

DISRUPTIVE LENDING FOR INNOVATIONS SIGNALING MODEL AND BANKS SELECTION OF STARTUPS

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ABSTRACT

Startups desperately need funding. But lending to startups is too risky for banks. How can banks lend to startups whose cash flow is negative, tangible assets are nonexistent, and most valuable assets are patents? In light of the uncertainties, what can banks do in lending for innovations? In this Article, we turn to economic theory to demonstrate how banks can make their selections of startups, ensuring their returns and encouraging innovations. Specifically, we create a signaling model with partial separating equilibria to demonstrate how banks can address the information asymmetry problem by relying on a truth-telling signal in assessing the likelihood a startup firm will obtain subsequent rounds of capital funding. The model is consistent with evidence from publicly available sources.

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A version of the paper was presented at PatCon, University of San Diego School of Law and USPTO Conference on IP and Business. We appreciate valuable comments from Rosemarie Ziedonis, Questrom School of Business, Boston University and participants at the two conferences.

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INTRODUCTION

The US Patent and Trademark Office released its latest Intellectual Property and U.S. Economy report, emphasizing how patent-intensive industries contribute to the nation's economic growth.¹ By USPTO indications which incorporate findings from other studies, revenue specific to the licensing of intellectual property rights totaled \$115.2 billion in 2012.² With respect to employment, the IP-intensive industries directly accounted for and indirectly supported 45.5 million jobs or thirty percent of the nation's employment.³ It is undeniable that intellectual property, namely, patents, copyrights, and trademarks, are valuable corporate assets and important to the engine of growth and employment.

Companies, small or large, private or public, acquire patents organically

1. Economics & Statistics Administration and U.S. Patent and Trademarks Office, *Intellectual Property and the U.S. Economy: 2016 Update*, <https://www.uspto.gov/sites/default/files/documents/IPandtheUSEconomySept2016.pdf> [<https://perma.cc/8JFT-4CTM>].

2. *Id.* at 26.

3. *Id.* at 13.

in-house⁴ or inorganically through purchase⁵ and license deals.⁶ Some startups with valuation above one billion dollars stockpile patents for defensive purposes before they go public.⁷ Established companies accumulate patents for direct investments and corporate strategies.⁸ Acquiring patents from others can require large sums of money. The sale of

4. For example, in the cryptocurrency area, companies, such as Goldman Sachs, not known for seeking patents was granted its SETLcoin cryptocurrency patent. While AT&T, not known in the bitcoin industry, was also awarded a patent for a bitcoin-powered subscriber server. See Chuan Tian, *The Rate of Blockchain Patent Applications Has Nearly Doubled in 2017*, COINDESK (Jul 27, 2017, 5:03 PM), <https://www.coindesk.com/rate-blockchain-patent-applications-nearly-doubled-2017/> [<https://perma.cc/5N77-6T8B>] (noting that there was a ninety percent increase in patent applications relating broadly to blockchain technology from 2016-2017).

5. See, e.g., Steve Lohr, *Microsoft's AOL Deal Intensifies Patent Wars*, NEW YORK TIMES, (Apr. 9, 2012), <http://www.nytimes.com/2012/04/10/technology/microsoft-to-buy-aol-patents-for-more-than-1-billion.html> [<https://perma.cc/9DUF-NML7>] (commenting on Microsoft's purchase of 800 patents from AOL for more than \$1 billion as another example of patents as "valued assets and feared weapons" that "companies are battling in the marketplace and in courtrooms around the world, where patent claims and counterclaims are filed almost daily").

6. Regarding the importance of patent licensing, companies in the "Internet of Things" space look to patent license packages as an answer to avoid the patent war experienced by the smartphone industry. See Kennie Ho, *4 Things You Need to Know About the Impending Internet-of-Things Patent Wars*, FINNEGAN, (May 16, 2016), <https://www.finnegan.com/en/insights/4-things-you-need-to-know-about-the-impending-internet-of-things.html> [<https://perma.cc/QMP6-7K2W>] (drawing lessons from the Smartphone patent wars for companies operating in the IoT industries).

7. See Charles Arthur, *Facebook Buys 750 IBM Patents: But Why Does It Need to Fight Yahoo?*, THE GUARDIAN, (Mar. 23, 2012, 11:51 AM), <https://www.theguardian.com/technology/2012/mar/23/yahoo-facebook-patents> [<https://perma.cc/7UD7-2ZVV>] (noting that Facebook "prepares a war chest" of patents which are "essential tool in any sizable company's defences" and that patent portfolio is an "essential weapon for any company as it grows"); see also *Industry Report – Billion Dollar Start-Ups: Do Unicorns Like Patents*, IAM, (Sept. 2, 2015), <http://www.iam-media.com/industryreports/detail.aspx?g=346fef38-7aba-481c-abc-b01f17f0497ce> [<https://perma.cc/AU5Z-KCNN>] (reporting that some young companies with billion dollar valuation but fewer patents than "established competitors, many of which will be considering how to slow...down" the unicorns, must "boost their patent holdings through acquisition."); Efrat Kasznik, *The Role of Intellectual Property in Unicorn Valuations*, THE BUS. JOURNALS, (Nov. 4, 2015), <https://www.bizjournals.com/bizjournals/how-to/funding/2015/11/role-of-intellectual-property-in-unicorn-valuation.html> [<https://perma.cc/3YZ8-SJJE>] (analyzing patent portfolios of young companies with high valuations and noting vulnerabilities without having strong patent portfolios); For a list of unicorn companies, see also The Global Unicorn Club, CBINSIGHTS, <https://www.cbinsights.com/research-unicorn-companies/> [<https://perma.cc/TY45-YCNF>].

8. See Antonio Regalado, *Google's Growing Patent Stockpile*, MIT TECH. REV., (Nov. 29, 2013), <https://www.technologyreview.com/s/521946/googles-growing-patent-stockpile/> [<https://perma.cc/9C6N-GGRL>] (studying Google's patent acquisition behavior that drove the company to create "an arsenal so big that others would be afraid to sue, lest Google would sue back").

