

“Cost of Experimentation and the Evolution of Venture Capital” by Michael Ewens, Ramana Nanda, and Matthew Rhodes-Kropf

Summary by Michelle Fang

Technological changes, such as the advent of Amazon’s Web Services (AWS) in 2006, substantially have lowered the cost of starting new businesses and opened a new range of investment opportunities that were not previously viable. This paper argues that a technological shock to the cost of starting a new business, namely a sudden change in technology that significantly effects economic, social, or political outcomes, has led venture capital middlemen to adapt to new investment methods and strategies. One key change is the increased prevalence of a “spray and pray” investment approach in the early rounds where investors provide little funding and limited governance (typically in the form of an investor not taking a board seat). This less costly approach is applied to an increased number of startups, each of which therefore has a higher likelihood of failure/abandonment. Another change includes the entry of new financial intermediaries, such as accelerators and Micro-VCs. The paper shows that the substantially lowered barriers to starting a business leads to a rise in the type of innovation that allows the future potential of the venture to be revealed more quickly and cheaply. Consequently, this leads to a reduction in the relative share of investments in innovation in complex technologies where initial experiments may cost more and reveal less.

The authors first explain that the venture capital model arose in the mid-20th century to channel capital necessary to finance various new technologies. They use the analogy of specialized investment banks adapting to the needs of railroad construction to demonstrate that financial intermediaries also need to adapt to new technology. They provide evidence on how the venture capital investment model has evolved fundamentally in the past decade, especially in early-stage financing of software and service-oriented startup ventures. The decrease in cost of starting a new business causes a shift in investment strategy to the “spray and pray” technique. This is a shift away from the traditional value-added governance approach, in which venture capital investors take a central role in monitoring and governing early-stage ventures to help them grow, which then leads to a higher probability of a successful “exit,” or monetization event for the VC.

Specifically, the falling cost of starting firms can alter the way VCs select and govern their portfolio of investments due to the higher value of these abandonment options. A venture begins when the founders conceive an idea that they will then prototype, build a minimum viable product (MVP), and pitch to VCs. At this stage, VCs will typically perform due diligence on the venture and decide whether to give the founders a term sheet, a contract that outlines the key terms of the deal. VCs often stage their investments in multiple rounds over time, where each round is essentially an experiment that generates information about the ultimate value of the startup. In 2006, the introduction of AWS and cloud computing, a network of remote servers hosted on the Internet to store, manage, and process data, allowed startups to “rent” hardware space in increments and scale as demand grew instead of making large fixed upfront investments in hardware. The ability to rent hardware allows entrepreneurs to initially raise smaller amounts of capital to test technological viability and customer demand.

Therefore, the primary effect of cloud computing is not lowering total costs but rather the cost of initial experiments when the probability of failure was high.

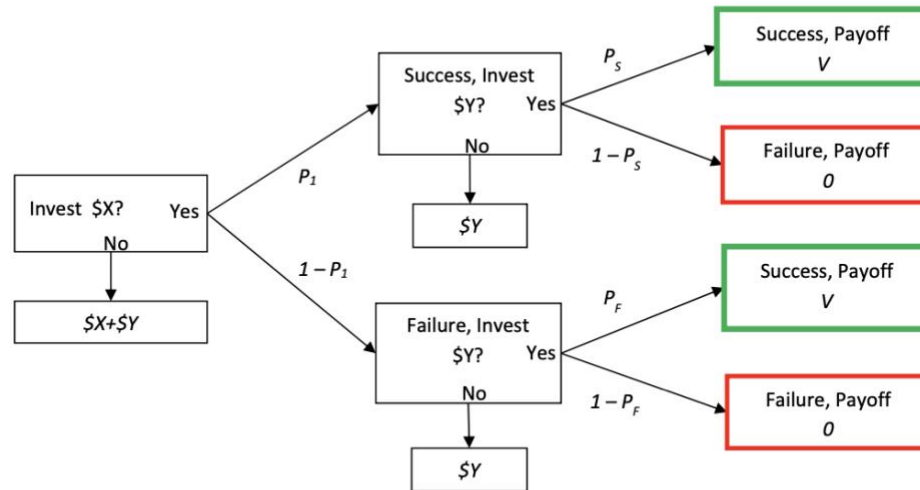


FIGURE 1. EXTENSIVE FORM REPRESENTATION OF THE INVESTOR'S GAME TREE

Moreover, the paper demonstrates how the falling costs of starting new businesses allow entrepreneurs who would have previously not been financed to receive early stage funding. These newly viable ventures have a lower probability of success on average but a higher return if successful; these are referred to as “long shot bets”. The intuition for why funding these very low-probability early ventures is worthwhile is that if investors put a lower probability on the startup demonstrating intermediate success, observing success after the first round of funding will lead investors to update their prior beliefs more. Ultimately, this leads to a greater increase in valuation in the next round of funding.

