

# ENTREPRENEURIAL DISCOVERY CAPITAL

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## **Abstract**

This paper identifies how capital losses are unavoidably incurred in the discovery of viable entrepreneurial ventures. Losses are proportional to the novelty and perceived profit potential of a prospective venture, exemplified by the high risk/high return nature of high technology start-ups. Venture capitalists internalize the costs and benefits of this discovery process, and set up portfolios where the majority of funded ventures unavoidably fail or earn subpar returns. They incur these losses in order to discover the one Winner venture whose outside returns will compensate for the capital losses in the failed ventures. The investment in failing ventures is unavoidable and necessary to discover the Winner because the winning business model cannot be determined *ex ante*. I call this investment “Entrepreneurial Discovery Capital.” This paper hypothesizes that many industry and economy-wide cycles may be the result of such a process that occurs at a much larger scale than a single fund. Venture capital in microcosm provides a model of an economy-wide process where the decisions of myriad market participants are coordinated “as if by an invisible hand” by signals from the capital markets.

JEL Codes: E32, E71, G01, G24, G41, L26, M13, O31

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## **Introduction**

This paper is motivated by two observations. The first is the regularity of business startup failures. Whether it is a corner grocery store or a cutting edge biotechnology firm, the risk of failure is ubiquitous and unavoidable. Those who finance the businesses have a powerful profit and loss incentive to avoid investing in losers, but despite due diligence, they are unable to pick only the future winners and invest in those.

The second observation is that the particular risk of investing in a business seems to be proportional to the novelty and perceived profit potential of the new business concept (Shepherd, et al., 2000). Ordinary businesses, which employ existing technologies in a well-understood manner, such as grocery stores or retailers, fail at the rate of about 50% after five years (SBA 2012). High technology startups funded by venture capitalists, on the other hand, fail or earn subpar returns at a much higher rate of around 95% (Gage 2012). Perhaps unsurprisingly, reflecting the lower *ex ante* risk of failure, ordinary businesses offer much lower prospective returns to investors than high-tech startups. On the other hand, successful high-tech companies – “Winners” – create billionaires of their founders and outsize returns to the capitalists who finance them.<sup>1</sup> (See Table 1.)

A Winner, in this context, is a company that succeeds in profitably exploiting a novel technology. It may also refer to one of a small number, usually not more than 2 or 3 companies, that together succeed in profitably exploiting a novel technology. An example is Google, which dominates the Internet search and advertising industry. Another is Uber and Lyft, which together

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<sup>1</sup> In 2004 Google had an initial public offering valuing the firm at \$23 billion. The 2012 IPO of Facebook at a market capitalization of \$104 billion.

dominate the Internet-based ride-hailing industry. As we will see below, venture capital is an area of finance devoted to uncovering Winners.

Winners imply losers, companies that fail to profitably exploit a novel technology. So, in contrast to Google, which figured out how to profitably exploit Internet search, there is Netscape, which failed. In terms of ride sharing, the industry is so new that the losers have not yet fallen out.

With such a low probability that any particular high tech investment is a Winner, venture capitalists have developed a specialized method to discover such Winners. That method is described below. In their effort to discover and profit from investments in Winners, the venture capitalist unavoidably must invest in many failures. That unavoidable investment in failures is the cost of discovering Winners. I call this investment “Entrepreneurial Discovery Capital.”

Entrepreneurial Discovery Capital is present throughout the economy. This paper uses the empirical example of venture capital finance to illustrate Entrepreneurial Discovery Capital in action and then to argue, by inference, that it exists throughout the economy. Entrepreneurial Discovery Capital is offered as a hypothesis to explain economic cycles and related phenomena, such as the investment “manias” or “bubbles” that accompany these cycles. The investing of Entrepreneurial Discovery Capital causes the boom; the consumption of that capital and the accompanying failure of numerous businesses is the bust. The outcome of this process is the successful financing of entrepreneurial ventures whose products and services advance our standard of living.

Using venture capital as a model, this paper explains why Entrepreneurial Discovery Capital exists, and why it is a hypothesis for cyclic economic phenomena.

## **Overview of Venture Capital**

Venture capital is a method of funding start-ups or very young companies in high technology sectors, such as information technology and biomedicine.<sup>2</sup> The first venture capital firm, American Research and Development (ARD), was established in 1946 by scientists from MIT and Harvard. It was devoted to investing in high-risk companies that were based on technologies developed for World War II. The advent of the personal computer and later the Internet industries, coupled with a regulatory change in 1979 that allowed pension funds (a major source of new capital) to invest in venture capital funds, led to rapid growth in the industry from the 1980s onward.

A venture capital fund is a pool of money raised from investors (called limited partners) and managed by a general partner. The fund invests in a portfolio of startup businesses, taking some form of equity or equity-like interest in each of the companies (investees) that it invests in.<sup>3</sup> A venture capital fund is different from other investment funds, such as hedge funds or mutual funds because it takes an active role in advising and managing its investees.<sup>4</sup> Unlike the latter two types of investment funds, a venture capital fund is also illiquid. Investors generally will have their investments tied up for 7-10 years as investees progress from the start-up phase and mature in their operations to the point where their securities can be offered to the public in an IPO (initial public offering) or the investee can be sold to another corporation. Generally, this means achieving a track record of growth in sales and profitability. The IPO or, increasingly, the

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<sup>2</sup> This overview of how venture capital operates is largely drawn from Gompers & Lerner (2001a, 2001b).

<sup>3</sup> Usually convertible preferred stock, but also convertible debt (Kaplan & Strömberg 2003).

