1994	88	73	15	17%
1995	140	115	25	18%
1996	121	96	25	21%
1997	108	81	27	25%
1998	69	63	6	9%
1999	224	193	31	14%
2000	187	150	37	20%
2001	24	19	5	21%
2002	23	18	5	22%
2003	23	20	3	13%
2004	70	46	24	34%
2005	40	34	6	15%
2006	41	32	9	22%
2007	56	42	14	25%
2009	6	6	0	0%
2010	16	12	4	25%
Total	1,377	1,114	263	19%

Panel B: Distribution of Inventor- and Non-Inventor-Led Technology IPOs by Industry

Fama–French 12 Industries	Total IPOs	IPOs with Non-Inventor CEO	IPOs with Inventor CEO	Percent of IPOs with Inventor CEO
Business Equipment	792	661	131	17%
Healthcare	322	226	96	30%
Communication	79	75	4	5%
Wholesale and Retail	37	35	2	5%
Manufacturing	19	10	9	47%
Consumer Non-Durables	7	6	1	14%
Consumer Durables	5	5	0	0%
Chemicals	1	0	1	100%
Other	115	96	19	17%
Total	1,377	1,114	263	19%

Panel C: Distribution of the Cumulative Number of Patents Received by Inventor CEOs at the time of IPO

Cumulative # of patents at the time of IPO	# of CEOs
1	58
2	38
3–10	89
> 10	78
Total	263

Panel D: Distribution of the Number of Future Citations Received by Inventor CEOs for their Patents at the time of IPO

Cumulative # of future citations for patents at the time of IPO	# of CEOs
1–30	47
31–100	60
101–400	92
> 400	64
Total	263

Table 2
Summary Statistics

This table presents summary statistics for select variables used in this study. All variables have been winsorized. Their definitions are provided in Appendix A. *Inventor CEO*, *Founder CEO*, *PhD*, *Top-Tier Underwriter*, *VC-Backed*, *Hot*, and *Off-the-Wave* are all indicator variables. The sample is based on high-technology IPOs in the US during 1992–2010.

Variables	Mean	Median	St. Dev.	Min.	Max.
Panel A: Firm and CEO Characteristics at the time of IPO					
Underpricing	34.22%	15.87%	55.37	-29.55%	282.80%
Underpricing - Bubble Period	73.35%	46.81%	82.25	-29.55%	282.80%
Underpricing - Excluding Bubble Period	18.76%	11.11%	27.64	-29.55%	282.80%
Inventor CEO	0.19	0	0.39	0	1.00
Founder CEO	0.48	0	0.50	0	1.00
PhD	0.16	0	0.37	0	1.00
Generality	-0.02	-0.32	0.97	-0.98	3.29
Board Experience	2.03	1.00	1.94	0.00	10.00
Rel. Ind. Experience	0.68	1.00	0.47	0.00	1.00
CEO Age (in years)	47.88	47.00	9.07	30.00	75.00
Total Assets (in million $)	72.56	21.92	175.30	0.61	1212.56
R&D/Total Assets	25.83%	16.91%	31.81%	0.00	177.63%
Firm Patents	4.31	0.00	9.49	0.00	57.00
Firm Age (in years)	9.20	7.00	8.76	0.00	58.00
ROA	-25.36%	-2.95%	67.96%	-371.13%	62.87%
Top-Tier Underwriter	0.73	1.00	0.44	0	1.00
VC-Backed	0.67	1.00	0.47	0	1.00
Hot IPO Market	0.61	1.00	0.49	0	1.00
Off the-Wave	0.30	0	0.46	0	1.00
Panel B: Post-IPO Innovation (Averaged Over Three Years)					
Number of Patents	2.04	0	6.73	0	91.00
Number of Citations	84.54	0	291.09	0	3150.34
Number of Top 1% Patents	0.05	0	0.25	0	3.00
Number of Top 5% Patents	0.22	0	0.90	0	12.00
Generality	0.21	0	0.29	0	0.88
Originality	0.16	0	0.26	0	0.85

Table 3
Univariate Tests for Differences Across Inventor and Non-Inventor led IPOs

This table reports univariate tests of the differences in select variables across inventor and non-inventor led IPOs. The *t*-statistics (Wilcoxon *z*-statistics) are used to test for differences between the means (medians). *Inventor CEO*, *Founder CEO*, *PhD*, *Top-Tier Underwriter*, *VC-Backed*, *Hot IPO Market*, and *Off-the-Wave* are all indicator variables. Detailed variable definitions are provided in Appendix A. The sample is based on high-technology IPOs in the US during 1992–2010. *, **, and *** denote significance level at the 10%, 5%, and 1% level, respectively.

	Mean			Median		
Variables	IPOs with Non-Inventor CEO	IPOs with Inventor CEO	*t*-statistic for difference	IPOs with Non-Inventor CEO	IPOs with Inventor CEO	Wilcoxon *z*-statistic for difference
Panel A: Firm and CEO Characteristics at the time of IPO						
Underpricing	35.52%	28.73%	-1.79*	16.11%	13.16%	-2.05**
Underpricing - Bubble Period	73.49%	72.65%	-0.07	49.20%	38.24%	0.06
Underpricing - Excluding Bubble Period	19.74%	14.89%	-2.22**	11.75%	9.01%	-2.33**
Inventor CEO	0.00	1.00		0.00	1.00	
Founder CEO	0.42	0.73	9.32***	0.00	1.00	9.04***
PhD	0.11	0.38	11.34***	0.00	0.00	10.85***
Generality	0.00	-0.10	-1.50	-0.32	-0.30	-0.10
Board Experience	2.11	1.73	-2.86***	1.00	1.00	-2.19**
Rel. Ind. Experience	0.67	0.70	0.88	1.00	1.00	0.88
CEO Age (in years)	47.86	47.97	0.17	47.00	47.00	0.22
Total Assets (in million $)	80.65	38.30	-3.54***	22.28	18.63	-3.04***
R&D/Total Assets	23.20%	36.97%	6.40***	14.80%	24.03%	7.49***
Firm Patents	3.12	9.31	9.84***	0.00	4.00	11.93***
Firm Age (in years)	9.39	8.41	-1.64	7.00	7.00	-0.09
ROA	-22.20%	-38.74%	-3.56***	0.70%	-20.36%	-3.28***
Top-Tier Underwriter	0.74	0.72	-0.64	1.00	1.00	-0.64
VC-Backed	0.66	0.74	2.57**	1.00	1.00	2.57**
Hot IPO Market	0.62	0.59	-0.85	1.00	1.00	-0.85
Off-the-Wave	0.29	0.34	1.37	0	0	1.37