Motorola Mobility's and Nortel's patent portfolios clearly sets a new standard for multibillion dollar deals, but "smaller" hundreds of million dollar deals are also becoming common.⁹ The patent market and monetization today are global in scope.¹⁰ To fuel the patent market, more than three million patent applications were filed with patent offices globally during 2016, representing the seventh straight year of patent filing increase. Outside the U.S. borders, China's total patent application filing is greater than the filings in the United States, Japan, South Korea and Europe combined.¹¹ In the US, patent application filings for fiscal year 2016 exceeded 650,000 while the USPTO issued 347,642 new patents and monitored 1,144,304 pending patent applications in 2017.¹²

Given the vast number of patents and patent applications available and strong indications that patents are valuable as corporate assets, why do banks refuse to lend against patents? As we have documented in our companion paper, banks have a strong aversion to patents and are wary of lending to innovative startups due to default risks.¹³ In this Article, we focus on how banks can efficiently identify high-quality eligible startups in order to minimize risks. We seek to answer what signals banks rely on to make their

9. See David Cohen, *A Look at Facebook's Patent Acquisitions*, ADWEEK (September 3, 2014), <http://www.adweek.com/digital/envision-ip-patent-acquisitions/> [<https://perma.cc/GA6S-CJWY>] (listing patent acquisitions by Facebook that emphasize sales of patents within the price range of hundreds of millions of dollars); Cadie Thompson, *Facebook buys Microsoft Patents for \$550 Million*, CNBC, (April 23, 2012, 2:15 PM), <http://www.cnbc.com/id/47144621> [<https://perma.cc/4HES-PGR8>] (detailing Facebook's purchase of 650 patents from Microsoft for \$550 million in cash).

10. See, e.g., Gene Quinn, *Bullish or Bearish on the 2018 Patent Market?*, IPWATCHDOG, (Nov. 5, 2017), <http://www.ipwatchdog.com/2017/11/05/bullish-bearish-2018-patent-market/id=89498/> [<https://perma.cc/T2G5-XFH5>] (reporting that the patent market in 2018 will be "bullish" because of "jobs and China," as China has been doing the exact opposite of the United States when it comes to patents. "It is investing heavily in patents, and its patent system and is creating a serious venue for patent holders to enforce their rights. In fact, in many respects, China now takes patent protection more seriously than the United States. I think the implications of this, as well as the serious inability of American companies to protect their technologies at home, particularly in light of foreign competition, is going to impact Congressional thinking on patent issues for the better."

11. Steve Brachmann, *WIPO Stats on Patent Application Filings Shows China Continuing to Lead the World*, IPWATCHDOG, (Dec. 12, 2017), <http://www.ipwatchdog.com/2017/12/12/wipo-stats-patent-application-filings-china-lead/id=90855/> [<https://perma.cc/N7KM-XZRY>].

12. U.S. Patent and Trademark Office, *Performance and Accountability Report 2017*, 170-74, <https://www.uspto.gov/sites/default/files/documents/USPTOFY17PAR.pdf> [<https://perma.cc/KTX5-7MP2>].

13. See Xuan-Thao Nguyen and Erik Hille, *Patent Aversion: An Empirical Study of Bank Financing with Patent Collateral, 1980-2016* 9 UC Irvine L. Rev. 141 (2018); Xuan-Thao Nguyen and Erik Hille, *IP Venture Banking: Disrupting Tech Lending with Warrants and Collateral* (on file with the authors).

lending decisions in the innovation economy sectors. Because the innovation economy sectors are where Venture Capital (“VC”) firms operate and the majority of banks dare not tread, startups have little access to bank’s cheap loans. Our economic model aims to disrupt the barrier faced by the startups.

Our Article is the first to provide a model based on economic theory of separating equilibrium in venture lending by banks. The model illustrates how the information asymmetry problem related to banks’ venture lending can be resolved through a partial separating equilibrium created by a credible, truth-telling, and costly effort signal, which indicates the current health and outlook of a potential startup client. That means banks will depend on credible indicators of the likelihood that the startup that has already obtained Series A funding will be able to receive subsequent VC rounds. It is these subsequent rounds that provide the capital to repay the bank loan.¹⁴ The model demonstrates that the entrepreneur’s costly efforts beyond the fundraising all startups must do are credible signals for banks to rely on in screening startups for venture loans.

The Article proceeds as follows. Part I provides the background and impetus for our economic model of how banks should solve information asymmetry in order to lend to winning startups. Part I explains how outlier banks have managed risks associated with tech lending to startups by creating a unique business solution that we coined “IP Venture Banking”. With the insights from IP Venture Banking, we turn to economics theory to create our model.

Part II looks to the agency model and terms of contract model in VC funding to startups in an attempt to draw lessons for outlier banks’ solving information asymmetry problems in making their venture lending decisions. Despite some similarities, the solutions to VCs are not applicable to banks. Part III goes beyond the economics framework in Part II by canvassing existing studies related to signaling mechanisms in VC and venture debt financing with patents as collateral. In other words, Part III searches for “the missing credible signals” that is truth-telling incentive compatibility in outlier bank lending to innovative startups. No such models exist in the literature but the review is helpful in constructing our model.

Before we delve into our model of credible signals, Part IV explains the background of signaling separating equilibrium theory. Scholars have applied the theory and created models in different situations to solve information asymmetry problems. In Part V, we demonstrate our economic

14. Derek Ridgley, *Credit Insights: The Ins And Outs Of Raising Venture Debt*, SVB, (January 16, 2018), <https://www.svb.com/blogs/derek-ridgley/credit-insights-the-ins-and-out-s-of-raising-venture-debt/> [https://perma.cc/AHN2-NRYB] (subsequent venture equity is the primary source of loan repayment).

theory through the modeling of costly effort partial separating signal. Essentially, the model reveals how outlier banks reduce information asymmetry problems by relying on a costly truth-telling signal — the effort of the entrepreneur to secure extra *unnecessary* VC participants in the next rounds of capital funding from high quality outside VCs.