<sup>4</sup> A venture capital fund is typically organized as a private investment fund. Although it is a type of private equity, the term “private equity fund” usually refers to funds that invest in less risky, more mature companies or pools of assets than a venture fund (Gompers et al. 2016, 8).

sale of an investee to an acquirer, is known as the “exit” or “cash-out” event when limited partners receive their investments back plus accrued profits or losses.<sup>5</sup>

Venture capitalists have evolved a variety of techniques to manage the unusually high risk of investing in high-tech startups. Three of the most important of these are:

- Staging investments
- Representation on investee boards of directors
- Frequent meetings and communication

**Staged investments**—Venture capital firms will typically invest in 1-4 rounds of financing between initial funding and cash-out. The rounds of funding are a winnowing process that sorts the successful investees from the ones that are failing. Only firms that achieve financial and performance milestones receive an additional round of funding. Firms that don’t meet these thresholds are liquidated or sold off.

**Boards of Directors**—Venture capital firms usually place a representative on the boards of directors of their investee companies. This allows the venture capital firm to monitor each firm and influence strategic decision-making at board meetings. In addition, the typical venture capital firm actively monitors its investees in frequent face-to-face meetings and other communications.<sup>6</sup> This is an important reason why venture capital firms and their investees tend to be located near each other geographically. For example, the largest concentration of venture capital firms and high-tech startups in the world is located in Silicon Valley, California.<sup>7</sup>

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<sup>5</sup> Prior to the 2000 peak of the “Internet bubble,” most exits were IPOs. Now, 15% are via IPO and 53% are through acquisitions by other companies (Gompers et al., 2016, 55).

<sup>6</sup> Venture capitalists typically meet with investees at least once per week (Gompers et al. 2017, 27, 60).

<sup>7</sup> The area southeast of San Francisco, centered on San Jose. The venture capital industry in California is much larger than the rest of the country. The top three regional centers of venture capital in the U.S. in 2016, and assets under management were: California \$181.4 billion, Massachusetts \$50.2 billion, and New York \$45.6 billion. (NCVA 2017, 14). Globally, the U.S. leads the world in venture capital investing.

The investment goal of a venture capital fund is to choose successful investees and then cash out at a profit when the equity it holds in the investees can be sold (or distributed to the fund investors) in an IPO or, increasingly, through acquisition by a larger company. This is called the “cash-out” phase of a fund. A successful venture capital firm will raise and liquidate a series of funds over the lifetime of the firm.

**Table 1—Selected Major Venture Capital Firms and Their Key Investments**

VC Firm	Founded	Key Investment Highlights
Accel Partners	1983	Funded more than 300 companies including Facebook, Spotify, DJI, Jet.com
Sequoia Capital	1972	Backed companies that represent \$1.4 trillion in stock market value (22% of NASDAQ)
Kleiner Perkins Caufield & Byers	1972	500 ventures backed like Google, Amazon, Genentech, AOL, Electronic Arts, Sun Micro
Benchmark Capital	1995	Extremely focused “maverick” 5-partner fund – last decade returns of 1,000% net of fees
Bessemer Venture Partners	1911	Oldest VC in the U.S., over 100 IPOs, funded LinkedIn, Yelp, Pinterest

<b>New Enterprise Associates</b>	<b>1977</b>	<b>World's largest VC (\$18 billion AUM), invested in 650 companies, 500 liquidity events</b>
<b>Index Ventures</b>	<b>1996</b>	<b>160 companies funded like Dropbox, Etsy, Supercell, Squarespace</b>
<b>Meritech Capital Partners</b>	<b>1999</b>	<b>Invests in late stage investments, funded Facebook, Cloudera, Salesforce.com</b>
<b>Lightspeed Venture Partners</b>	<b>2000</b>	<b>Backed 200 companies like Doubleclick, Informatica, Snapchat, Solazyme</b>
<b>Greylock Partners</b>	<b>1965</b>	<b>Early-stage focus, funded Facebook, LinkedIn, Airbnb, Instagram, Workday</b>
<b>Andreessen Horowitz</b>	<b>2009</b>	<b>Young VC firm, funded Facebook, Groupon, Twitter, Zynga, Skype, Instagram, Oculus VR</b>
<b>Union Square Ventures</b>	<b>2003</b>	<b>One of the top returning VC funds globally, \$1 billion exit every year since 2011</b>

Source: <https://www.nanalyze.com/2017/01/top-12-venture-capital-firms/>

Venture capital competes with other investment choices and must offer a sufficiently attractive risk and return profile to attract investment. Risk, in this context, refers to the volatility

of returns, including the possibility of a complete loss. Portfolio theory (Markowitz 1952) tells us that, all else equal, investors require a higher return to compensate for greater risk. Venture capital funds diversify risks by investing in a *portfolio* of investees, but the returns on venture capital funds are still more volatile than many other investment alternatives. In a recent survey, venture capitalists, in conversations with prospective investors, have indicated that their funds would achieve rather high annual returns of 24%.<sup>8</sup> This reflects the greater risk (volatility of returns) of investing in venture capital funds compared with lower risk/lower return investments, such as the stock market or Treasury bonds. Since 2004, the average venture capital fund has outperformed the S&P 500 stock market index (Harris et al. 2016). The fund's investors (limited partners) are typically large institutional investors such as university endowments, charitable foundations, pension funds, insurance companies, and wealthy individuals (NCVA 2017, 8).

### **The Investing Funnel**

After receiving funding commitments from investors, the general partner selects companies (investees) for the fund to invest in. This selection process can be characterized as a funnel with two stages: the Deal Selection or “Armchair” Stage, and the Capital Commitment Stage (Gompers et al. 2016, Sahlman 1990).<sup>9</sup>

#### ***The Deal Selection or “Armchair” Stage***

A typical venture capital firm will conduct due diligence on 80-120 potential investees before it selects one to include in the fund. This involves, to varying degrees, reviewing business plans and financial forecasts, evaluating products, markets and production methods, and meeting management teams. This is the Deal Selection or (my term) “Armchair” stage of investing. It is a

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<sup>8</sup> Gompers et al. 2016, 35, 62. In “cash-on-cash” terms, the desired return that prospective investors sought in their investment in an average venture capital fund was 3.5x.

