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Technology timing of IPOs and venture capital incubation

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ABSTRACT

This paper investigates whether industry technological changes affect the timing of venture capital-backed IPOs. Venture capitalists (VCs) shorten incubation periods and take portfolio companies public when the industry exhibits high levels of technological change. This technology timing of IPOs reflects the VCs' efforts to raise future capital. In particular, during periods of greater technological change, VCs that conduct IPOs after shorter incubation periods obtain more subsequent funding. However, portfolio companies with shorter incubation periods earn fewer patents, are less likely to survive, and experience worse stock returns after their IPOs. These findings provide new insights into VCs' strategic exit decisions due to changes in the technological environment, as well as how their decisions affect the post-exit performance of their portfolio companies.

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1. Introduction

Technological innovations are the fundamental drivers of industry dynamics, job creation, and economic growth (Hochberg et al., 2010; Schumpeter, 1942). Venture capital (VC) plays a crucial role in funding and promoting technological innovations (Kortum and Lerner, 2000). Furthermore, VC firms often base their investment decisions on industry- or firm-level technological innovations. As Hellmann and Puri (2000, p.963) point out, VCs "tend to closely follow the technology and market developments in their area of expertise in order to stay in the deal flow and to be able to make an informed investment decision."

This paper investigates how technological changes affect VCs' exit decisions. The importance of VCs' exit decision is described by Gompers and Lerner (2004) that "The need to ultimately exit investments shapes every aspect of the venture capital cycle." Indeed, VCs' exit decisions affect returns to venture investors, the performance of VCs, and their ability to raise additional capital. VCs' exit decisions also impact the size and valuations of the initial public offering (IPO) markets.[1] However, despite the close link between VCs' activity and technological innovations, the existing literature has not considered the potential relation between technological innovations and VCs' exit decisions. Considering the drastically changing volume of VC-backed IPOs in response to the boom and bust of the most recent high-tech bubble, and the growing concerns for a new high-tech bubble, this research question needs more academic scrutiny.[2]

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[1] According to Ritter (2012), 35% of all IPOs conducted between 1980 and 2011 are backed by VCs.

[2] For example, on March 27, 2011, the New York Times article "Investing Like It's 1999" noted, "Banks pouring money into technology funds, wealthy clients and institutions clamoring to get pieces of start-ups, expectations of stock market debuts building … some investors with memories of the Internet bust a decade earlier are wondering whether this sudden burst of activity spells danger for the industry once again." The Economist article "The New Tech Bubble" on May 12, 2011, made similar points.

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Consequently, this paper fills in this gap and addresses two interlinked research questions. First, do industry-specific technological changes affect the timing of VC-backed IPOs? Second, what consequences might such technology timing of IPOs have? Using the annual percentage change in industry patenting as a proxy for industry technological changes, this study reveals that the time from the initial VC investment to the IPO date – a measure we call the VC incubation period – decreases when the industry experiences greater technological changes.[3] These results remain robust even after controlling for equity market conditions, VC firm and fund characteristics, other industry characteristics, and survivorship bias.[4]

This paper further investigates causes for the above findings of the technology timing of VC-backed IPOs and hypothesizes that when the surrounding industry is experiencing a period of greater technological change, the incentives to raising future capital drives VCs to shorten the incubation period and take portfolio companies public earlier. To test this VC fundraising hypothesis, extended analyses examine the relation between the incubation period length and post-IPO VC fundraising for portfolio companies undergoing rapid industry technological changes. The findings first show that VCs raise more subsequent capital by taking firms public during periods of greater industry technological changes. Furthermore, when the industry experiences greater technological changes, VCs that conduct IPOs after shorter incubation periods obtain more subsequent funding. Therefore, in support of the VC fundraising hypothesis, this study finds that to attract future capital, VCs take advantage of hot technology periods, shorten incubation periods, and bring portfolio companies public.[5]

A separate research question pertains to the potential consequences of this strategic exit timing decision in response to industry technological changes. The length of time VCs remain invested with a company (i.e., the incubation period) constitutes an intangible form of capital that creates value; according to Kaplan and Schoar (2005, p. 1822), "Successful GPs (general partners) might not easily scale up investments by putting more money in any particular deal or investing in more companies because they provide other inputs that are difficult to scale, such as time and advice." Sorensen (2007) further recognizes that VCs' most scarce resource is time. Portfolio companies that experience shorter incubation periods because VCs sense technology changes thus may receive less monitoring and nurturing by VCs, such that they perform worse after the IPO.