Using a VentureSource database which tracks venture capital activity in the United States, the authors create a systematic analysis of VC financings using 26 distinct industry segments. This analysis demonstrates that the advent of cloud computing did not affect all industries equally—its effects are more dominant on businesses with a stronger online presence, such as software-as-a-service (SaaS), social networks, and e-commerce websites. In this example, the authors assign each of the 26 categories to “treated” or “control” based on whether the typical firm in that category benefits from the introduction of AWS. The paper defines 8 treated industries where AWS helps with outsourcing the company’s backend online; these industries have keywords such as “software,” “web,” and “service.” The 18 control industries have keywords that referred to tangible goods, such as “drug,” “devices,” and “system.” The authors’ analysis compares VC investments between 2006-2010 with investments from 2002-2005. The results show that investments in firms for the treated sectors rose from 375 firms per year to over 700 firms. To prove that the results are not driven by other potential technological changes, such as the introduction of the iPhone or Appstore, the authors exclude firms that are in any way related to that development and find that it does not impact their results.

Moreover, this paper finds a significant decrease in capital invested by VCs in first financings for startups founded in sectors benefitting most from the introduction of AWS. Compared to the control group, there is a 15 to 27% decrease in the initial investment for a startup in the treated group. This difference is a \$670 thousand to \$1.3 million fall in the average capital invested. However, the total capital raised by companies that survived 3 years or more is unchanged, effectively allowing startups to shift their large capital investments to later stages when there is less uncertainty. This means that the primary effect of AWS is on a startup's path of funding over time, rather than its total fundraising.

Additionally, the authors find that in sectors impacted by technological shock, there is a change in the number of investments and governance method. First, the number of initial investments made per year by VCs nearly doubled; however, there is not an equivalent increase in follow-up investments, as one would expect if the VCs are using the first stage as a selection mechanism. Based on evidence from newly financed firms in treated and control sectors from 2002 to 2010, the authors observe a marked increase in investments in the treated sector after 2005. Moreover, paired with the increase in number of investments is a decrease in the likelihood of VCs to actively govern their portfolio companies. The authors find that investors are 21% less likely to take a board seat in the first round of financing for startups in the post-2005 treated group.

Further, after the technological shock, the authors find that VCs increased their investments in startups run by younger founders with less entrepreneurial experience. These younger and less experienced founding teams could either be "worse" teams or "long shot bets" but either should require increased governance. However, the fall in board activity means that these younger teams are not receiving that support. The authors hypothesize that an increase in "long shot bets" will lead to an increase in failure rates after the first round of funding and a higher step-up in values for firms that received follow-on financing. The data shows that startups in the treated industry post-2006 were less likely to receive a follow-up investment and more likely to fail. The lower likelihood of receiving a follow-on funding shows that these new investments were long-shot bets rather than worse firms. Measuring the step-up value across rounds or the change in valuation from the post-money valuation in the initial round of funding to the pre-money valuation in the next round of financing, the authors observe an increase in equity valuation of about 15-20% for startups in the treated sector. The paper concludes that the evidence is in favor of a shift to higher option value rather than lower quality investments post-AWS.

The authors later explain that the results are consistent with the introduction of AWS and not driven by changes due to the financial crisis or iPhone and open-source software. The authors find that while the number of deals fell 25% from 2008 to 2009, the deal volume actually increased 15% from 2009 to 2010. If the authors exclude new financings in 2009, there are no material impact on the results. Moreover, the paper includes a variety of tests to show that the growth of open-source software and the iPhone mobile ecosystem were unlikely drivers of the changes. For example, the authors find that the frequency of the term "open source" and other popular programming languages were prevalent before the introduction of AWS and constant over their experiment's timeframe.

This paper further explains that the VCs' shift away from value-added governance to a more passive approach at the early stage has led to the rise of new financial intermediaries known as accelerators. The role of VCs to add value to their investments may have decreased at the point in the startup's lifecycle where the value-add is most needed. This is especially true for younger and more inexperienced founders who have promising technology but need more experience and mentorship when running a firm. The authors further use this finding to explain the creation of intermediary services like accelerators, defined as fixed, cohort-based programs, including mentorship and educational components that culminate into a public pitch or demo day. The first accelerator, Y-combinator, was founded in 2005, and today, estimates of the numbers of accelerators are around 300-2,000. Accelerators provide scalable, lower cost forms of mentorship to inexperienced founding teams while helping to screen deal flow for VCs through demo days.

The effect of this shift on investment strategy and innovation is ambiguous. On one hand, it increases the chances of radical new business models such as Airbnb's but it also makes it more difficult for complex technologies to survive. Companies whose costs of experimentation are higher or have a slower revelation of information of the startup's final value receive less financing, despite intense societal interests. Examples of complex technologies with longer time frames and higher upfront costs include renewable energy technologies and cancer therapies.

In summary, the authors show empirically that technological shocks that decrease the initial cost of starting new firms fundamentally change investment strategies. The paper documents that lower costs of experimentation impact the early stages of a startup's life as VCs to shift to a "spray and pray" strategy that especially benefits the type of startup business where information is revealed quickly and cheaply.