<sup>9</sup> Gompers uses the term Deal Selection Stage instead of Armchair Stage, which is my term.



very active process that is conducted not just in armchairs. The term is chosen to distinguish this stage from the next stage, the Capital Commitment Stage, because this stage occurs before any capital is committed. The general partner of the fund and his analyst team conduct due diligence and select the investees. They utilize special industry expertise they possess. Many venture capital firms specialize in a particular industry, such as information technology or biomedicine, and utilize their years of experience, industry knowledge, and people connections to vet their prospects. This stage takes an average of 83 days to complete and 118 hours of due diligence (Gompers et al. 2016, 19).

### ***The Capital Commitment Stage***

At the end of the Deal Selection/Armchair Stage, the venture capitalist has decided which of the prospects to invest in. Because of the intensive, ongoing monitoring required, a fund cannot have too many investees. The intensive need for monitoring by the general partner and his analyst team limits the number of investees at the upper end of a range. At the same time, two reasons ensure a minimum number of investees at the lower end of the range: the need to reduce the volatility of returns through portfolio diversification, and the need to have enough investees to increase the odds that at least one of them will be a Winner. The latter is crucial to the success of a venture capital fund. It is the presence of a Winner in the portfolio that drives the investment return of the total portfolio, as discussed below and illustrated in Figure 1.

A typical venture capital fund will consist of 10-20 investees. Assuming 100 prospects for each selected investee, this means that a typical fund will have screened 1000-2000 prospects before selecting the 10-20 investees in the fund. The venture capital selection “funnel” has a wide mouth and a small exit.

## **The Unusual Economics of Venture Capital: Winner Takes All and Unavoidable Losers**

Despite such extensive due diligence during the Armchair Stage, many of the investees will fail, as illustrated in Figure 1 below. Since 1960 venture capital funds have consistently reported that  $\frac{1}{4}$  to  $\frac{1}{3}$  of their investees fail, resulting in a complete loss of the venture capitalist's investment.<sup>10</sup> Of the remaining investees, nearly all of them earn subpar returns, i.e., returns that are below plan. Out of a typical venture capital fund with 10-20 investments, only 1 or 2 of them typically may be classified as Winners.<sup>11</sup>

A Winner is an investment that, upon exit, achieves a rate of return that exceeds the target rate of return used by the venture capitalist in screening prospective investees. At the Deal Selection Stage, the venture capitalist is seeking to identify investees that he hopes will exceed this target rate of return. Venture capitalists typically quantify the magnitude of returns as a multiple of initial investment, or a "cash-on-cash" multiple (Gompers 2016, 7). Thus, if a venture capitalist makes a \$1 million investment that, upon IPO, becomes worth \$10 million, the venture capitalist has achieved a "cash-on-cash" return of 10x.<sup>12</sup>

In a 2016 survey, venture capital general partners said they were targeting investees that will produce cash-on-cash returns of at least 5.5x (Gompers et al. 2016, 21, 48).<sup>13</sup> Thus, to be included in the fund, a prospective investee must be able to credibly demonstrate to the general partner that it will be able to produce a cash-on-cash return greater than 5.5x. In terms of an annual rate of return, the target was 31% (Gompers et al. 2016, 21).

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<sup>10</sup> Gompers et al. 2016, 29, cites 32% failures.

<sup>11</sup> Gompers et al. 2016, 30: 9% have exit cash-on-cash multiples >10x. 24% lost money. 19% earned subpar returns.

<sup>12</sup> In other industry, this would be called a "10-bagger," a term coined by the highly-regarded stock market investor Peter Lynch.

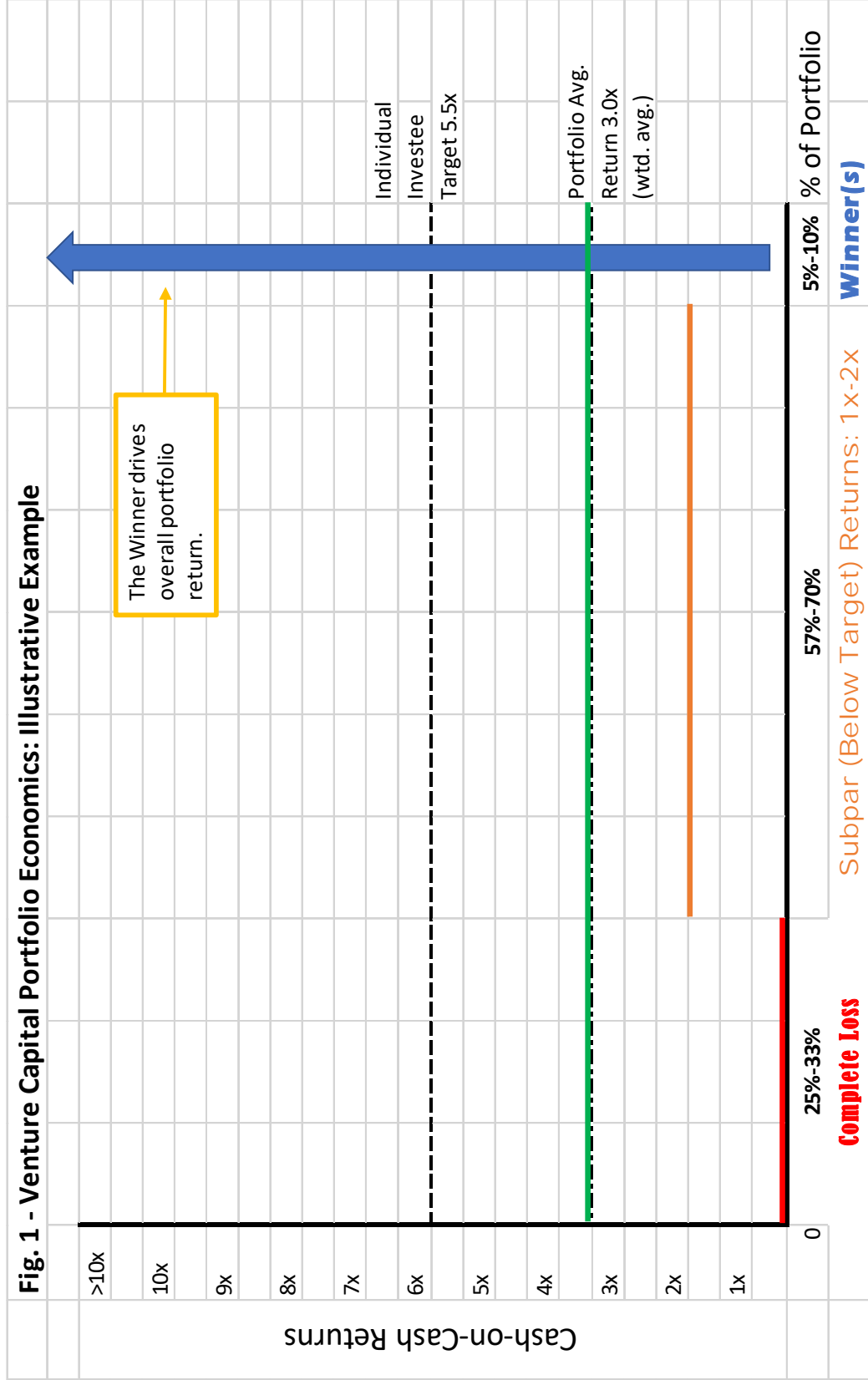
<sup>13</sup> The data was drawn from a survey of 13,448 individuals working in the venture capital industry. 889 responded from firms representing 63% of assets under management. The data was conducted between November 2015 and March 2016. Since the industry is private and not obligated to publicly post results, performance data is difficult to obtain. This is the most comprehensive source of recent data on venture capital performance.