Panel B: Post-IPO Innovation (Averaged Over Three Years)						
Number of Patent	2.04	5.74	7.31***	0	2.33	12.24***
Number of Citations	84.54	205.95	5.47***	0	56.50	11.33***
Number of Top 1% Patents	0.05	0.13	3.79***	0	0.00	3.52***
Number of Top 5% Patents	0.22	0.59	5.30***	0	0.00	6.96***
Generality	0.21	0.44	11.62***	0	0.52	11.21***
Originality	0.16	0.29	7.19***	0	0.24	8.49***

Table 4
Inventor CEOs and IPO Underpricing

This table reports the relationship between inventor CEOs and IPO underpricing. We estimate the following regression.

$$Underpricing_i = \alpha_0 + \beta\ Inventor\ CEO_i + c'controls_i + Industry\ FE + Year\ FE + \varepsilon_i$$

The subscript *i* signifies the IPO firm. The dependent variable in all regressions is the percentage first-day return, calculated as the closing price on the first day of trading less the offer price, divided by the offer price. The key explanatory variable is *Inventor CEO* that takes the value of one if the IPO is led by an inventor CEO, and zero otherwise. The vector of controls includes various CEO, firm and IPO characteristics. All variables are measured at the time of the IPO. Detailed description of these is provided in Appendix A. The first two columns report the results for the full sample. Columns (3) through (8) report the results for the sub-samples sorted on R&D intensity (i.e., R&D expenditure divided by Total Assets), *Size* (i.e., Total Assets) and *ROA*. For each characteristic, we sort the sample into two groups based on its median value in our sample. Industry fixed effects are based on Fama–French 48-industry classification and year fixed effects are based on the IPO year. The sample includes high technology U.S. IPOs from 1992 to 2010. The *t*-statistics (in parentheses) are computed using heteroskedasticity-consistent standard errors that are corrected for clustering across year and industry. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

	Dependent Variable = Underpricing					
	Full Sample Analysis		Sub-Sample Analysi			
	With Year FE	With Bubble Dummy	Low R&D Intensity Firms	High R&D Intensity Firms	Small Firms	Large Firms
Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)
Inventor CEO	-3.82**	-4.71***	3.37	-10.99**	-7.17***	1.30
	(-2.44)	(-2.60)	(0.43)	(-2.24)	(-4.54)	(0.22)
Founder CEO	0.18	0.16	-1.54	3.50	2.27	-0.98
	(0.33)	(0.11)	(-0.90)	(1.26)	(0.55)	(-0.38)
Ph.D.	2.65	1.96	2.49	3.83	-5.62	12.00
	(1.08)	(0.73)	(0.82)	(0.73)	(-0.98)	(1.54)
Generality Index	6.35	5.89	10.61	2.10	5.90	5.07
	(1.08)	(1.11)	(1.33)	(0.49)	(0.88)	(1.09)
Board Experience	-2.75	-2.69	-5.04	-0.48	-2.81	-2.59
	(-1.12)	(-1.25)	(-1.41)	(-0.29)	(-0.96)	(-1.33)
Rel. Ind. Exp.	2.57	2.73	7.57*	-1.56	4.97	1.81
	(0.94)	(1.07)	(2.11)	(-0.48)	(1.35)	(0.53)
CEO Age	-10.41	-9.91**	-13.22	-13.16*	-11.24**	-7.10

	(-1.54)	(-2.08)	(-0.92)	(-1.90)	(-2.71)	(-0.76)
ln(Total Assets)	1.84	0.73	1.48	8.50*	5.31	0.02
	(1.18)	(0.62)	(0.94)	(2.07)	(1.46)	(0.01)
R&D/Total Assets	6.84*	5.33	92.94**	6.31*	5.76	18.43
	(1.91)	(1.46)	(2.27)	(1.79)	(1.55)	(0.62)
Firm Patents	3.86*	3.95*	4.44*	1.48	6.28	0.94
	(1.93)	(1.93)	(1.98)	(0.67)	(1.08)	(1.67)
Firm Age	-6.74***	-7.53***	-4.95**	-10.54**	-5.20**	-5.94**
	(-3.59)	(-3.65)	(-2.50)	(-2.80)	(-2.41)	(-2.14)
ROA	4.87***	4.54***	-1.18	2.00	4.54*	-18.75*
	(4.34)	(3.80)	(-0.38)	(1.62)	(2.01)	(-1.74)
Top-Tier Underwriter	11.11**	12.47***	13.50***	6.65	9.98	11.95***
	(2.37)	(2.65)	(2.90)	(0.94)	(1.13)	(3.53)
VC-Backed	5.48	4.18	2.97	0.73	4.60	-0.60
	(1.11)	(0.92)	(0.77)	(0.16)	(0.82)	(-0.24)
Hot IPO Market	6.14**	6.58*	3.56	10.76**	6.99	1.94
	(2.23)	(1.74)	(1.32)	(2.16)	(1.49)	(0.55)
Bubble Period		43.17***				
		(7.76)				
Observations	1,377	1,377	689	683	687	685
R-squared	0.281	0.281	0.287	0.342	0.286	0.326
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	No	Yes	Yes	Yes	Yes

Table 5
Inventor CEO and the Preponderance of IPOs in Difficult Financing Conditions

This table investigates the ability of inventor CEOs in successfully going public in difficult financing conditions. In Column (1), we estimate the following probit regression.

$$Off\text{-}the\text{-}Wave_i = \alpha_0 + \beta\ Inventor\ CEO_i + c'controls_i + Industry\ FE + \varepsilon_i$$

The subscript *i* signifies the IPO firm. The dependent variable is *Off-the-Wave* which is an indicator variable that takes the value of one if the month in which the IPO takes place is an off-the-wave month, and zero otherwise. In Columns (2) and (3), we estimate OLS regressions with R&D scaled by assets and log of assets, respectively, as the dependent variables, as specified below.

$$Firm\ Characteristic_i = \alpha_0 + \beta\ Inventor\ CEO_i + c'controls_i + Industry\ FE + Year\ FE + \varepsilon_i$$

The key explanatory variable in all regressions is *Inventor CEO*, which takes the value of one if the IPO is led by an inventor CEO, and zero otherwise. The vector of controls includes various CEO, firm and IPO characteristics. Detailed description of these is provided in Appendix A. All variables are measured at the time of the IPO. Year fixed effects are based on the IPO year and industry fixed effects are based on Fama–French 48-industry classification. The statistical significance in Column (1) is based on z-statistics, and in the remaining columns on *t*-statistics. These are reported in parentheses, and are computed using heteroskedasticity-consistent standard errors that are corrected for clustering across year and industry. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