Part VI shows that our theoretical economic modeling has real world evidence. We explain and examine the observable practices of outlier banks, Silicon Valley Bank and Comerica Bank, specifically, how they actually make lending decisions to startups and reap benefits from the warrants to acquire stock in the startup.

The Article ends with a conclusion that it is time for banks to reconsider their refusal to lend to startups. We want to encourage banks across the nation to engage in the innovation economy sectors where startups are desperate for loans in between VC funding rounds. In return, banks can realize benefits by unlocking patents and other intellectual property assets as key drivers of the enterprise through obtaining warrants as part of the loan cost.¹⁵ In the end, banks lend to innovators while embracing a new lending model that benefits both the lenders and the borrowers.

I. IMPETUS AND INSIGHTS FROM IP VENTURE BANKING

A. *The Knot in Bank Lending to Startups*

Banks operate within a heavily regulated industry under both state and federal regimes.¹⁶ Due to the regulatory constraints in banking, banks must be prudent in its lending practices. Under lending regulations, banks are very reluctant to lend to startups due to high levels of risk.¹⁷ These startups

15. Our future research will focus on outlier banks and later-stage growth companies, including *post* IPO companies. We will also conduct a case study of specific IP Venture Banks. Additionally, we will investigate IP enhancement in venture banking.

16. *The FDIC and the Banking Industry: Perspective and Outlook*, (Jan. 19, 2018), <https://www.fdic.gov/about/strategic/strategic/bankingindustry.html> [<https://perma.cc/D5K6-GJAQ>] (explaining that the FDIC is the primary federal regulator of federally insured state-chartered banks that are not members of the Federal Reserve System.); Arthur E. Wilmarth, Jr., *The Expansion of State Bank Powers, the Federal Response, and the Case for Preserving the Dual Banking System*, 58 *FORDHAM L. REV.* 1133, 1152-54 (1990) (detailing the history of the dual banking, federal and state, system in the United States).

17. Warren Lee, *7 Reasons Banks Not Lending to Small Businesses*, *THE LENDING MAG*, (Nov. 13, 2015), <https://thelendingmag.com/banks-not-lending-to-small-business/> [<https://perma.cc/R6LX-W2XN>] (asserting that: “heightened regulation standards have caused banks to be extra-careful about the risk in their investment portfolios and drastically tighten up standards. . . . Unfortunately, small businesses are inherently riskier than huge corporations, which makes banks hesitant about extending credit to them. Moreover, banks require physical property as collateral. This makes it hard for startups and new businesses that may not have

typically have no cash flow, no tangible assets, and no products in the marketplace.¹⁸

The few banks that do lend to startups cannot lend to just any startup.¹⁹ With startups that have procured a few patents, banks exhibit strong aversion to lending against patents.²⁰ Reasons include the lack of reliable valuation methodology and readily available markets, as patents are illiquid and risky collateral.²¹ Also, under banking regulations, “readily marketable collateral” does not cover patents and other intellectual property assets.²² Even with the

real estate or valuable equipment to offer as collateral, and small business owners may be uncomfortable using their personal assets (family homes and automobiles) as business loan collateral.”)

18. Martin Zwilling, *10 Ways For Startups To Survive The Valley Of Death*, FORBES, (Feb. 18, 2013, 11:30PM), <https://www.forbes.com/sites/martinzwilling/2013/02/18/10-ways-for-startups-to-survive-the-valley-of-death/#569bc24469ef> [<https://perma.cc/V8PA-DF3H>] (describing the difficulty of covering the negative cash flow in early stages of a startup as the “valley of death”). “Companies that reach highly competitive Series A rounds typically have systematically reduced their company’s product, market and execution risk during the seed stage. The founders of these companies use their seed capital to efficiently orchestrate a process-oriented set of experiments that culminate in evidence of product-market fit.” Nnamdi Okike, *Charting a Path from Seed to a Competitive Series A Round*, TECHCRUCH, (May 7, 2015),

19. Banks make their decisions to lend to only startups that have the “ability to raise additional capital to fund growth and repay the debt.” Derek Ridgley, *Extend Your Startup’s Runway: How Venture Debt Works*, SVB, (October 13, 2016), https://www.svb.com/Blogs/Derek_Ridgley/Extend_your_startup_s_runway_How_venture_debt_works [<https://perma.cc/EW2V-K3H9>].

20. Without access to traditional loans from banks, IP-centric companies gravitate to alternative or specialty lenders for loans against IP. Nevertheless, in the alternative space, “valuations are a critical step in the process of lending against IP.” Bruce W. Burton, et. al., *Financing Alternatives for Companies: Using Intellectual Property as Collateral*, SRR, (2014), <https://www.innovasafe.com/pdf/financing-alternatives-companiesusing-ip-collateral.pdf> [<https://perma.cc/5EN9-Y4WL>].

21. *Id.* (noting that loans provided by specialty lenders against banks are “costly” because IP assets are illiquid and risky collateral). For a discussion on numerous methods of patent valuations and their associated concerns, see Krista F. Holt, et. al., *What’s It Worth? Principles of Patent Valuation*, ABA SECTION OF INTELLECTUAL PROPERTY LAW, https://www.americanbar.org/content/dam/aba/publications/landslide/2015-september-october/ABA_LAND_v008n01_whats_it_worth_principles_of_patent_valuation.authcheckdam.pdf [<https://perma.cc/LUT3-WCLM>]; J. Timothy Cromley, *20 Steps for Pricing a Patent*, J. OF ACCOUNTANCY, (Nov. 1, 2004), <https://www.journalofaccountancy.com/issues/2004/nov/20stepsforpricingapatent.html> [<https://perma.cc/73YA-UBLV>].