## ***Winner Takes All***

As illustrated in Figure 1, almost all of the returns of a venture capital fund come from the Winner. The return on a particular venture capital fund is simply the weighted average of all investments in the portfolio: the losers, the subpar returners, and the Winners. The driving force of the returns is the Winner. In general, a fund that “snares” a Winner in its portfolio will be successful, while a fund that fails to snare a Winner will be considered a failure. The enormous returns from the Winner are so high relative to the other investees in the portfolio that it drives overall returns. (A Winner in a venture capital fund may be similar to having a star athlete on a basketball team, like LeBron James. In sports, the star player can often carry the whole team. In venture capital, the Winner always carries the whole team.)

Although a portfolio of investments, as described in the earlier section, reduces the volatility of returns, making venture capital a more attractive investment for investors, the primary purpose of holding numerous investees in the fund is to identify and capture the Winner(s). There is a low probability that any single investee will turn out to be a Winner. By having more investees in the fund, the venture capitalist increases the probability that the fund will contain one or two Winners. It is the outsized returns of the Winners that drive the overall return of the fund, illustrated in Figure 1.

**Fig. 1 - Venture Capital Portfolio Economics: Illustrative Example**



Because of the financial and reputational importance of Winners to venture capitalists, the limited and general partners – along with the financial press and popular media – fixate on Winners. There are many dramatic success stories of venture capital Winners, such as those illustrated in Table 2. Today, the five largest public companies that trade on the New York Stock Exchange and the tech-heavy NASDAQ stock market, shown in Table 2, all began as firms who received their early funding from venture capitalists:

**Table 2 - Top Five Public Companies by Market Capitalization:**

**Venture Capital Financing**

<b>Firm</b>	<b>Market Cap.<sup>14</sup></b>	<b>Founding</b>	<b>IPO</b>	<b>VC \$</b>	<b>VC Date</b>	<b>VC Return<sup>15</sup></b>
<b>Apple</b> <sup>16</sup>	\$894	1976	1980	\$518K	1978	<b>235x</b>
<b>Alphabet (Google)</b> <sup>17</sup>	\$751	1998	2004	\$25M	1999	<b>81x</b>
<b>Amazon</b> <sup>18</sup>	\$726	1994	1997	\$8M	1996	<b>7x</b>
<b>Microsoft</b> <sup>19</sup>	\$716	1975	1986	\$1M	1981	<b>48x</b>
<b>Facebook</b> <sup>20</sup>	<sup>2122</sup> \$513	2004	2012	\$12.7M	2005	<b>247x</b>

<sup>14</sup> Market Capitalization, \$ billions, as of 3/2/18. Source: *Wall Street Journal*, www.wsj.com.

<sup>15</sup> Return on the initial investment at time of IPO, expressed as a cash-on-cash multiple.

<sup>16</sup> <https://www.investopedia.com/articles/active-trading/080715/if-you-would-have-invested-right-after-apples-ipo.asp>, accessed 4/18/18.

<sup>17</sup> [http://billburnham.blogs.com/burnhamsbeat/2005/06/just\\_how\\_much\\_d.html](http://billburnham.blogs.com/burnhamsbeat/2005/06/just_how_much_d.html), accessed 4/18/18. Kleiner Perkins and Sequoia each invested \$12.5 million. The value upon IPO in 2004 was \$2.03 billion.

<sup>18</sup> <https://www.quora.com/Who-were-the-original-investors-in-Ama-zon-and-how-much-pre-IPO-investment-did-Ama-zon-receive-in-total>, accessed 4/18/18. Kleiner Perkins invested just one year before the IPO, explaining the lower return multiple. However, the stock has gained many-fold since the IPO.

<sup>19</sup> <https://beta.techcrunch.com/2017/08/08/a-look-back-in-ipo-microsoft-the-software-success/>, accessed 4/18/18. \$1M for 5% stake. David F. Marquardt of Technology Venture Investors (TVI) was the sole venture capital investor in Microsoft.

<sup>20</sup> <https://techcrunch.com/2010/11/19/accel-facebook-chunks-of-stock/>. 5/1/05 \$12.7 million, Accel Partners, 12.96% stake. Sold out two years before IPO; at IPO stake worth more.

