



BACKGROUND NOTE

Financing for Innovation

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FINANCING FOR INNOVATION

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Innovation, particularly technological innovation, is increasingly important for a country's economic growth and development. However, different from other investment, innovative activities and research and development (R&D) are inherently difficult to finance due to the risk of imitation, significant degree of uncertainty, lack of tangible assets, and long-term horizon. According to a recent survey conducted by KPMG on corporate leaders, the main obstacles that hold back the full deployment of innovation are the lack of resources and the uncertainty about the amount of spending needed to make these deployments worthwhile.² It goes back to the age-old question of how to finance and budget innovative projects effectively.

Typically, in its earliest stage, a start-up firm may rely on seed financing, mostly from individual investors such as friends, family, and wealthy individuals. As the firm grows and its funding requirements increase, the startup will turn to professional investors like accelerators, incubators, angel investors, venture capital, and private equity to raise the capital needed for business expansion. Accelerators and incubators offer powerful supports to startups at progressive stages in their development, including funding and valuable services, such as office space, mentorship on business model, expert business and technology assessment, networking opportunities with other startups, and potential customers and investors (Zappala and Rinkunas 2019). Most of incubators serve economic development missions like job opportunities and local business without requesting equity in return. In contrast, most accelerators provide limited funding in return for equity or convertible debt/equity.

The distinction among angel investors, venture capital and private equity lies in the scale of their investments, the size of the companies they invest in, and the stage of the business life cycle that this company is in. Venture capital is often deployed to young startups in their initial phases of

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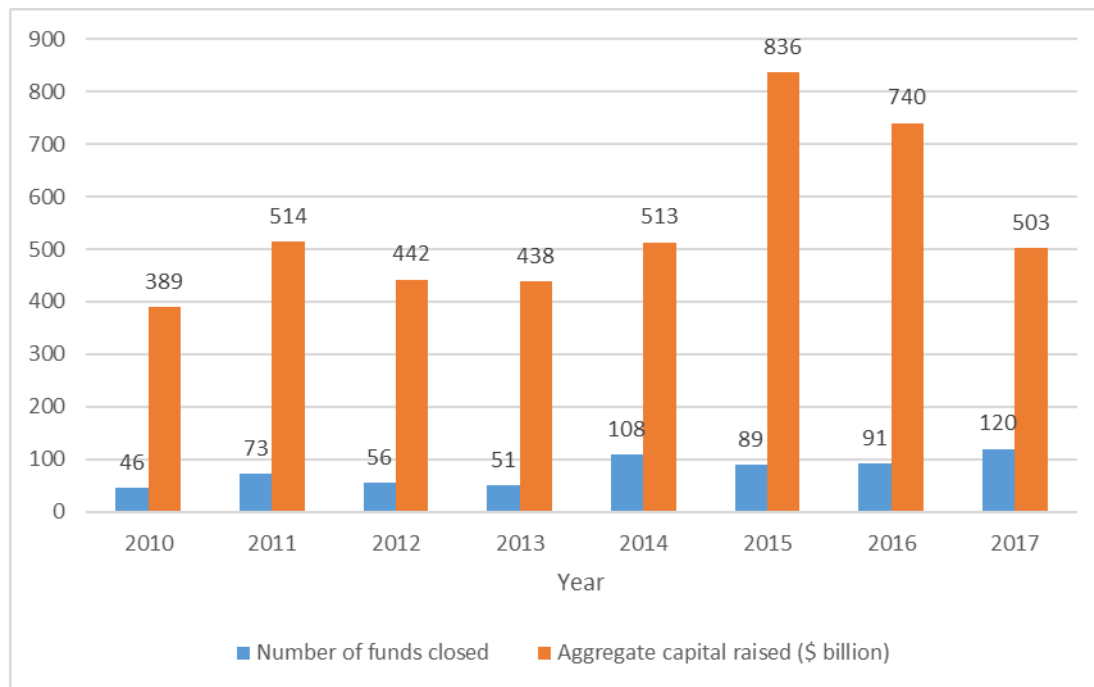
² *The Wall Street Journal*. Companies Take a Piecemeal Approach to Automation Tech, 4 April 2019.

development while private equity tends to invest in more mature companies and may even engage in the acquisition of the entirety of the company. Angel investors are usually experienced entrepreneurs or high net worth individuals who invest in companies seeking early stage financing without having a personal connection to the company prior to the investment. They are particularly important for the financing of very early stage ventures and for small amounts, with venture capital investors coming in in subsequent rounds. Given that there is still no standard definitions and clear lines among venture capital, public equity, and angel investors, the three categories are discussed as a single financing instrument under the name of venture capital below.