To assess the consequences of shorter incubation periods, this study focuses on portfolio companies' post-IPO performance, i.e., patenting, stock returns, and survival probabilities. According to Krishnan et al. (2011), post-IPO performance of these companies is important to various parties of interests—IPO investors, VCs, entrepreneurs, and VCs' capital providers. This paper first considers VC portfolio companies' post-IPO patenting, because patents represent the realization of a firm's R&D activities and long-term investments (Lerner et al., 2011). Further, because most companies engage in intensive R&D activity, patents should be considered in the overall performance assessments. Patents also appear increasingly important to the business of portfolio companies and help determine their stock market value (Hall et al., 2005; Kaplan et al., 2009; Rossi, 2006).

The study results show that incubation period length has a positive impact on portfolio companies' post-IPO performance, such that companies with shorter VC incubation periods file fewer (ultimately successful) patent applications after IPOs, are less likely to survive within 5 years of their IPOs, and earn lower stock returns. These results remain robust even after controlling for incubation period endogeneity, survivorship bias, and the pre-VC investment maturity of the portfolio companies. Overall, these findings highlight the trade-offs when VCs' strategic exit timing decisions are based on industry-specific technology booms. Although VCs raise more subsequent funds by shortening the incubation periods during these periods of technological changes, portfolio companies suffer worse post-IPO performance due to the shorter time VCs spend on monitoring and nurturing these companies prior to their IPO.

This study therefore offers four main contributions. First, it points to a new dimension with regard to the causes of VCs' strategic exit decisions. According to prior literature, the key determinants of VCs' exit decisions are equity market conditions (Lerner, 1994) and the VCs' reputation (Gompers, 1996). This article provides novel evidence that the decision also depends on industry-specific levels of technological changes, though a timing of IPO decision based on technological changes can adversely affect the post-exit performance of portfolio companies due to a shorter incubation period.

Second, this study adds to the literature concerning the timing of IPOs. Prior literature indicates that IPO timing depends on IPO market conditions (Lerner, 1994; Lowry and Schwert, 2002; Ritter, 1991, among others), information production costs (Chemmanur and Fulghieri, 1999), product market characteristics (Chemmanur et al., 2010), the information spillover effect (Alti, 2005), returns to the VCs (Inderst and Muller, 2004; Michelacci and Suarez, 2004), and the trade-offs between entrepreneurs' private benefits and the benefits of diversification (Benninga et al., 2005). Within a theoretical framework, Maksimovic and Pichler (2001) show that both technology and competitive risks affect the timing of IPOs in an industry characterized by rapid technological changes. Further, Michelacci and Suarez (2004) and Tinn (2010) develop theories on the stock markets' beneficial roles in facilitating exit of entrepreneurs investing in technology. Their models suggest that technological spillovers and/or the level of technology adoption affect a firm's incentives to go public. In contrast, this article offers the first empirical evidence that technological changes affect IPO timing, then demonstrates that this technology timing of IPOs results from VCs' fundraising motives.

Third, this article contributes to extant literature on the governance roles of equity investors. In particular, the shareholder's investment horizon is an important proxy for the degree of monitoring by equity investors (Bushee, 1998; Chen et al., 2007;

[3] This measure, the annual percentage change in industry patenting, appears in other studies as a proxy for technological changes. For example, Hsu (2009) uses annual log differences in patenting and finds that technological shocks help explain aggregate stock market premiums.

[4] The interpretation of an explanatory variable in a hazard model is twofold: First, it measures how the explanatory variable affects the time to the event. Second, it describes how the explanatory variable affects the timing of the events.

[5] Under the VC fundraising hypothesis, shorter incubation periods do not always lead to more future fundraising. This hypothesis predicts that such a relation holds only during periods of greater industry technological change.

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