<sup>21</sup> <https://www.forbes.com/sites/tomiogeron/2012/05/17/facebook-prices-ipo-at-38-per-share/#24d8da88728a>

<sup>22</sup> <https://www.crunchbase.com/organization/facebook#section-overview>

Successful high-tech startups, like the Winners in Table 2, tend to become dominant industry players in entirely new industries. Thus, Microsoft became the leading (and virtually sole) provider of operating systems to the entirely new personal computer industry in the late 1970s. Google became the leading provider of Internet search and advertising in the entirely new Internet industry in the early 2000s. Facebook became the leader in the entirely new industry of social media in the late 2000s. Looking back, the same can be said for earlier “hi-tech” industries, such as railroads, electricity, automobiles, etc.<sup>23</sup> Each of these newly emerged high-technology industries displayed large economies of scale and/or network economies that resulted in one or a handful of firms dominating large new industries and generating large profits. The huge returns for investors (venture capital or otherwise) who successfully identify the Winners reflects the Winner Take All economics of high-technology industries.

### ***The Unavoidable Losers***

Despite such an extensive due diligence, the venture capitalist cannot simply pick the Winners. He can winnow out many losers, reducing the quantity of capital lost in them, but unavoidable and significant losses accrue within nearly every venture capital fund.

Kerr (2014b) documents this inability. Upon initial funding (i.e., upon completion of the Armchair Stage), he asked the general partners of a sample of funds to rank the investees in terms of how he expected them to perform. Next, Kerr compared that *ex ante* ranking (just prior to funding) with the *ex post* ranking of how the investments actually performed upon liquidation

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<sup>23</sup> Ford Motor Company provides a good example in the automobile industry, later joined by a handful of companies that ultimately succeeded, such as General Motors and Chrysler. Those are three winners out of a field of over 1,000 companies seeking to mass produce automobiles in the late 19<sup>th</sup> and early 20<sup>th</sup> centuries. Another example, now obscure and forgotten, is in the electricity industry. Commonwealth Edison emerged as the sole provider of electricity in Chicago in the early 20<sup>th</sup> century by outcompeting a field of more than two dozen competitors. The CEO of the firm, Samuel Insull, figured out, ahead of others, that he could sell electricity for less by running the plants 24 hours per day. He called this process “massing production,” a term, ironically, that was later used by Henry Ford to describe his process, which he modified to “mass production” (Niles 2008).

of the fund. The two rankings were almost perfectly *uncorrelated* with a correlation coefficient of 0.1. Kerr (2014a) uncovered the same result with “angel funds.” An angel investor is similar to venture capital, except that they invest earlier in the life of a firm than a venture capitalist, investing at the seed stage or very early startup stage of a firm.<sup>24</sup>

With such huge returns available from the well-publicized winners, why can't the venture capitalists simply pick them and avoid losing capital investing in companies that fail or earn subpar returns? The general partner invests his own money in the fund. He has “skin in the game.” He bears losses along with the limited partners, and he profits alongside the limited partners from Winners. The venture capitalist has the *incentive* to scrupulously avoid picking losers and only pick winners.

The venture capitalist is also highly qualified to make good choices. The typical venture capitalist is an industry expert and/or employs industry expert analysts in the targeted industry. He may spend most or all of his career only investing in that particular industry. He has accumulated years of expertise and deep industry contacts that he can and does utilize to help him evaluate potential investments.

As discussed earlier, the venture capitalist employs an extensive review process, on average evaluating 101 proposals for each proposal he selects for funding (Gompers et al. 2016). He employs an average of 118 hours of due diligence for each proposal selected for funding (Gompers et al. 2016).

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<sup>24</sup> The seed stage is just prior to startup and may involve funding a prototype or some other initial step to see if the venture is worth starting. It is less organized as a distinct investment industry than venture capital. Kerr (2014a) also found a 0.1 correlation (statistically, no correlation) between the *ex ante* and *ex post* phases of angel funding.

Despite *internalizing* the costs and benefits of investing - and the huge potential gains from picking Winners -- the venture capitalist still makes many more bad choices than good ones. Kerr (2014b) shows that this inability is unavoidable.

### **Venture Capital Is a Screening Process that Expends Entrepreneurial Discovery Capital**

I call the capital invested in the companies that failed and the opportunity cost of the companies that earned subpar returns *Entrepreneurial Discovery Capital* (EDC). EDC is the unavoidable cost of discovering Winners. EDC is financial capital that is lost in the process of uncovering Winners. It is capital that, if the investor had the benefit of hindsight, he never would have expended.

This analysis recasts the traditional view of venture capital and possibly of finance more broadly. The fundamental purpose of venture capital is cognitive. Its purpose is to uncover Winners, and EDC is the cost of that discovery process. However, EDC is “wasted” only in an engineering, mechanical sense, not in an economic sense. To say that this capital is wasted, one must assume that the successful enterprise could be known in advance. However, despite the very competitive world of venture capital finance, venture capitalists still cannot simply pick the winners. They cannot figure out a way to avoid “wasting” that capital. (The cash-on-cash returns in the last column of Figure 3 illustrate the enormous profits a venture capitalist would earn if he could simply pick the winners and avoid investing all that extra capital.)

Viewed from an economic discovery perspective, the capital is not wasted. Since the venture capital fund internalizes all of the wins and losses of the financing decisions, the “wasted” capital is willingly spent up front by the venture capitalist in order to discover the winning enterprise. This capital expended to discover the winning business model is Entrepreneurial Discovery Capital (EDC).



## Characteristics of EDC

**EDC arises when only entrepreneurial *action* can discover winning business models.**

EDC arises when the perceived opportunity of the potential Winner is huge, and that opportunity is matched by cognitive difficulty in identifying that winner. This combination of large prospective returns matched by great uncertainty over which particular firm can capitalize on the returns is the *sine qua non* of high-technology startups. The cognitive challenge that the venture capitalist faces is that the Winner (after the Armchair Phase of due diligence) is discoverable *only* through (costly) entrepreneurial *action*. At that point, the discovery of the Winner is no longer purely a mental exercise, but it requires the formation and operation of an actual business venture.