	Dependent Variable =		
	Off-the-Wave	R&D / Total Assets	Ln (Total Assets)
	(1)	(2)	(3)
Explanatory Variables			
Inventor CEO	0.098*	0.065*	-0.164***
	(1.91)	(1.68)	(-2.99)
Founder CEO	-0.029	0.006	0.012
	(-0.33)	(0.24)	(0.18)
Ph.D.	0.220*	0.022	-0.177
	(1.84)	(0.67)	(-1.60)
Generality Index	0.294***	0.047*	-0.083*
	(4.20)	(1.84)	(-1.86)
Board Experience	-0.137***	-0.027*	0.099***
	(-3.22)	(-1.96)	(13.17)
Rel. Ind. Exp.	-0.014	0.011	-0.042
	(-0.21)	(0.46)	(-0.94)
CEO Age	0.168	0.089**	1.062***
	(0.86)	(2.39)	(9.74)
ln(Total Assets)	0.253***		
	(3.52)		
R&D/Total Assets	0.016		
	(0.09)		
Firm Patent	-0.020		
	(-0.32)		
Firm Age	0.168***		
	(2.70)		

ROA	-0.070		
	(-0.40)		
Top-Tier Underwriter	-0.107	0.001	1.027***
	(-0.70)	(0.08)	(7.19)
VC-Backed	-0.092	0.113***	-0.257**
	(-0.92)	(4.59)	(-2.36)
Hot IPO Market		-0.013	-0.095
		(-0.59)	(-0.74)
Observations	1,377	1,377	1,377
(Pseudo) R-squared	0.114	0.234	0.384
Industry FE	Yes	Yes	Yes
Year FE	No	Yes	Yes

Table 6
Inventor CEOs and Post-IPO Innovation

The table reports the estimates from several regressions that examine the relationship between inventor CEOs and post-IPO firm innovation, using following regression specification.

$$Innovation_{i,t+1\ to\ t+3} = \alpha_0 + \beta\ Inventor\ CEO_{i,t} + c'controls_{i,t} + \gamma\ Innovation_{i,t-2\ to\ t} + \varepsilon_{i,t+1\ to\ t+3}.$$

The subscripts *i* signifies the IPO firm and *t* the year in which the IPO takes place. The dependent variables are alternate measures of a firm's innovation output averaged over the three years following the IPO. The key explanatory variable in all regressions is *Inventor CEO*, which takes the value of one if the IPO is led by an inventor CEO, and zero otherwise. The vector of controls includes various CEO, firm and IPO characteristics. Detailed description of these is provided in Appendix A. All the explanatory variables, except for the lagged value of the dependent variable, are measured at the time of the IPO. The lagged values of the dependent variables are computed as averages over the three years preceding the IPO year, and are included to control for the unobserved differences in firm's innovation ability. Year fixed effects based on the IPO year and industry fixed effects are based on Fama–French 48-industry classification. The *t*-statistics (in parentheses) are computed using heteroskedasticity-consistent standard errors that are corrected for clustering across year and industry. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

	Dependent Variable = Post-IPO Innovation					
	Patents	Citations	Top 1% Patents	Top 5% Patents	Generality	Originality
Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)
Inventor CEO	1.30**	34.29	0.06**	0.13***	0.06*	0.11***
	(2.19)	(1.54)	(2.90)	(3.08)	(1.88)	(3.23)
Founder CEO	0.31	16.33	-0.002	0.05	0.02**	0.04**
	(0.74)	(0.93)	(-0.12)	(0.74)	(2.40)	(2.58)
Ph.D.	0.36	9.04	-0.02	-0.002	-0.04*	-0.003
	(0.58)	(0.41)	(-0.92)	(-0.03)	(-1.87)	(-0.16)
Generality	0.22	1.88	-0.01	0.002	0.02	0.03
	(0.72)	(0.12)	(-0.35)	(0.03)	(1.19)	(1.54)
Board Experience	0.28	12.21	0.01	0.02	-0.002	0.001
	(1.48)	(1.31)	(0.89)	(0.67)	(-0.28)	(0.18)
Rel. Ind. Exp.	-0.13	9.75	0.01	0.03	0.01	-0.002
	(-0.49)	(0.71)	(0.48)	(0.75)	(0.68)	(-0.13)
CEO Age	-0.85	-31.81	-0.01	-0.13	0.03	0.03
	(-0.89)	(-0.68)	(-0.22)	(-0.70)	(0.75)	(1.45)
ln(Total Assets)	0.44**	14.60***	0.01	0.05*	-0.01**	-0.01
	(2.42)	(2.96)	(1.40)	(1.76)	(-2.74)	(-1.42)
R&D/Total Assets	1.09	21.11	0.03	0.08	0.002	0.06**

	(1.47)	(0.72)	(1.27)	(0.86)	(0.06)	(2.32)
Firm Age	-0.22	10.02	0.004	0.02	0.002	0.01
	(-1.09)	(1.05)	(0.33)	(0.68)	(0.13)	(0.92)
ROA	0.76	10.39	0.01	0.01	0.001	0.02
	(1.65)	(0.84)	(0.74)	(0.20)	(0.15)	(1.55)
Top-Tier Underwriter	0.61**	8.71	0.004	0.04	0.02	0.03**
	(2.39)	(0.69)	(0.21)	(1.63)	(1.55)	(2.86)
VC-Backed	-0.15	-8.52	0.002	-0.02	0.04***	0.05***
	(-0.43)	(-0.46)	(0.10)	(-0.28)	(3.63)	(3.56)
Hot IPO Market	0.34	11.54	0.03	0.04	-0.02	-0.02
	(0.68)	(0.57)	(1.16)	(0.62)	(-1.66)	(-1.51)
Pre-IPO Patent	1.42***					
	(5.08)					
Pre-IPO Citations		0.65***				
		(9.27)				
Pre-IPO Top 1% Patent			0.38***			
			(4.27)			
Pre-IPO Top 5% Patent				0.688***		
				(7.00)		
Pre-IPO Generality					0.31***	
					(9.92)	
Pre-IPO Originality						0.38***
						(14.73)
Observations	1,377	1,377	1,377	1,377	1,377	1,377
R-squared	0.33	0.40	0.19	0.30	0.41	0.37
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 7
Inventor CEOs and Post-IPO R&D Expenditure, Cash Holding and Leverage

This table reports the association between inventor CEOs and post-IPO R&D expenditure, cash holdings and leverage, using the following regression.

$$Characteristic_{i,t+1\ to\ t+3} = \alpha_0 + \beta\ Inventor\ CEO_{i,t} + c'controls_{i,t} + \gamma\ Characteristic_{i,t} + \varepsilon_{i,t+1\ to\ t+3}.$$

The subscripts *i* signifies the IPO firm and *t* the year in which the IPO takes place. The dependent variables are various characteristics of the firm. These are measured as averages over the three years following the IPO. The key explanatory variable in all regressions is *Inventor CEO*, which takes the value of one if the IPO is led by an inventor CEO, and zero otherwise. The vector of controls includes various CEO, firm and IPO characteristics. Detailed description of these is provided in Appendix A. All the explanatory variables are measured at the time of the IPO. We include the lagged values of the dependent variables to control for the unobserved differences in firm characteristics. Year fixed effects based on the IPO year and industry fixed effects are based on Fama–French 48-industry classification. The *t*-statistics (in parentheses) are computed using heteroskedasticity-consistent standard errors that are corrected for clustering across year and industry. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