22. 12 C.F.R. § 32.2(v) (2015) provides that “readily marketable collateral” means “financial instruments and bullion that are salable under ordinary market conditions with reasonable promptness at a fair market value determined by quotations based upon actual transactions on an auction or similarly available daily bid and ask price market.” The term “financial instrument” is further defined in 12 C.F.R. § 32.2(p) (2015) as follows: “Financial instrument means stocks, notes, bonds, and debentures traded on a national securities exchange, OTC margin stocks as defined in Regulation U, 12 CFR part 221, commercial paper, negotiable certificates of deposit, bankers’ acceptances, and shares in money market

fortunate few startups that have received VC funding, banks are still very cautious.²³ The survival rate for startups between Series A round of funding obtained from VCs to the next Series B round of funding is about fifty percent.²⁴ That means for banks to succeed in the venture lending niche, they need reliable signals to screen the startups that will be able to pay back the loans.

B. Warrants as Enterprise Value of Intellectual Property

In creating a model on signaling mechanism, we take advantage of our companion paper where we have identified the outlier banks that make loans to startups whose intellectual property assets are key drivers of the enterprise value.²⁵ Out of 6,000 banks, only a small number of banks have created a unique business model of tech lending to the entrepreneurial startup economy based on the enterprise value of the intellectual property owned by the startups.²⁶ That means when the startup's enterprise value enjoys higher valuation at a later acquisition or possible IPO, the bank also obtains benefits from the high valuation.²⁷ Accordingly, the banks demand warrants to purchase stock in the startup as part of the venture loan cost.²⁸

and mutual funds of the type that issue shares in which national banks or savings associations may perfect a security interest. Financial instruments may be denominated in foreign currencies that are freely convertible to U.S. dollars.” The term “financial instrument” does not include mortgages.

23. Banks generally lend to established companies with tangible assets, not patents. See Bank of America Merrill Lynch White Paper, *Frequently Asked Questions About Asset-Based Lending*, (Jan. 2014), http://www.ohiomfg.com/wp-content/uploads/01-13-17_lb_tax_FAQ-Asset-Based-Lending.pdf [<https://perma.cc/JYM4-MTFT>].

24. See Jason D. Rowley, *The Startup Funding Graduation Rate is Surprisingly Low*, MATTERMARK (Sept. 28, 2016), <https://mattermark.com/startup-graduation-rate-surprisingly-low/> [<https://perma.cc/7H2E-DAPA>] (finding that startup matriculation rates for 2009-2012 is 31.7% for Series A, 17% for Series B, 7.4% for Series C, 2.4% for Series D, 1% for Series E, and 0.3% for Series F). For an explanation of what Series funding by VCs mean, see Shoshanna Delventhal, *Series A, B, C Funding: How It Works*, INVESTOPEDIA, (Dec. 29, 2017), <https://www.investopedia.com/articles/personal-finance/102015/series-b-c-funding-what-it-all-means-and-how-it-works.asp> [<https://perma.cc/K6GZ-Q6WV>].

25. See Xuan-Thao Nguyen and Erik Hille, *IP Venture Banking: Disrupting Tech Lending with Warrants and Collateral* (on file with the authors).

26. *Id.*

27. *Id.*

28. Andy Weyer of Square 1 Bank provided the following financial covenants and pricing for venture loan by banks:

Most venture banks require financial covenants (e.g., minimum revenue at 75% plan, maximum net loss at 125% plan or minimum equity raise by a certain date), but the overall cost of capital is relatively low (interest rates at 4%-8%, upfront fees at 0.25%-0.50% and warrants at 3%-5%).

Andy Weyer, *Typical Venture Debt Terms*, SQUARE 1 BANK, (Feb. 24, 2014),

A warrant is a derivative that confers the right to buy a certain amount of shares in the startup at a fixed low price.²⁹ An outlier bank can demand a warrant of less than a 0.5 percent share in the company.³⁰ The bank can cash in on the warrant any time before the expiration date.³¹ Obviously, the bank holds on to the warrant and redeems it at the most opportune time. Illustratively, Comerica bank received a warrant to purchase 233,333 shares of Celator Pharmaceuticals, Inc. at \$0.60 per share on March 11, 2009.³² The expiration date for the warrant was March 11, 2016.³³ By May 2016, Jazz Pharmaceuticals PLC offered to acquire Celator for \$1.5 billion or \$30.25 a share.³⁴ The warrant became an attractive return on the loan for the bank.

Another example on the benefits of warrant to outlier banks is Silicon Valley Bank (SVB). In the second quarter for 2015 alone, SVB's gain on the equity warrants was \$23.6 million.³⁵ That amount included \$13.9 million related to FitBit's IPO. FitBit is the maker of fitness-tracking wristbands.³⁶ The gains on the second quarter for 2015 alone exceeded all the losses SVB bank incurred in the preceding ten years.³⁷

The bank also takes a security interest in the patents just in case the startup fails.³⁸ Comparing the warrant to the security interest in the patents, the warrant has a much more valuable upside.³⁹ The banks rely on the

<https://www.square1bank.com/insights/typical-venture-debt-terms/> [<https://perma.cc/EP2F-SWDN>]. A sample warrant from Square 1 Bank is available at <http://contracts.onecle.com/otonomy/square-one-warrant-2012-07-31.shtml> [<https://perma.cc/N8N8-3L2H>].

29. A warrant is a derivative that confers the right, but not the obligation, to buy or sell a security – normally an equity – at a certain price before expiration. *See Warrant*, INVESTOPE DIA, <https://www.investopedia.com/terms/w/warrant.asp#ixzz55PvKWdUr> [<https://perma.cc/CT55-SQNZ>].

30. *Id.*

31. *Id.*

32. *Comerica Bank Warrant*, <https://www.sec.gov/Archives/edgar/data/1327467/000119312512517529/d411577dex43.htm> [<https://perma.cc/JJ6S-AVD3>] (last visited Sept. 17, 2018).

33. *Id.*

34. Cory Renauer, *Why Celator Pharmaceuticals Is Up 1,610% in 2016*, THE MOTLEY FOOL, (June 27, 2016, 8:21AM), <https://www.fool.com/investing/2016/06/27/why-celator-pharmaceuticals-is-up-1610-in-2016.aspx> [<https://perma.cc/XW3A-GHM9>].