In this context, the role of the business venture is one of discovery. The business becomes a cognitive tool that facilitates the discovery of the Winning Business Model, i.e., the business model that can most profitably implement the innovation. The success of that effort is measured via profit and loss. A profit indicates a net gain and the opportunity for additional funding and expansion. A loss indicates that there is a net loss of resources and that further resources should not be committed. Profits will attract capital and further investment, while losing businesses are liquidated and forgotten (or maybe they just live on as case studies in MBA courses).

Some recent examples:

- Facebook was the winning business model capitalizing on the innovation of social media; MySpace was a loser. Both firms were funded by venture capital.
- Google was the winning business model capitalizing on the innovation of search using the World Wide Web. Netscape (after venture capital funding and a successful IPO) was the loser. Both firms were funded by venture capital.

- Amazon was the winning business model implementing the innovation of home delivery of goods using the Internet. Pets.com was an early loser. Both were funded by venture capital.

The magnitude of the discovery challenge is proportional to the number and variety of unknowns. It stands to reason that the more novel the innovation that the entrepreneur seeks to exploit (which is characteristic of “high-tech”), the more unknowns he has to uncover the answers to. The more unusual/novel the innovation, the more difficult it is to find the right answers to questions such as: How large is the market? Who are the customers? Which particular product will they buy? At what price point will they buy? How should this product be marketed? How much education will the customer need to appreciate the novel product? How will regulators deal with something they haven’t seen before (e.g., drones or driverless cars)?

Theoretically possible parameters can be established through Armchair processes of analysis, but actual answers to these questions require setting up the business, making the product, and selling it to customers, and then repeatedly revising plans after sales and profit/loss results come in. This is the process that a venture capitalist facilitates when he shepherds a potential Winner through successive rounds of financing.

### **EDC in the Broader Economy: Coordination in the Capital Markets**

So far, we have shown that EDC arises when venture capitalists fund businesses implementing novel technologies, such as biotechnology or the Internet. Despite the expertise and internalization of costs and benefits, venture capitalists cannot avoid expending large quantities of EDC in order to discover the Winner(s), the companies that can most profitably implement the new technologies.

The venture capitalist internalizes the costs and benefits of his investments into a single fund. Across the broader economy, there is no one managing the process. Instead of being internalized in a single fund, the costs and benefits of investing in the broader economy are dispersed among myriad participants: investors, underwriters, entrepreneurs, suppliers, and employees. Yet, although each of these individuals acts out of their individual self-interest, their actions are coordinated, as if “led by an invisible hand” (Smith 1776).

Friedrich Hayek describes how coordination is achieved in the goods markets: it happens through the price mechanism (Hayek 1996 [1945]). Each individual participant conveys his local knowledge of time and place to the market through his buying and selling decisions, which affect prices. In turn, each participant responds to the changes in prices. The price changes signal changes in supply and demand conditions, the details of which each market participant may not know and usually does not have to know in order to act. It is enough to respond to the change in prices. The price mechanism coordinates the actions of myriad buyers and sellers in the goods markets.

In the *market for entrepreneurial discovery*, the capital markets, using a greater variety of prices and signaling mechanisms than the goods markets, are the chief coordinating mechanisms. Savings and investing decisions, underwriting decisions, the actions of scientists and technological innovators and, above all, the decisions of entrepreneurs to launch businesses, are all guided by the signals of the capital markets.

The most obvious of these signals is the stock market. Venture capital firms, for example, depend on the Initial Public Offering (IPO) to “cash out” of many of their private market investments. The IPO crystallizes the value of the firm for the venture capitalist, who takes the money and returns it to the fund’s investors (or distributes the stock to them). However, the IPO

also crystallizes the value of the firm to the mass investing public. This is why IPOs are widely followed. Underwriters even price IPOs to yield “pops,” or significant opening day increases, to signal the attractiveness of the company to new investors.[citation]

The stock market is not the only signaling mechanism. The entire securities industry, including financial reporting, also aids this process. The securities industry employs stock analysts who publish research on companies. Companies employ investor relations professionals to educate investors. The securities industry underwrites and sells securities and promotes and distributes them through networks of brokers and salespeople.

Financial media is an important part of the process of discovery. During the 1990s Internet boom, CNBC, a cable news station, was widely watched. *The Wall Street Journal*, the *Financial Times* and other publications were widely read. Companies fed this process with quarterly earnings reports and conference calls, in addition to “roadshows” to promote security offerings.

This information process with many disparate players, each possessing localized knowledge, can be visualized as an intricate web of connections with each participant representing a node (Wagner 2010). Information is acted upon by those closest to it, and then knowledge of the action radiates out first to parties closest to the initial actor and then further out, with each party processing the information in their own minds and responding to their local sources of knowledge.

The process is a spontaneous order.<sup>25</sup> However, the coordinating mechanisms are more numerous than a single price mechanism. A price mechanism -- the capital markets and

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<sup>25</sup> The term was coined by Scottish Enlightenment philosopher Adam Ferguson in *Essay on the History of Civil Society*. He referred to social processes that were “the result of human action, but not the execution of any human design.” Friedrich Hayek employed the concept of a spontaneous order to explain the result of the price mechanism, where there is no central planner, yet market participants behavior is coordinated. Boettke (1990) describes the

particularly the stock market -- is fundamental to the whole process. However, information about the potential value of the new entrepreneurial ventures is communicated in numerous channels, not all of them involving the stock market.