	Dependent Variable =			
	Post-IPO ln(1+R&D)	Post-IPO R&D/Total Assets	Post-IPO Cash/Total Assets	Post-IPO Leverage
Explanatory Variables	(1)	(2)	(3)	(4)
Inventor CEO	0.168***	0.003	0.003	-0.002
	(3.65)	(0.22)	(0.28)	(-0.27)
Founder CEO	0.025	-0.006	0.009	0.013***
	(0.73)	(-0.58)	(0.70)	(3.33)
Ph.D.	0.014	-0.004	-0.032**	-0.005
	(0.20)	(-0.29)	(-2.48)	(-0.41)
Generality Index	0.086**	-0.002	-0.009**	-0.005
	(2.09)	(-0.35)	(-2.07)	(-0.65)
Board Experience	0.006	0.002	0.002	0.003
	(0.29)	(0.55)	(0.55)	(0.85)
Rel. Ind. Exp.	-0.001	-0.010	0.003	-0.013*
	(-0.02)	(-1.24)	(0.46)	(-1.80)
CEO Age	-0.136	0.003	-0.030	0.004
	(-1.27)	(0.16)	(-1.41)	(0.43)
ln(Total Assets)	-0.136***	-0.004	-0.026***	0.041***
	(-7.91)	(-0.80)	(-8.44)	(4.50)
Firm Age	-0.099***	-0.013	0.016*	-0.015**
	(-5.71)	(-0.85)	(1.86)	(-2.03)
ROA	0.151***	0.005	0.003	-0.035***
	(3.99)	(0.49)	(0.31)	(-5.37)
Top-Tier	0.245***	-0.019**	0.003	-0.016***
	(4.59)	(-2.44)	(0.27)	(-3.19)
VC Backed	0.168**	0.022**	0.033***	-0.025***
	(2.44)	(2.56)	(4.47)	(-3.56)
Hot IPO Market	-0.000	-0.015	0.019*	0.003
	(-0.01)	(-1.43)	(1.79)	(0.39)

Pre-ln(R&D)	1.068***			
	(22.24)			
R&D/Total A.		0.272***		
		(17.13)		
R&D/Total Assets			0.047***	-0.011**
			(4.93)	(-2.59)
Pre-Cash/Total A.			0.218***	
			(9.72)	
Pre-Leverage				0.179***
				(6.80)
Observations	1,265	1,265	1,261	1,258
R-squared	0.795	0.455	0.328	0.402
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Table 8
Inventor CEO and the Post-IPO Efficiency of R&D

This table examines the association between inventor CEO and the efficiency of R&D expenditure. We re-estimate the regressions in Table 6, after adding an interaction term between inventor CEO and R&D expenditure scaled by total assets. We do so following Byun, Fuller and Lin (2021), who interpret this variable as a measure of the efficiency of the firm's R&D expenditure.

$$Innovation_{i,t+1\ to\ t+3} = \alpha_0 + \beta_1\ Inventor\ CEO_{i,t} + \beta_2\ Inventor\ CEO_{i,t}\ x\ \left(\frac{R\&D}{Total\ Assets}\right)_{i,t} + \beta_3\left(\frac{R\&D}{Total\ Assets}\right)_{i,t} + c'controls_{i,t} + \gamma\ Innovation_{i,t-2\ to\ t} + \varepsilon_{i,t+1\ to\ t+3}.$$

The subscripts *i* signifies the IPO firm and *t* the year in which the IPO takes place. The dependent variables are alternate measures of a firm's innovation output averaged over the three years following the IPO. *Inventor CEO* is an indicator variable takes the value of one if the IPO is led by an inventor CEO, and zero otherwise. The key explanatory variable is the interaction term between *Inventor CEO* and R&D intensity, which aims to capture the efficiency of the firm's R&D. The vector of controls includes various CEO, firm and IPO characteristics. Detailed description of these is provided in Appendix A. All the explanatory variables, except for the lagged value of the dependent variable, are measured at the time of the IPO. The lagged values of the dependent variables are computed as averages over the three years preceding the IPO year, and are included to control for the unobserved differences in firm's innovation ability. Year fixed effects based on the IPO year and industry fixed effects are based on Fama–French 48-industry classification. The *t*-statistics (in parentheses) are computed using heteroskedasticity-consistent standard errors that are corrected for clustering across year and industry. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

	Dependent Variable = Post-IPO Innovation					
	Patents	Citations	Top 1% Patents	Top 5% Patents	Generality	Originality
Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)
Inventor CEO	1.872**	49.856	0.067**	0.172***	0.067*	0.118**
	(2.43)	(1.48)	(2.50)	(3.10)	(2.06)	(2.78)
Inventor CEO * R&D/Total Assets	-1.629	-44.111	-0.024	-0.133	-0.023	-0.032
	(-1.70)	(-0.92)	(-0.70)	(-1.42)	(-0.95)	(-0.84)
Founder CEO	0.299	16.109	-0.002	0.049	0.018**	0.035**
	(0.77)	(0.92)	(-0.13)	(0.73)	(2.48)	(2.56)
Ph.D.	0.433	11.140	-0.016	0.005	-0.034*	-0.002
	(0.74)	(0.53)	(-0.84)	(0.07)	(-1.77)	(-0.08)
Generality Index	0.211	1.757	-0.006	0.001	0.017	0.025
	(0.66)	(0.11)	(-0.35)	(0.03)	(1.17)	(1.52)
Board Experience	0.283	12.240	0.010	0.023	-0.002	0.001
	(1.48)	(1.31)	(0.89)	(0.67)	(-0.28)	(0.18)
Rel. Ind. Exp.	-0.118	10.138	0.006	0.030	0.010	-0.002
	(-0.43)	(0.71)	(0.48)	(0.74)	(0.70)	(-0.11)
CEO Age	-0.917	-33.593	-0.010	-0.133	0.033	0.027
	(-0.99)	(-0.73)	(-0.25)	(-0.73)	(0.72)	(1.46)