Venture capital backing is one of the important factors which fuel the entrepreneurial ecosystem and innovation productivity of a firm (Kortum and Lerner 2000). Venture capitalists act not only as financial intermediaries but also have a broader value-added impact on the development of firms backed by them, in particular in terms of advising companies on their business and financial strategy, taking board seats, enhancing top management team quality, improving corporate governance, raising additional funds, and consolidating various resources for the firms through multiple funding stages (Baker and Gompers 2003; Bernstein, Giroud and Townsend 2018; Chemmanur, Simonyan, and Tehranian 2016; Hochberg 2012; Lerner 1995; and Samila and Sorenson 2011). The successful stories of Silicon Valley start-up firms prove that venture capital backing leads to professionalization of such firms, including formulation of human resource policies, adoption of stock option plans, and hiring of marketing vice-president. Firms backed by venture capital are more likely and faster to replace the founder of a firm with an outside chief executive officer because venture capitalists take both supportive and controlling roles in such replacement decisions (Hellmann and Puri 2002). Even though venture capital backing of a firm is overall associated with that firm's greater innovation productivity, not all venture capitalists may have the same effect in this respect. Initial public offering (IPO) firms backed by corporate venture capital (venture capital funds established by corporations) are more innovative than IPO firms backed by independent venture capital (venture capital funds established by independent venture capital firms) because the former has longer investment horizons, pursues strategic objectives in addition to financial objectives, and are better equipped with industrial and technological knowledge (Chemmanur, Loutskina, and Tian 2014). Moreover, more failure-tolerant venture capital firms encourage greater innovation productivity. This is especially true for the riskier ventures started in times of recession, in early development stages, or investing in industries where innovation is hard to achieve (Tian and Wang 2014). In addition to promoting the development of local venture capital industries, encouraging the entry of highly reputable foreign venture capitalists may also be conducive to enhancing innovation in Asian emerging economies,

since local venture capitalists can learn a lot from making syndicated investments with foreign venture capitalists in entrepreneurial firms (Chemmanur, Hull, and Krishnan 2016).

Figure 1: Annual Asia-Focused Private Equity and Venture Capital Fundraising, 2010–2017



Source: Preqin.

Public equity markets affect the innovation process through various dimensions. The most important role is the provision of capital to funding R&D and innovation activities of fast-growing and young companies which are typically highly innovative, not profitable yet, but have huge growth potentials (Acharya and Xu 2017; Brown and Petersen 2009; Comin and Nanda 2019; and Hsu, Tian, and Xu 2014). This is particularly true in the case of technology firms because other forms of financing, such as debt, may be typically limited for technology firms because of the high degree of uncertainty associated with R&D investments and the lack of tangible assets to be used as collateral. Indeed, since 1980, more than 40% of the firms that went public and transitioned to public equity markets in the United States (US) were technology firms, raising more than \$250 billion in gross proceeds (Ritter and Welch 2002). The shifts in the supply of equity finance during the 1990s dramatically alleviated financing constraints for young and innovative firms in the US, which in turn spurred the country's R&D boom (Brown, Fazzari, and Petersen