### ***The Internet Boom: Example of an EDC–Driven Economic Cycle***

More recently, a two-decade long stock market boom, driven by personal computers in the 1980s and accelerated by the development of the Internet and the World Wide Web in the early 1990s led to the “Dot.com boom and bust.” The 1990s Internet-driven stock market boom was the fastest in American history, eclipsing the 1920s stock market boom, which was similar in also being driven by major technological advances (Perez 2009). The Internet boom radiated into all sectors of the American economy.

The entrepreneurial process of discovery was brutal and fast during the 1990s Internet boom. Netscape, an Internet browser, had its IPO in 1995, two years after the mass roll-out of the World Wide Web, a technology that made the Internet easily usable by the mass public. The stock more than doubled on the day of its IPO, sending a powerful signal to all participants, current and potential, that there was tremendous money to be made in Internet stocks and Internet startups.<sup>26</sup> This signal, and many others, induced a flood of money into the capital markets to invest in Internet businesses, much of which came from established investors, and much of it came from new investors who had never before invested in the stock market.<sup>27</sup>

The Internet, in its promise and novelty, was a major innovation. The potential value of the Internet as an innovation was perceived by early (venture capital) investors and further

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development of the concept from the Scottish Enlightenment to its use by Friedrich Hayek and the Austrian School economists.

<sup>26</sup> <https://www.fool.com/investing/general/2013/08/09/the-ipo-that-inflated-the-dot-com-bubble.aspx>.

<sup>27</sup> The massive addition of “newbie capital” was also a feature of the 1920s stock market boom. As evidence of that, Wall Street trading firms built rooms reserved just for women, who began investing in the stock market for the first time (White 1990).

validated through dramatic market signals, such as the Netscape IPO. This was followed by further IPOs and other market signals, and became a self-reinforcing process where the rise in the stock prices themselves attracted further investment, often from poorly informed “newbie” investors (Chancellor 1999).

When the NASDAQ stock market (on which most Internet stocks traded) peaked in March 2000, it had a combined market capitalization of \$6.6 trillion.<sup>28</sup> At its market bottom in April 2003, it had fallen to \$411 billion.<sup>29</sup> That decline in market capitalization is a (rough) quantitative measure of EDC across an entire economy. The written-off capital in the stock market and the many failed Internet startups was the cost for discovering the Amazon.com and similar Winners among the sea of losing ventures, the Netscapes, Pets.com, et al. The Internet boom illustrates the principle of our model: the magnitude of the EDC is proportional to the *ex ante* risk/return potential of the new technology. Just as the novelty and promise of Internet technology was enormous, the quantity of EDC -- the magnitude of the losses and writeoffs during the bust -- was also enormous. The magnitude of these dislocations was so large that the boom and bust did not just affect the Internet industry, but it had economy-wide implications. After an economic boom during the 1990s, a short recession began in March 2001, just one year after the NASDAQ peak.<sup>30</sup>

The entrepreneurial discovery process is a process where the decisions of the myriad participants are coordinated through the capital markets and related capital markets industries (such as the financial press). The chief price signal is the stock market, but other signals matter,

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<sup>28</sup><http://blogs.reuters.com/data-dive/2015/03/11/nasdaq-looks-different-15-years-after-its-peak-then-and-now/>.

<sup>29</sup> [https://ycharts.com/companies/NDAQ/market\\_cap](https://ycharts.com/companies/NDAQ/market_cap).

<sup>30</sup> <http://www.nber.org/cycles.html>.

such as the windfalls that employees earn on stock options.<sup>31</sup> It is a Hayekian process of knowledge discovery and coordination where the relevant knowledge is dispersed in the minds of millions of market participants, and it happens spontaneously.

The key difference between this process and the process described by Hayek where prices coordinate the goods markets is the magnitude of the discovery challenge. The discovery challenge is much greater in the capital markets when major technological innovations like the Internet introduce dramatic novelty and uncertainty (Shepherd, et al., 2000). Entrepreneurs and their financiers utilize institutions like venture capital and the capital markets to reduce that uncertainty and discover the new ventures that can most profitably exploit these innovations. The scope of this challenge means that much more information of many different types must be coordinated through a much greater variety of prices and market signals.

### **Similarity of EDC Theory to Schumpeter's Theory of Business Cycles Driven by Entrepreneurial Innovation**

This paper develops a novel concept to explain numerous startup failures that accompany innovation: Entrepreneurial Discovery Capital. EDC is the unavoidable capital losses that finance the discovery of winning businesses that are most capable of profitably exploiting a new technology. The magnitude of EDC is proportional to the challenge of the discovery process. Where there is greater uncertainty, as with novel technologies, there are also larger-scale capital losses. The financing of businesses that eventually fail on a large scale is offered as a hypothesis for technological-driven booms followed by busts at the industry level and at an economy-wide level.

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<sup>31</sup> Stock grants and options were a major (and inexpensive) way for Internet startups to attract employees, who accepted the stock in lieu of cash because of the prospect of large gains in appreciation. The employees, like venture capitalists, were hoping that the firm they worked for would become a Winner with huge stock gains.

This theory builds on the business cycle and economic development theory of Joseph Schumpeter (1983 [1934, 1911]). Schumpeter developed a theory of the business cycle where innovation drives the boom and the bust. The Schumpeterian mechanism works in two ways: (1) The new entrepreneurial firm provides fresh demand for the factors of production, bidding up the prices and pressuring weak firms. (2) At the same time, it directly pressures competing new and old businesses with its superior business model. This is the process of “creative destruction” Schumpeter, J. A. ([1950] 2008). The most successful entrepreneur, usually the pioneer or first mover, emerges as the winner out of the ash heap of entrepreneurial failures during the recessionary phase.

The main difference between my hypothesis and Schumpeter’s theory is the role of discovery. Schumpeter focused on the effects of entrepreneurial demand on factor prices and competing businesses. In Schumpeter’s theory, the entrepreneur disturbs the economy as a side effect of his actions, but it is not a discovery process. In my hypothesis, in order to *discover* the winning entrepreneur, EDC must be invested, resulting in the boom and the bust.