ln(Total Assets)	0.459**	15.229**	0.008	0.049	-0.007**	-0.010
	(2.35)	(2.73)	(1.46)	(1.73)	(-2.44)	(-1.34)
R&D/Total Assets	1.538*	33.323	0.034	0.112	0.008	0.060*
	(1.92)	(1.22)	(1.40)	(1.27)	(0.28)	(1.93)
Firm Age	-0.207	10.422	0.004	0.026	0.002	0.012
	(-1.03)	(1.03)	(0.36)	(0.73)	(0.15)	(0.92)
ROA	0.687	8.442	0.007	0.001	0.000	0.021
	(1.44)	(0.66)	(0.67)	(0.02)	(0.02)	(1.54)
Top-Tier	0.608**	8.714	0.004	0.042	0.018	0.034**
	(2.25)	(0.69)	(0.21)	(1.69)	(1.56)	(2.80)
VC Backed	-0.181	-9.415	0.002	-0.019	0.039***	0.044***
	(-0.48)	(-0.49)	(0.08)	(-0.32)	(3.71)	(3.55)
Hot IPO Market	0.315	11.016	0.027	0.035	-0.017	-0.016
	(0.61)	(0.51)	(1.12)	(0.58)	(-1.67)	(-1.52)
Pre-IPO Patent	1.422***					
	(5.08)					
Pre-IPO Citations		0.650***				
		(9.18)				
Pre-IPO Top 1% Patent			0.380***			
			(4.29)			
Pre-IPO Top 5% Patent				0.688***		
				(6.97)		
Pre-IPO Generality					0.312***	
					(9.87)	
Pre-IPO Originality						0.377***
						(13.95)
Observations	1,377	1,377	1,377	1,377	1,377	1,377
R-squared	0.334	0.399	0.192	0.303	0.408	0.365
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 9
Inventor CEOs and Post-IPO Abnormal Stock Returns: Fama–French Time Series Regressions

This table reports the estimates of abnormal stock returns during the 3-year post-IPO period for firms led by inventor and non-inventor CEOs. Standard calendar time portfolio approach is followed with intercepts from Fama–French factor model regressions depicting the abnormal returns, as specified below.

$$R_{pt} - R_{ft} = Intercept + \beta_1(R_{m,t} - R_{f,t}) + \beta_2(R_{m,t-1} - R_{f,t-1}) + \beta_3 SMB_t + \beta_4 SMB_{t-1} + \beta_5 HML_t + \beta_6 HML_{t-1} + \in_{p,t}$$

The subscripts *p* and *t* depict portfolio and month, respectively. The dependent variable in the first (second) column is the equally weighted monthly percentage return on a portfolio of IPO firms led by inventor CEOs (non-inventor CEOs) that have gone public during the prior 36 months. The dependent variable in the last column is the difference between the monthly returns of equally-weighted portfolios of inventor- and non-inventor-led IPOs. ($R_m - R_f$) is the realization of the market risk premium. SMB_t is the return on a portfolio of small stocks minus the return on a portfolio of big stocks. HML_t is the return on a portfolio of high book-to-market stocks minus the return on a portfolio of low book-to-market stocks. The factor returns are supplied by Kenneth French. All regressions are estimated using 257 monthly observations for the period February 1992 to June 2013. The regressions are estimated using weighted least squares, with the weights based on the number of IPO firms in the monthly portfolio. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Variables	Inventor CEOs	Non-Inventor CEOs	Difference (Inventor – Non-Inventor)
$(R_{m,t} - R_{f,t})$	1.21***	1.36***	-0.22***
	(15.09)	(19.54)	(-2.69)
$(R_{m,t-1} - R_{f,t-1})$	0.32***	0.33***	0.06
	(3.98)	(4.73)	(0.63)
SMB_t	1.49***	1.01***	0.42***
	(16.03)	(9.34)	(6.59)
SMB_{t-1}	0.07	0.09	-0.06
	(0.80)	(0.82)	(-0.93)
HML_t	-0.99***	-0.70***	0.07
	(-9.34)	(-6.54)	(0.57)
HML_{t-1}	-0.07	-0.15	-0.22**
	(-0.64)	(-1.49)	(-2.07)
Intercept	0.96**	0.15	1.81***
	(2.55)	(0.55)	(5.71)
# of Months	257	257	257
Avg. No. of Stocks Per Month	35	140	175
R-squared	0.88	0.76	0.38

Table 10
Endogeneity Analysis: The Effect of Changes in Enforceability of Non-Competition Agreements on the Relationship Between Inventor CEOs and the Success of an IPOs

This table reports the results of a difference-in-difference (DID) analysis in which we examine whether our results are affected by changes in the enforceability of non-competition agreements. In Panel A (B), we examine how the relationship between inventor CEO and IPO outcomes (post-IPO innovation) documented in Table 4 and 5 (Table 6) are affected by changes in the enforceability index. We create two new variables: *After*, which takes the value of 1 for all IPOs in the year 1997 onwards when the enforceability index in Florida changed, and equals zero otherwise; and Treated, which takes the value of one for Florida that was the only state where the index changed, and equals zero for all other states. We then use the newly created variables to create three interaction variables and include them in all regressions. The key explanatory variable is the triple interaction term, *Inventor CEO x After x Treated*, which is the DID estimator, and captures how the effect of inventor CEO varies due to the changes in the enforceability index. To illustrate, Column (1) in Panel A re-estimates the regression in Column (1) of Table 4 with the following specification.

$$Underpricing_{i,s} = \alpha_0 + \beta_1\, Inventor\ CEO_i + \beta_2\, Inventor\ CEO_i\ x\ After + \beta_3\, Inventor\ CEO_i\ x\ Treated + \beta_4\, Inventor\ CEO_i\ x\ After\ x\ Treated + c'controls_i + State\ FE + Industry\ FE + Year\ FE + \varepsilon_{i,s}$$

The subscript *i* signifies the IPO firm, and *s* the state in which the firm is headquartered. We do not include the time subscript as all variables are measured at the time of the IPO. Other variables and the vector of controls remains the same as before. Columns (2) through (4) in Panel A re-estimates the results of Table 5 after the inclusion of the additional variables. Industry fixed effects are based on Fama–French 48-industry classification and year fixed effects are based on the IPO year end. State fixed effects relate to the state in which the IPO firm is headquartered. The sample includes high technology U.S. IPOs from 1992 to 2010, and exclude those in Louisiana and Texas. The *t*-statistics, or z-statistics (Column (2)) are in parentheses. They are based on heteroskedasticity-consistent standard errors that are corrected for clustering across year and industry. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Panel A: Effect of Changes in the Enforceability Index on the Relationship between Inventor CEO and IPO Outcomes

	Dependent Variable =			
	Underpricing	Off-the-Wave	R&D/Total Assets	ln(Total Assets)
Explanatory Variables	(1)	(2)	(3)	(4)
Inventor CEO*Treated*After	-50.936	-0.637	-0.122	-0.393
	(-1.59)	(-0.69)	(-0.39)	(-0.54)
Inventor CEO*Treated	34.829	0.456	0.097	-0.099
	(1.21)	(0.58)	(0.46)	(-0.09)
Inventor CEO*After	2.287	0.844***	-0.058	-0.069
	(0.41)	(4.81)	(-0.63)	(-0.45)
Inventor CEO	-5.873	-0.514***	0.095	-0.095
	(-1.16)	(-3.96)	(1.72)	(-0.97)
Founder CEO	0.610	-0.019	0.010	0.022
	(0.27)	(-0.26)	(0.38)	(0.37)
Ph.D.	2.500	0.215**	0.020	-0.185*
	(0.59)	(1.99)	(0.60)	(-1.74)
Generality Index	5.713	0.276***	0.042	-0.062
	(1.00)	(2.99)	(1.39)	(-1.21)
Board Experience	-2.749	-0.121**	-0.028*	0.095***