2009). In addition to the provision of capital to high-growth innovative companies, the public equity markets play an even greater role in nurturing entrepreneurial ecosystem through changing the venture capital activities. It creates the opportunity for early-stage investors, such as venture capital firms, to sell their investments through the IPO markets (and subsequent equity issuances) and exit their investments. There are considerable evidences highlighting the impacts of public equity market on the fund-raising process (Gompers and Lerner 1998), returns and investment decisions of venture capital industry (Cochrane 2005 and Kaplan and Schoar 2005). In this regard, the vibrant venture capital markets in the US is attributed to the existence of a robust IPO market (Black and Gilson 1998). Since 1970, roughly 40% of American firms going public have been backed by venture capital. This number is even higher, reaching more than 60%, when focusing on technology firms (Bernstein 2017). In contrast, venture capital activity is moderate in more bank-central economies such as Japan and Germany, where the IPO markets are often lack of momentum. Despite the increasing reliance on public market financing, the agency costs associated with the transition from private to public firms and the corresponding managerial myopia can adversely affect innovation (Stein 1988 and Holmstrom 1999). The combination of public ownership structure, the quick reaction of prices to quarterly earnings reports, and analysts' expectations may deter the managers to be engaged in innovative projects that are highly uncertain and needs time to materialize (Ferreira, Manso and Silva 2014). The quality of innovation could even deteriorate in post-IPO years, which cannot be fully explained by the life cycle of the firm. In particular, public firms tend to rely on external innovation through acquisition and conduct less exploratory innovation following the departure of key employees after IPOs (Babina, Ouimet, and Zarutskie 2016 and Bernstein 2015). Several mechanisms have been explored to mitigate the agency costs. In particular, the insulation of managers from short-term pressure, the implementation of anti-takeover provisions (Pugh, Jahara, and Oswald 1999 and Chemmanur and Tian 2018), the introduction of institutional ownership (Francis and Smith 1995; and Aghion, Van, Reenen and Zingales 2013) and concentrated ownership (Lerner, Sorensen, and Stromberg 2011) may cultivate the tolerance for failure and benefit innovation.

In the emerging economies where the public equity markets and other market-based financing systems are underdeveloped, most firms still rely heavily on **banking sector** to finance innovation activities (Ayyagari, Demirgüç-Kunt, Maksimovic 2011). However, the existing theories provide contrasting answers to the question of whether banking development promote innovation. The traditional wisdom that banks evaluate and screen entrepreneurs, channel resources to productive uses, and diversify risks of innovative projects (King and Levine 1993; and Laeven,

Levine, and Michalopoulos 2015) does not necessarily render a beneficial effect to innovation if banks cannot resolve considerable information asymmetry arising from the implementation of novel but uncertain projects under relationship lending (Aghion and Tirole 1994 and Rajan and Zingales 2003). While empirical studies offer mixed evidences, which reflects the theoretical ambiguity, the differences can be potentially explained by the nature of the banking development and the different underlying working mechanism. The history of banking development in the US indicates that the interstate deregulation is beneficial for innovation through the channels of lowering the entry barrier, intensifying banking competition, reducing banks' market power, encouraging banks' risk taking, and eventually expanding the credit supply for small, private, innovative, and external finance-dependent firms, which in turn moderates the incentive for these firms to be acquired by public firms to ease the financial constraints (Amore, Schneider, and Zaldokas 2013; Chava et al. 2013; and Cornaggia et al. 2015). In contrast, the intrastate bank deregulation, which strengthens the bargaining power of banks relative to young and private firms, decreases the banks' incentive to lend to innovative firms, and disrupts the existing relationship lending is harmful for innovation (Chava et al. 2013 and Hombert and Matray 2016). These findings highlight that the impacts of bank deregulation on corporate innovation depend on the nature of financial reform. A cross-country comparison on the respective effects of equity markets and credit markets on technological innovation demonstrates that equity market development exerts positive influence on industries' innovation, whereas credit market development has opposite effect (Hsu, Tian, and Xu 2014). The negative effect of credit market is attributed to the facts that bank-based financial system lacks effective price signal (Rajan and Zingales 2001 and Beck and Levine 2002) and debt financing is ill-suited for risky and uncertain innovative projects, which involves intensive use of intangible asset with limited value as collateral. However, the study focusing on Asian economies shows that credit market development in general and banking sector in particular have exerted a positive effect on the intensity and quality of innovation in industries that are more dependent on external finance or are naturally more innovative. The predominant effect of banking sector on innovation comes from the overall depth and size of the domestic market (Lin, Liu, and Lai 2018).

Altogether, innovation differs from regular investment by multiple margins that may expose such activities to higher financing friction. Moreover, given these characteristics, it might not be surprising that young and publicly traded firms in high-tech industries are less likely to fund their innovative activities using debt which usually requires collateral, and typically includes provisions that ensure downside protection. However, innovation value mostly comes from its option value

given the uncertainty it involves, and therefore venture capital and equity securities might be better suited to share the potential upside with financiers. It is clear that vibrant IPO markets and public equity markets are important in the economy to enhance innovative activity. Therefore, various policies that attempt to ease the access of private firms to IPO markets are important. Such policies can include more relaxed regulatory requirements for the listing of small and young firms or, alternatively, policies that reduce the uncertainty associated with the IPO selection and approval process.

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