Venture capital presents a model of a cyclical discovery process that occurs in the wider economy. Inside a venture capital fund, the cost (EDC) and benefits (Winners) are internalized. In the wider economy, the same discovery process occurs in the public markets, in particular the stock market. The economy acts as if it were a giant venture capital fund, but there is no single “general partner” coordinating the process. Instead, it is coordinated through the signals of the capital markets.

Just as in a venture capital fund, EDC is expended on a vast scale during the boom phase, as investors collectively seek to uncover the Winners. When most of that investment is revealed as failures, the magnitude of EDC is revealed in the market meltdown, such as the stock market



crash that followed the 1990s Internet boom. This paper hypothesizes that the large scale of EDC investment that accompanies major innovations, such as the Internet, is a reason for recurring economy-wide cycles of boom and bust. Thus, the boom and bust cycle that characterizes capitalist economies may be part of a constructive discovery process, a process that uncovers the business ventures that can most profitably exploit new technologies.

## REFERENCES

- Boettke, P. J. (1990). "The Theory of Spontaneous Order and Cultural Evolution in the Social Theory of F.A. Hayek." *Cultural Dynamics*, 3(1), 61-83.
- Chancellor, E. (1999). *Devil Take the Hindmost: A History of Financial Speculation*. New York: Plume.
- Gage, D. (2012). Venture Capital's Secret 3 Out of 4 Start-Ups Fail. *The Wall Street Journal*. September 20, 2012.
- Gompers, P. A., & Lerner, J. (2001a). The Venture Capital Revolution. *The Journal of Economic Perspectives*, 15(2), 145-168.
- Gompers, P. A., & Lerner, J. (2001b). *The Money of Invention: How Venture Capital Creates New Wealth*. Harvard Business School Press.
- Gompers, P. A., & Lerner, J. (2006). *The venture capital cycle*. Cambridge, MA: MIT Press.
- Gompers, P. A., Gornall, W., Kaplan, S. N. & Strebulaev, I. A. (2016). How Do Venture Capitalists Make Decisions? (August 1, 2016). Stanford University Graduate School of Business Research Paper No. 16-33; European Corporate Governance Institute (ECGI) - Finance Working Paper No. 477/2016. Available at SSRN: <https://ssrn.com/abstract=2801385>.
- Gornall, W. & Strebulaev, I. A. (2015). The Economic Impact of Venture Capital: Evidence from Public Companies (November 1, 2015). Stanford University Graduate School of Business Research Paper No. 15-55. Available at SSRN: <https://ssrn.com/abstract=2681841> or <http://dx.doi.org/10.2139/ssrn.2681841>.
- Harris, R., Jenkinson, T. & Kaplan, S. (2016). How do private equity investments perform compared to public equity? *Journal of Investment Management* 14(3), 1-24.
- Hayek, F. A. (1996). The Use of Knowledge in Society [1945]. In F. A. Hayek (Ed.), *Individualism and Economic Order*, Reprint edition, 77-91.
- Kaplan, S. N. and Strömberg, P. E. (2004). Characteristics, contracts, and actions: Evidence from venture capitalist analyses. *The Journal of Finance* 59(5), 2177-2210.
- Kerr, W. R., Lerner, J., and Schoar, A. (2014a). The Consequences of Entrepreneurial Finance: Evidence from Angel Financings. *Review of Financial Studies*, 27(1): 20-55.
- Kerr, W. R., Nanda, R., and Rhodes-Kropf, M. (2014b). Entrepreneurship as Experimentation. *Journal of Economic Perspectives*, 28(3), 25-48.

- Loughran, T., and Ritter, J. (2004). Why Has IPO Underwriting Changed Over Time? *Financial Management*, Autumn 2004, 5-37.
- Markowitz, H. (1952). Portfolio Selection. *The Journal of Finance*, March 1952, 7(1), 77-91.
- National Venture Capital Association (NCVA). 2017 Year Book.  
<https://nvca.org/blog/nvca-2017-yearbook-go-resource-venture-ecosystem/>
- McCraw, T. K. (2007). *Prophet of Innovation: Joseph Schumpeter and Creative Destruction*. Belknap Press.
- Niles, R. C. (2008). Property Rights and the Crisis of the Electric Grid. *The Objective Standard*, Summer 2008.
- Perez, Carlota. (2009). The double bubble at the turn of the century: technological roots and structural implications. *Cambridge Journal of Economics*. 2009, 33, 779–805  
doi:10.1093/cje/bep028.
- Sahlman, W. A. (1990). The structure and governance of venture-capital organizations. *Journal of Financial Economics* 27(2), 473-521.
- Schumpeter, J. A. ([1950] 2008) *Capitalism, Socialism and Democracy*, 3d ed., New York: Harper Collins.
- Schumpeter, J. A. ([1951] 2008) *Essays on Entrepreneurs, Innovations, Business Cycles, and the Evolution of Capitalism*. New Brunswick: Transaction Publishers.
- Schumpeter, J. A. ([1934] 1983). *The Theory of Economic Development*. New Brunswick, NJ: Transaction Publishers. (1934 English translation of 1926 2d German ed. First published 1911).
- Shepherd, D. A., Douglas, E. J., & Shanley, M. (2000). New venture survival: ignorance, external shocks, and risk reduction strategies. *Journal of Business Venturing*, 15(5-6), 393-410. doi:10.1016/s0883-9026(98)00032-9
- Small Business Administration (SBA 2012), U.S. Government. “Do economic or industry factors affect business survival? (June 2012). Retrieved April 30, 2017, from <http://www.sba.gov/>.
- Smith, A. (1776). *An Inquiry into the Nature and Causes of the Wealth of Nations*.
- Wagner, R. E. (2010). *Mind, Society, and Human Action: Time and Knowledge in a Theory of Social Economy*. Routledge.

White, E. N. (1990). The Stock Market Boom and Crash of 1929 Revisited. *Journal of Economic Perspectives*. Spring 1990, 4(2), 67-83.