35. *See* E. Scott Reckard, *At Silicon Valley Bank, Risky Tech Start-ups Are Lucrative Business*, L.A. TIMES, (Aug. 8, 2015) (reporting on SVB's warrants holding).

36. *Id.*

37. *Id.*

38. Secured transactions allow banks to repossess the patent collateral and sell the patents to others to recover the loan. Illustratively, SVB bank took a security in patents when it made a loan to Ozro. A year and half later, Ozro was in financial trouble and the bank sold its security interest rights in the patents to XACP. As anticipated, Ozro defaulted on the loan and XACP foreclosed on the patents and sold them at public auction. *See Sky Techs. LLC v. SAP AG*, 576 F.3d 1374, 1376-78 (Fed. Cir. 2009).

39. Comerica's holding on to the warrants in Celator Pharmaceuticals yielded better

warrants for a substantial profit at a subsequent enterprise valuation date – VC funding round, acquisition, or initial public offering (IPO).⁴⁰ The business model employed by outlier banks is what we call “IP Venture Banking.”⁴¹ With these insights from outlier banks, we turn to economics theories and signaling models.

II. LENDER’S DECISION AND INFORMATION ASYMMETRY

Information asymmetry is a familiar problem banks encounter when they decide to lend to entrepreneurial firms.⁴² In an information asymmetry situation, one party has all the information while the other party does not.⁴³

returns than SVB’s loan and security interest in Ozro. See Warrant, *supra* note **Error! Bookmark not defined.**, and compare SVB’s security interest in Ozro, *supra* note **Error! Bookmark not defined.** with Comerica’s Bank Warrant, *supra* note **Error! Bookmark not defined.**

40. *Id.* (comparing SVB’s security interest in Ozro, *supra* note **Error! Bookmark not defined.** with Comerica’s Bank Warrant, *supra* note **Error! Bookmark not defined.**, the warrant is the more valuable source of bank profits); Ridgley, *supra* note **Error! Bookmark not defined.** (question 11, states that the low interest rates charged does not cover the appropriate risk-adjusted interest, thus it is the warrants that are the potential upside for the lender).

41. SVB, Square 1 and Comerica are examples of banks engaging in IP Venture Banking. See *Resources for Innovators*, COMERICA BANK, <https://www.comerica.com/business/industry-solutions/specialized-industries/technology-life-sciences.html> [<https://perma.cc/93NU-LZFG>]; *Your Next Stage Starts Here*, SQUARE 1 BANK, <https://www.square1bank.com/> [<https://perma.cc/SR4J-HG7U>]; *Facts at a Glance*, SVB, <https://www.svb.com/newsroom/facts-at-a-glance/> [<https://perma.cc/PH7L-NX2Q>] (describing each banks venture debt lending practices to startups that we are calling “IP Venture Banking” when there is a security interest/lien or negative pledge of the startups IP). For a further description of SVB’s venture debt services see Ridgley, *supra* note **Error! Bookmark not defined.**; Ridgley, *supra* note **Error! Bookmark not defined.**; Shane Anderson, *The Role Of Venture Debt In A Booming Tech Market*, SVB, (October 9, 2018), <https://www.svb.com/blogs/shane-anderson/the-role-of-venture-debt-in-a-booming-tech-market/> [<https://perma.cc/H9A6-M74T>].

42. See Abraham J.B. Cable, *Fending for Themselves: Why Securities Regulations Should Encourage Angel Groups*, 13 U. PA. J. BUS. L. 107, 122 (2010) (“‘Information asymmetry’ refers to the concept that whatever information is available about the company’s prospects at the time of the investment is ‘soft’ (not easily observable by an investor and difficult for an entrepreneur to communicate credibly).”).

43. Examples of information asymmetry are plenty. A common example is the informed seller and uninformed buyer. Contingent payments may act as “a screening device to assist sellers to signal their unobservable quality to uninformed buyers.” Brian JM Quinn, *Putting Your Money Where Your Mouth Is: The Performance of Earnouts in Corporate Acquisitions*, 81 U. OF CINCINNATI L. REV. 127, 142 (2012). In the context of corporate acquisitions, “price contingent on future performance — such as an earnout provision — that both provides investment incentives and bridges the information asymmetry between the parties.” Albert Choi & George Triantis, *Strategic Vagueness in Contract Design: The Case of Corporate Acquisitions*, 119 YALE L.J. 848, 861 (2010). Information asymmetry, in some cases, are

In startup financing, the entrepreneurs have all the information about the startup's technologies, innovation, business operation, competition, and prospects.⁴⁴ If banks want to lend to the startups, banks are the uninformed party facing serious information asymmetry problems in screening startups while having no traditional means to reduce default risks compared to lending to established companies.⁴⁵ Because banks can easily obtain information relating to the established company's cash flow, earnings, credit history, and tangible assets, among others, banks continue their traditional lending practices.⁴⁶ Startups simply cannot provide what banks require for a loan.

In broad strokes, banks with a desire to engage in lending to startups in the innovation intensive sectors face information asymmetry problems that are similar to the problems VC financing face. But the solutions to VCs are different compared to banks, as banks are heavily regulated.

In the VC financing model, the informed entrepreneurs have all the information and the uninformed investors, including individuals and institutions, have none.⁴⁷ Yuk-See Chan solved the information asymmetry problem in his agency model by introducing VCs as the informed intermediaries based on their experience and expertise in the industry,

results of criminal activities. See A.C. Pritchard, *Market as Monitors: A Proposal to Replace Class Actions with Exchanges as Securities Fraud Enforcers*, 85 VA. L. REV. 925, 941 (1999) ("Fraud on the market, therefore, creates information asymmetries between traders. These information asymmetries mean potential profits for informed traders and corresponding losses for the uninformed.").