	(-1.11)	(-2.49)	(-1.78)	(5.06)
Rel. Ind. Exp.	3.478	-0.034	0.013	-0.055
	(1.07)	(-0.43)	(0.50)	(-0.83)
CEO Age	-9.528	0.177	0.101**	1.044***
	(-1.31)	(0.91)	(2.15)	(8.17)
ln(Total Assets)	2.178	0.250***		
	(1.50)	(4.08)		
R&D/Total Assets	6.418*	0.038		
	(1.97)	(0.21)		
Firm Patent	3.383	-0.034		
	(1.70)	(-0.51)		
Firm Age	-6.885**	0.187***		
	(-2.72)	(3.74)		
ROA	4.844***	-0.068		
	(3.03)	(-0.40)		
Top-Tier	11.257*	-0.116	0.008	1.016***
	(1.84)	(-0.83)	(0.49)	(7.03)
VC Backed	5.152	-0.085	0.102***	-0.238*
	(1.05)	(-0.89)	(3.60)	(-1.83)
Hot IPO Market	6.007*		-0.020	-0.074
	(1.87)		(-0.74)	(-0.55)
Observations	1,372	1,356	1,372	1,372
(Pseduo) R-squared	0.303	0.144	0.256	0.418
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	No	Yes	Yes
State FE	Yes	Yes	Yes	Yes

Panel B: Effect of Changes in the Enforceability Index on the Relationship between Inventor CEO and Post-IPO Innovation

	Dependent Variable = Post-IPO Innovation					
	Patents	Citations	Top 1% Patents	Top 5% Patents	Generality	Originality
Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)
Inventor CEO*Treated*After	-3.008	468.125	0.308	0.827	-0.064	-0.137
	(-1.44)	(1.21)	(0.75)	(0.93)	(-0.85)	(-1.30)
Inventor CEO*Treated	1.159	-54.761	0.027	-0.161	0.092	0.106
	(0.73)	(-0.91)	(0.34)	(-1.40)	(0.60)	(0.65)
Inventor CEO*After	1.350*	-50.837	-0.002	-0.003	-0.042	0.072
	(1.80)	(-1.22)	(-0.04)	(-0.02)	(-0.84)	(1.63)
Inventor CEO	0.392	61.855**	0.053*	0.116	0.086*	0.056
	(0.75)	(2.25)	(1.76)	(1.22)	(1.89)	(1.63)
Founder CEO	0.318	15.539	-0.002	0.049	0.018**	0.035**
	(0.75)	(0.91)	(-0.15)	(0.74)	(2.25)	(2.63)
Ph.D.	0.400	6.573	-0.018	-0.004	-0.037*	-0.001

	(0.66)	(0.33)	(-0.85)	(-0.05)	(-1.94)	(-0.05)
Generality	0.218	4.108	-0.004	0.006	0.016	0.025
	(0.71)	(0.27)	(-0.24)	(0.12)	(1.08)	(1.51)
Board Experience	0.283	11.179	0.009	0.021	-0.001	0.001
	(1.46)	(1.18)	(0.82)	(0.61)	(-0.23)	(0.16)
Rel. Ind. Exp.	-0.109	7.976	0.005	0.028	0.009	-0.001
	(-0.41)	(0.64)	(0.39)	(0.74)	(0.58)	(-0.07)
CEO Age	-0.861	-38.500	-0.015	-0.141	0.035	0.027
	(-0.90)	(-0.89)	(-0.45)	(-0.83)	(0.78)	(1.14)
ln(Total Assets)	0.438**	15.012**	0.008	0.048*	-0.007**	-0.010
	(2.45)	(2.81)	(1.42)	(1.82)	(-2.40)	(-1.57)
R&D/Total Assets	1.066	22.449	0.028	0.075	0.003	0.050**
	(1.41)	(0.72)	(1.26)	(0.82)	(0.12)	(2.41)
Firm Age	-0.202	9.656	0.004	0.025	0.001	0.013
	(-0.91)	(0.92)	(0.36)	(0.71)	(0.08)	(1.02)
ROA	0.734	11.559	0.009	0.006	0.003	0.022
	(1.52)	(0.83)	(0.87)	(0.18)	(0.38)	(1.44)
Top-Tier Underwriter	0.619**	8.036	0.004	0.041	0.019	0.034**
	(2.44)	(0.60)	(0.20)	(1.46)	(1.65)	(2.85)
VC-Backed	-0.134	-8.886	0.002	-0.017	0.039***	0.046***
	(-0.40)	(-0.45)	(0.12)	(-0.27)	(3.40)	(3.62)
Hot IPO Market	0.322	13.588	0.029	0.041	-0.017	-0.016
	(0.65)	(0.58)	(1.14)	(0.62)	(-1.54)	(-1.40)
Pre-IPO Patent	1.416***					
	(5.04)					
Pre-IPO Citations		0.654***				
		(9.16)				
Pre-IPO Top 1% Patent			0.382***			
			(4.17)			
Pre-IPO Top 5% Patent				0.691***		
				(7.14)		
Pre-IPO Generality					0.312***	
					(9.90)	
Pre-IPO Originality						0.378***
						(14.25)
Observations	1,377	1,377	1,377	1,377	1,377	1,377
R-squared	0.334	0.404	0.196	0.304	0.409	0.367
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 11
Sub-Sample Analyses for Founder CEOs

This table re-estimates the earlier full sample results for the sub-sample of firms led by founder CEOs. Panel A replicates the results in Tables 4 and 5. Specifically, Column (1) replicates the results of Column (1) in Table 4, whereas Columns (2) through (5) replicate the results of Table 5. Likewise, Panel B replicates the results in Table 6. The key explanatory variable is *Inventor CEO*. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Panel A: Inventor CEO and IPO Outcomes for the Founders-Only Sample