44. See Cable, *supra* note **Error! Bookmark not defined.** at 122. "[T]here is an imbalance of information in favor of the entrepreneur. In the face of information asymmetry, an investor will have a difficult time distinguishing between good and bad investments and will discount all the opportunities or price them all as mediocre, thereby raising the cost of capital for high-quality entrepreneurs."

45. *Id.* at 121 (noting that startups are poor candidates for traditional financing from banks due to lack of positive cash flow and lack of hard assets).

46. Banks typically engage in cash-flow lending and asset-based lending. See Mark N. Berman and Jo Ann J. Brighton, *Handbook on Second Lien Loans & Intercreditor Agreements* 6, (American Bankruptcy Institute, 2009). Cash-flow lending is a type of debt financing typically associated with traditional bank debt financing. It is senior debt financing provided to a borrower based on a certain multiple of profitability of the borrower deemed sufficient to give the lender comfort that the borrower will have sufficient cash flow to satisfy its obligations to the lender. In this regard, the cash flow-lender with a lien on all of the borrower's assets is concerned with the overall enterprise value of the borrower as a function of its earnings. Asset-based lending, in contrast, is where the lender makes its credit decision on the basis of the appraised value of the borrower's current assets (receivables, equipment and inventory) and expects that if the borrower defaults, the value of the assets even in liquidation will be sufficient to repay the loan.

47. Yuk-Shee Chan, *On the Positive Role of Financial Intermediation in Allocation of Venture Capital in a Market with Imperfect Information*, 38 THE JOURNAL OF FINANCE 1543, 1543 (1983).

enabling them to screen potential investments.⁴⁸ Consequently, VCs finance high quality projects, reject low quality projects, and ensure the integrity and viability of the entrepreneur funding market.⁴⁹ Building on the agency model, scholars developed new models to focus on terms of contract, illuminating further what VCs do to screen fledgling entrepreneurs in order to achieve good investment results.⁵⁰ For example, contract terms challenge entrepreneur's projections and discourage entrepreneurs with low-quality projects from participating in the VC pool of potential capital investment seekers.⁵¹ Contract terms relating to staged venture capital investment allow VCs to control when to release certain amounts of funding and when to discontinue.⁵² Also, contract terms force the entrepreneur to have skin in the game by tying compensation to specific milestones achieved by the firm, thus inducing the entrepreneur to reassess himself before seeking capital investment from VCs.⁵³

In short, both the agency model and the terms of contract model literature for VC capital investment screenings are numerous and have been explained and summarized elsewhere.⁵⁴ Can banks behave like VCs in screening borrowers who are startups?

Unlike VCs, banks conduct some due diligence in lending decisions but not at the same level.⁵⁵ Conventional bankers do not spend much time

48. *Id.* at 1543

49. *Id.* at 1543

50. For a summary of the literature, see Michael Klausner & Kate Litvak, *What Economists Have Taught Us about Venture Capital Contracting*, BRIDGING THE ENTREPRENEURIAL FINANCING GAP: LINKING GOVERNANCE WITH REGULATORY POLICY, (Michael Whincop, ed., Ashgate 2001), <https://ssrn.com/abstract=280024> or <http://dx.doi.org/10.2139/ssrn.280024> [<https://perma.cc/FY2P-KWSS>].

51. Mathias Dewatripont & Gerard Roland, *Soft Budget Constraints, Transition, and Financial System*, 156 JOURNAL OF INSTITUTIONAL AND THEORETICAL ECONOMICS (JITE)/ZEITSCHRIFT FÜR DIE GESAMTE STAATSWISSENSCHAFT 245, 252-53 (1999).

52. Paul A. Gompers & Josh Lerner, *Chapter 7*, THE VENTURE CAPITAL CYCLE, 168 (MIT Press 1999).

53. Steven N. Kaplan & Per Stromberg, *Venture Capitalists as Principals: Contracting, Screening, and Monitoring*, 91 THE AMERICAN ECONOMIC REVIEW 426, 427 (2001).

54. See Klausner & Litvak, *supra* note **Error! Bookmark not defined.**; Steven N. Kaplan & Per Stromberg, *Financial Contracting Theory Meets the Real World: An Empirical Analysis of Venture Capital Contracts*, 70 THE REVIEW OF ECONOMIC STUDIES 871, 281-315 (2003); Steven N. Kaplan & Per Stromberg, *Characteristics, Contracts, and Actions: Evidence from Venture Capitalist Analysis*, 59 THE JOURNAL OF FINANCE 2177, 2177-2210 (2004).

55. Unlike banks, VCs “perform substantial due diligence on potential investments ex ante and monitor them very closely ex post” Darian M. Ibrahim, *Financing the Next Silicon Valley*, 87 WASH. U. LAW. REV. 717, 730 (2010). With respect to bank due diligence, Risk Management Association produced a white paper to explain what type of due diligence that bankers must conduct in commercial lending. *Ethics and Commercial Lending: Understanding Due Diligence*, RMA, (July 2014), <https://www.rmahq.org/ethics-and-comm>

outside the office with potential borrowers; they do not serve on a startup's board, connect startup with industry leaders, or advise on management.⁵⁶ In other words, bankers are not the same type of financial intermediators as VCs. Moreover, startups do not have hard assets for traditional bank loans, meaning there is not much for banks to conduct due diligence on for potential loans. Banks are less informed intermediaries compared to VCs. Banks are relatively uninformed parties in screening which startups to lend to.⁵⁷

On the other hand, banks have access to deposits and cheap capital.⁵⁸

As a result, the cost of a loan from banks is significantly less than from non-bank lenders.⁵⁹ To minimize agency costs, banks take security interests

ercial-lending-understanding-due-diligence/ [https://perma.cc/28F8-QRLE].

56. VCs, on the other hand, have the skills and connection to be helpful to their portfolio companies. See George W. Dent, Jr., *Venture Capital and the Future of Corporate Finance*, 70 WASH. U. L.Q. 1029, 1034 n. 17 (1992) (“Venture capitalists claim that they often provide general management advice and useful business connections to portfolio companies, especially when the company needs further financing or wants to go public.”). However, “[a]lthough venture capitalists have the skill, connections, and possibly the desire to help portfolio companies, in practice they are too busy to devote sufficient time to be truly helpful.” *Id.*

57. Professor Darian M. Ibrahim has identified that there are specialized lenders who lend to startups by relying on a startup's VC backing and intellectual property for loan repayment requirement. These lenders solve the information asymmetry problem. Darian M. Ibrahim, *Debt as Venture Capital*, 2010 U. ILL. L. REV. 1169, 1175 (2010).

58. See, e.g., Hilary J. Allen, *Let's Talk About Tax: Fixing Bank Incentives to Sabotage Stability*, 18 FORDHAM J. OF CORP. & FINANCIAL L. 821, 839-40 (2013) (noting that “debt is rendered cheaper for banks because they have access to deposit insurance (which subsidizes the cost of “borrowing” from depositors), as well as access to emergency funding from central banks acting in their capacity as “lender of last resort” (which reduces the risk that banks will default on their noninsured debt, making that debt cheaper for banks to issue)); Financial Crisis Inquiry Commission, *The Financial Crisis Inquiry Report*, 39 (2011), http://fcic-static.law.stanford.edu/cdn_media/fcic-reports/fcic_final_report_full.pdf [https://perma.cc/T3RM-2XFZ] (“Unlike banks and thrifts with access to deposits, investment banks relied more on money market funds and other investors for cash; commercial paper and repo loans were the main sources.”). Banks have greater access to capital at cheaper rates than payday lenders since banks accept deposits.

59. For example, in the consumer lending market, non-bank lenders charge consumers 250% to 400% interest rate on small loans. See, e.g., Christopher L. Peterson, “*Warning: Predatory Lender*” – *A Proposal for Candid Predatory Small Loan Ordinances*, 69 WASH. & LEE. L. REV. 893, 906 (2012) (“In many states, payday lenders supported weak legislation that purported to “regulate” payday lending but actually had little substantive content and primarily served to legitimize hitherto illegal or even criminal loans. Indeed with average interest rates of around 400%, payday loans were actually much more expensive than the old mafia loan sharks that typically charged a relatively mild 250%.”). For small businesses, seeking loans from alternative lenders means significantly high cost. Andrew L. Wang, *Alternative Lending: Nonbank Business Funding Options*, NERDWALLET, (Jun. 27, 2017), <https://www.nerdwallet.com/blog/small-business/small-business-loans-alternative-lending/> [https://perma.cc/55NX-HKMM]. “Most alternative business lenders offer loans with double-digit, even triple-digit, rates. Why? One reason is that most online lenders also require

in real and personal property owned by potential borrowers and impose many covenants to restrict an entrepreneur's discretions.⁶⁰ Banks have long used contract terms to release loans in increments in accordance with the level of collateral availability, to retain the right to review new information about the borrower, and to allow banks flexibility to refuse requests to draw on credit line or waive events of default.⁶¹ Even in the high risk of IP Venture Banking, banks provide loans to startups at about 1/40th (as a measure of dilution) the cost of equity financing from a VC.⁶²

Overall, the agency model and terms of contract model are not suitable for banks seeking a reliable device to screen startups. In order to maintain a lower cost in lending to startups in the IP Venture Banking niche and adhere to banking regulations, banks must acquire the reliable signals about the health of potential startup clients. Since about half of the startups do not make it from Series A to Series B funding, it is imperative that banks have the most up-to-date information.⁶³ Before banks make a loan to the startup, banks want to know whether the firm will be able to obtain the next round of VC funding so it can repay the loan. In other words, banks need a truth-telling signal.

III. THE MISSING SIGNALS

Startups generally burn cash infusions.⁶⁴ They are hungry for equity and debt financing from investors.⁶⁵ Financing for innovation has attracted

shorter loan terms, which mean higher regular payments. Also, the borrowers these lenders encounter tend to be those that traditional banks deemed too risky to lend to. In setting higher rates, alternative lenders are baking in the higher likelihood that they're not going to get paid back." Sarita Harbour, *Why Online Business Loans Are More Expensive Than Bank Loans*, FUNDERA LEDGER, (Jan. 4, 2017), <https://www.fundera.com/blog/why-online-business-loans-are-more-expensive-than-bank-loans> [<https://perma.cc/HFT6-J26A>]. "Online business loans from alternative lenders cost more for borrowers because they cost more for lenders, too. Banks simply have access to cheaper money from a couple of different sources. . . . The money that alternative lenders offer to small business borrowers comes from investors like venture capital firms, hedge funds, and sometimes even individuals looking for a better return on their dollar."

60. George G. Triantis, *Financial Contract Design in the World of Venture Capital*, 68 THE U. OF CHICAGO L. REV. 305, 305-322 (2001).

61. *Id.* at 313.

62. Ridgley, *supra* note **Error! Bookmark not defined.**

63. See Rowley, *supra* note **Error! Bookmark not defined.**

64. See, e.g., EMERGING COMPANIES GUIDE, A RESOURCE FOR PROFESSIONALS AND ENTREPRENEURS 202-04 (Robert L. Brown & Alan S. Gutterman eds., 2d ed., 2004) (stating startups have high burn rates or how entrepreneurial startup quickly spends its cash each month and causes the entrepreneur to fear the length of the startup's runway or the amount of time the startup has before it runs out of cash).

65. See also George Deeb, *Comparing Equity, Debt and Convertibles for Startup*

many scholars to apply and construct theoretical frameworks, resolving informational asymmetries through identifying signals for VCs to screen startups for investments.⁶⁶ No existing scholarship, however, focuses on how banks consider their venture lending to startups after Series A.⁶⁷ None provide an economics modeling of bank lending to startups. Nevertheless, existing scholarship is helpful in thinking, applying, and modifying our economics model.