	Dependent Variable =			
	Underpricing	Off-the-Wave	R&D/Total Assets	ln(Total Assets)
Exaplanatory Variables	(1)	(2)	(3)	(4)
Inventor CEO	-3.708*	0.191**	0.058	-0.266**
	(-1.78)	(2.18)	(0.69)	(-2.19)
Ph.D.	4.053	0.111	0.025	-0.199
	(0.56)	(0.44)	(0.52)	(-0.99)
Generality Index	12.659	0.203**	0.065	-0.093
	(1.28)	(2.14)	(1.30)	(-1.25)
Board Experience	-4.602	-0.076	-0.032	0.105**
	(-1.03)	(-1.42)	(-1.47)	(2.39)
Rel. Ind. Exp.	4.476	-0.005	0.010	0.029
	(1.40)	(-0.07)	(0.48)	(0.32)
CEO Age	-10.680	0.235	0.039	1.469***
	(-0.89)	(0.56)	(0.85)	(50.22)
ln(Total Assets)	2.512	0.256***		
	(1.62)	(2.68)		
R&D/Total Assets	10.313***	-0.003		
	(3.60)	(-0.02)		
Firm Patent	6.604**	-0.084		
	(2.09)	(-1.58)		
Firm Age	-10.981***	0.157		
	(-3.34)	(1.34)		
ROA	8.935***	-0.168		
	(2.62)	(-1.19)		
Top-Tier	9.964*	-0.042	-0.003	0.977***
	(1.77)	(-0.21)	(-0.11)	(6.82)
VC Backed	0.067	0.026	0.085***	-0.038
	(0.01)	(0.19)	(3.98)	(-0.39)
Hot IPO Market	4.690		0.006	-0.102
	(1.08)		(0.08)	(-0.49)
Observations	649	649	649	649
R-squared	0.266	0.115	0.242	0.380
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	No	Yes	Yes

Panel B: Inventor CEOs and Post-IPO Innovation for Founders-Only Sample

	Dependent Variable = Post-IPO Innovation					
	Patents	Citations	Top 1% Patents	Top 5% Patents	Generality	Originality
Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)
Inventor CEO	1.266***	31.330	0.062**	0.139**	0.067	0.101**
	(3.29)	(1.00)	(2.78)	(2.67)	(1.18)	(2.16)
Founder CEO	0.000	0.000	0.000	0.000	0.000	0.000
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Ph.D.	0.416	-1.076	-0.031	-0.026	-0.020	-0.007
	(0.38)	(-0.03)	(-1.02)	(-0.27)	(-0.66)	(-0.23)
Generality	0.216	-18.846	-0.035	-0.067	-0.000	0.023
	(0.35)	(-0.88)	(-1.24)	(-0.91)	(-0.01)	(1.07)
Board Experience	0.299	18.559**	0.017	0.013	-0.002	-0.006
	(1.16)	(2.48)	(1.34)	(0.43)	(-0.25)	(-0.66)
Rel. Ind. Exp.	0.351	35.909	0.028	0.132*	0.012	-0.019
	(0.71)	(1.73)	(1.53)	(2.01)	(0.51)	(-0.69)
CEO Age	-2.086	-101.647	-0.121	-0.334	0.041***	0.032
	(-1.17)	(-1.26)	(-1.57)	(-1.00)	(4.69)	(0.90)
ln(Total Assets)	0.335	8.348	0.001	0.061	-0.009	-0.019**
	(1.55)	(0.76)	(0.06)	(1.34)	(-1.31)	(-2.31)
R&D/Total Assets	1.150	27.236	0.050	0.148	0.043	0.078
	(1.20)	(0.70)	(1.37)	(1.10)	(1.24)	(1.65)
Firm Age	0.147	28.683*	0.023*	0.060*	-0.025*	-0.003
	(0.49)	(1.95)	(1.81)	(1.88)	(-1.87)	(-0.30)
ROA	1.204	17.388	0.013	0.021	0.018*	0.049**
	(1.74)	(1.00)	(0.84)	(0.47)	(1.87)	(2.57)
Top-Tier Underwriter	0.927**	5.742	0.019	0.056	0.038**	0.056***
	(2.66)	(0.32)	(0.92)	(1.43)	(2.82)	(5.49)
VC-Backed	-0.343	-18.520	-0.023	-0.055	0.006	0.022
	(-0.83)	(-0.93)	(-0.71)	(-0.63)	(0.31)	(0.90)
Hot IPO Market	0.528	36.232	0.051	0.095	-0.023	-0.049**
	(0.50)	(0.96)	(1.64)	(0.80)	(-1.56)	(-2.63)
Pre-IPO Patent	1.202***					
	(3.41)					
Pre-IPO Citations		0.630***				
		(5.42)				
Pre-IPO Top 1% Patent			0.329***			
			(3.24)			
Pre-IPO Top 5% Patent				0.503***		
				(5.51)		
Pre-IPO Generality					0.303***	
					(6.14)	
Pre-IPO Originality						0.379***
						(7.11)

Observations	649	649	649	649	649	649
R-squared	0.311	0.407	0.222	0.253	0.415	0.375
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Appendix A
Variable Definitions and Data Sources

Variable	Description and Source
Panel A: CEO Characteristics	
Inventor CEO	A dummy variable that equals one if the CEO has at least one patent in his or her name filed in the year of IPO or earlier, and zero otherwise. (Source: Information about inventors come from Inventor Database of Lai, D'Amour, Yu, Sun, and Fleming (2013); we follow an elaborate process, described in detail in Section 4B, to match it with CEO identities obtained from a number of datasets including Execucomp, Capital IQ Professional Database, Web pages of companies, Bloomberg, DataStream, Google searches, and others.)
Founder CEO	A dummy variable that equals one if the CEO at the time of the IPO was a founder of the company, and zero otherwise. (Source: Information assembled from various sources including Capital IQ Professional Database, Field–Ritter dataset, DataStream, Compustat Capital IQ People Intelligence Compensation Summary Database; Web pages of the companies, and other internet websites.)
CEO Age	Age of CEO. (Source: Boardex, Capital IQ, Execucomp, Kenney-Patton IPO Database, and online sources including Bloomberg, NNDB, and company websites.)
PhD	A dummy variable that equals one if the CEO holds a Ph.D. Degree. (Source: Boardex, Capital IQ Professional Biographies, Execucomp, Kenney-Patton IPO Database, and miscellaneous online sources including Bloomberg, NNDB, and company websites.)
Board Exp	The total number of different boards a CEO has been a member of during his career. (Source: Capital IQ, Boardex.)
Relative Industry Experience	A dummy that equals one if the CEO has experience in the same industry at 2-digit SIC industry level. (Source: Boardex, Capital IQ, Bureau van Dijk Osiris.)
Generality	Following Custo´dio et al. (2013), Generality is an index created from the principal component analysis of five variables related to the employment background of the CEOs. We decribe each of these variable below, and then briefly depict the principal component procedure we adopt. Number of Positions (X1): It is defined as the total number of different positions in public companies held by the CEO during his career. (Source: Boardex, Capital IQ.) Number of Firms (X2): It is the number of different public companies where a CEO has worked. (Source: Boardex, Capital IQ.)

Number of Industries (X3): It is the number of different industries (based on 4-digit SIC code) in which the CEO has worked. (Source: Compustat. For the experience of a CEO in non-US publicly held company, we collect industry information from Bureau van Dijk Osiris, Thomson Reuters Datastream, Compustat Global.)

CEO Experience Dummy (X4): A dummy variable that equals one if the CEO also held the CEO position in another company. (Source: Boardex, Capital IQ.)

Conglomerate Experience Dummy (X5): A dummy variable that equals one if CEO has worked in a congolerate, defined as a company that has operations in more than one two-digit SIC industry. (Source: Compustat Business Segments Data, Bureau van Dijk Osiris, Thomson Reuters Eikon. When the segment information is not available in Compustat Business Segments Data and Bureau van Dijk Osiris, we manually collect the information from Thomson Reuters Eikon.)

The results from the principal component analysis of the above five variables is shown in the table below. Eigenvalue produced is quite similar to the one in Custo´dio et al. (2013).

	# of Positions	# of Firms	# of Industries	CEO Experience Dummy	Conglomerate Experience Dummy
Loadings	0.830	0.925	0.886	0.571	0.675
Scores	0.471	0.525	0.503	0.324	0.382
Proportion explained		0.622			
Eigenvalue		3.112			

GI_{it} =0.4706*$X1_{it}$ +0.5245*$X2_{it}$ + 0.5025*$X3_{it}$ +0.3237*$X4_{it}$ + 0.3824*$X5_{it}$
Following Custo´dio et al.(2013) the index is standardized to have mean of zero and standard deviation of one.

Panel B: Firm/Deal Characteristics

Underpricing	Stock return on the first day of trading in percentage terms, calculated as the closing price on the first day less the offer price, divided by the offer price. (Source: SDC Global New Issues database)
Ln(Total Assets)	Natural logarithm of the book value of the firm's total assets at the end of the fiscal year before the IPO. (Source: Compustat)
R&D/Total Assets	R&D expenditure divided by total assets, as at the end of fiscal year before the IPO. (Source: Compustat)
Firm Age	Natural logarithm of (one plus) the number of years since the firm was founded, measured at the time of the IPO. (Source: Jay Ritter's web site, missing ones hand collected)

ROA	Net operating profit divided by total assets, as at the end of fiscal year before the IPO. (Source: Compustat)
Top-Tier Underwriter	A dummy variable that equals one if the lead underwriter of the IPO is highly reputable. We download the data on the reputation ranks of underwriters from Jay Ritter's web site. The methodology for creating the ranks is provided in Loughran and Ritter (2004). The underwriter ranks range from 0 to 9. Following Loughran and Ritter (2004), the dummy variable, *Top-Tier Underwriter*, equals one if the lead underwriter is 8 or above. (Source: Jay Ritter's web site)
V*C-Backed*	An indicator variable set to one if the IPO is backed by one or more venture capital funds, else zero. (Source: SDC Global New Issues database; missing ones hand collected)
Hot IPO Market	An indicator variable that takes the value of one if the IPO is issued during the "hot" IPO market. Following Chemmanur and He (2011), we first compute the three-month moving averages of IPO volume in a particular Fama-French 49 industry for each month. We then define ''hot periods'' as those months in which the moving average falls into the top quartile of that industry's IPO months. We use the overall US IPO data to construct this variable, not just the sample of technology firms used in this study. (Source: SDC Global New Issues database)
Bubble Period	An indicator variable that equals one for the period September 1998 to August 2000, and zero otherwise (as in Lowry, Officer, Schwert, 2010).
Off-the-Wave	An indicator variable that takes the value of one if the IPO is issued during the "off-the-wave" periods (otherwise, known as "cold" IPO periods). To identify these periods, we closely follow Chemmanur and He (2011). We first compute the three-month moving averages of IPO volume in a particular Fama-French 49 industry for each month. Then we define ''hot periods'' as those in which the moving average falls into the top quartile of that industry's IPO months. Lastly, we define IPO waves as all sequences of consecutive ''hot periods'' that begin and end with a non-zero number of issuances. The months that are not part of the wave are classified as "off-the-wave" periods. (Source: SDC Global New Issues database)
Cash Holdings	The ratio of cash and marketable securities to total assets. (Source: Compustat)
Leverage	The ratio of the sum of long-term debt and current liability to total assets. (Source: Compustat)

Panel C: Innovation Measures

Firm Patents	The cumulative number of patents filed by a firm (that were subsequently granted) up until its IPO. (Source: 2010 version of patent data compiled by KPSS)
Patents	The number of patents filed in a year by the firm (that were subsequently granted) averaged over the three-year post-IPO period. We correct for the well-known truncation problem in patent counts by using the truncation correction weights that are calculated from the application-grant lag distributions as described in Hall, Jaffe and Trajtenberg (2001). (Source: 2010 version of patent data compiled by KPSS)

Pre-IPO Patents	The number of patents filed in a year by the firm (that were subsequently granted) averaged over the three years preceding the IPO. (Source: 2010 version of patent data compiled by KPSS)
Citations	The total number of future citations, excluding self-citations, received by the firm's patents filed in a year, averaged over the three-year post-IPO period. The citation count for each patent is corrected for the well-known truncation bias by dividing it by the average number of citations received in the same two-digit technological field in the same application year. (Source: 2010 version of patent data compiled by KPSS)
Pre-IPO Citations	The total number of future citations, excluding self-citations, received by the firm's patents filed in a year, averaged over the three-year preceding the IPO. (Source: 2010 version of patent data compiled by KPSS)
Top 1% Patent	The number of patents filed by a firm in a year that fall in the top 1% of the distribution of future citations in the same technological field, averaged over the three-year post-IPO period. Self-citations are excluded. (Source: 2010 version of patent data compiled by KPSS)
Pre-IPO Top 1% Patent	The top 1% of the distribution of future citations in the same technological field, averaged over the three years preceding the IPO. Self-citations are excluded. (Source: 2010 version of patent data compiled by KPSS)
Top 5% Patent	The number of patents filed by a firm in a year that fall in the top 5% of the distribution of future citations in the same technological field, averaged over the three-year post-IPO period. Self-citations are excluded. (Source: 2010 version of patent data compiled by KPSS)
Pre-IPO Top 5% Patent	The top 1% of the distribution of future citations in the same technological field, averaged over the three years preceding the IPO. (Source: 2010 version of patent data compiled by KPSS)
Generality	Average of the yearly Generality measures computed for the three-year post-IPO period. Generality measure considers the forward citations received by the patents. It is computed as one minus the Herfindahl index of the citations received by the patents that a firm applied for in a given year across two-digit technological classes. A high value indicates that a firm's patents are cited by subsequent patents across a wide range of fields. (Source: 2010 version of patent data compiled by KPSS)
Pre-IPO Generality	Average of the yearly Generality measures computed for the three-year preceding the IPO. (Source: 2010 version of patent data compiled by KPSS)
Originality	Average of the yearly Originality measures computed for the three-year post-IPO period. Originality measure considers the backward citations made by the firm in its patents. It is computed as one minus the Herfindahl index of the citations made by the patents that a firm applied for in a given year across two-digit technological classes. A high value indicates that the preceding patents cited belong to a wider set of technological classes. (Source: 2010 version of patent data compiled by KPSS)
Pre-IPO Originality	Average of the yearly Generality measures computed for the three-year preceding the IPO. (Source: 2010 version of patent data compiled by KPSS)