A. Patents as Signals in VC Funding to Startups

Many scholars have shown that patent filings by startups are signals for VCs to decide on investing in startups.⁶⁸ Other scholars have narrowed the

Financings, FORBES, (Mar 19, 2014), <https://www.forbes.com/sites/georgedeeb/2014/03/19/comparing-equity-vs-debt-vs-convertibles-for-startup-financings/#23d052f069ff> [https://perma.cc/H4BC-RQSR] (explaining different types of financing for startups, along with advantages and disadvantages for each type).

66. See generally Joel A.C. Baum & Brian S. Silverman, *Picking Winners or Building Them? Alliance, Intellectual, and Human Capital as Selection Criteria in Venture Financing and Performance of Biotechnology Startups*, 19 JOURNAL OF BUSINESS VENTURING 411-36 (2004); Dirk Engel and Max Keilbach, *Firm-level Implications of Early Stage Venture Capital Investment an Empirical Investigation*, 14 JOURNAL OF EMPIRICAL FINANCE 150-67 (2007). Others rely on financial contract design such as staged investments to screen out bad applicant. Kate Litvak, *Monte Carlo Simulation of Contractual Provisions: An Application to Default Provisions in Venture Capital Limited Partnership Agreements*, 98 CORNELL L. REV. 1495, 1517 (2013) (noting “VC screening: staged investment deters low-quality applicants from seeking funding because applicants know that even if they can fool an investor in the first round of financing, they will likely not succeed at doing so in the later rounds. This makes seeking funding marginally less attractive to low-quality applicants.”).

67. See, e.g., Yael Hochberg, Carlos J. Serrano, and Rosemarie Ziedonis, *Patent Collateral, Investor Commitment, and the Market for Venture Lending*, TECHNICAL REPORT, NATIONAL BUREAU OF ECONOMIC RESEARCH, (2014); Yael Hochberg, Carlos J. Serrano, and Rosemarie Ziedonis, *Intangible but Bankable*, 348 SCIENCE 1202 (2015).

68. See *infra*, notes 69 and 70; see generally Michael B. Heeley, Sharon F. Matusik, and Neelam Jain, *Innovation, Appropriability, and the Underpricing of Initial Public Offerings*, 50 THE ACADEMY OF MANAGEMENT JOURNAL 209-25 (2007); Ronald J. Mann & Thomas W. Sager, *Patents, Venture Capital, and Software Start-ups*, 36 RESEARCH POLICY 193-208 (2007); Jerry Cao & Po-Hsuan Hsu, *The Informational Role of Patents in Venture Capital Financing*, Technical Report (2011); Carolin Haussler, Dietmar Hargho, and Elizabeth Muller, *To Be Financed or Not . . . the Role of Patent for Venture Capital-Financing* 1-47 (2009) <http://ftp.zew.de/pub/zew-docs/dp/dp09003.pdf> [https://perma.cc/2BCE-W7DZ]; Annamaria Conti, Jerry Thursby, and Marie Thursby, *Patents as Signals for Startup Financing*, 61 THE JOURNAL OF INDUSTRIAL ECONOMICS 592-622 (2013); Annamaria Conti, Marie Thursby, and Frank Rothaermel, *Show Me the Right Stuff: Signals for High-tech Startups*, 22 JOURNAL OF ECONOMICS & MANAGEMENT STRATEGY 341-64 (2013); Gili Greenberg, *Small Firms, Big Patents? Estimating Patent Value Using Data on Israeli Start-ups' Financing Rounds*, 10 EUROPEAN MANAGEMENT REVIEW 183-96 (2013); David H. Hsu & Rosemarie H. Ziedonis, *Resources as Dual Sources of Advantage: Implications for Valuing Entrepreneurial-firm Patents*, 34 STRATEGIC MANAGEMENT JOURNAL 761-81 (2013); David

importance of this patent filings signal to being only relevant for Series A funding.⁶⁹ With respect to embryonic and younger startups, however, patents are not signals. The most credible indicators for seed and angel funding are investments from founder's friends and family.⁷⁰ However, other scholars have found no differentiation in the success of startups between those with and without patents.⁷¹

Numerous scholars have identified patents correlating with startup success, calling this signaling, but did not provide any explanation of how this signal would be credible or could serve as a separating signal or equilibrium.⁷² Moreover, these studies did not focus on bank's lending to startups. They primarily focused on venture debts and funding by mostly non-banks to startups.⁷³

B. Audretsch, Werner Bante, and Prashanth Mahagaonkar, *Financial Signaling by Innovative Nascent Ventures: The Relevance of Patents and Prototypes*, 41 RESEARCH POLICY 1407 (2012); Sebastian Hoenen, Christos Kolympiris, Wilfred Schoenmakers, and Nicholas Kalaitzandonakes, *The Diminishing Signaling Value of Patents Between Early Rounds of Venture Capital Financing*, 43 RESEARCH POLICY 956-89 (2014); Sudipto Bhattacharya & Jay R. Ritter, *Innovation and Communication: Signaling with Partial Disclosure*, 50 THE REVIEW OF ECONOMIC STUDIES 331-46 (1983); Clarisa Long, *Patent Signals*, 69 U. OF CHICAGO L. REV. 625-79 (2002); Ronald J. Mann, *Do Patents Facilitate Financing in the Software Industry?*, 83 TEXAS L. REV. 961 (2005); David H. Hsu & Rosemarie H. Ziedonis, *Patents as Quality Signals for Entrepreneurial Ventures*, 8 ACADEMY OF MANAGEMENT ANNUAL MEETING PROCEEDINGS 1-6 (2008); Iain M. Cockburn & Megan MaeGarvie, *Research, Patents, Thickets, and the Financing of Early-Stage Firms: Evidence from the Software Industry*, NATIONAL BUREAU OF ECONOMIC RESEARCH (2007); Mark A. Lemley, *Rational Ignorance at the Patent Office*, 95 NORTHWESTERN U.L. REV. 1495 (2001).

69. See generally Engel & Keilbach, *supra* note 66; Conti, Thursby, & Rothaermel, *supra* note 68; Conti, Thursby, & Thursby, *supra* note 68; Greenberg, *supra* note 68; Hsu & Ziedonis, *supra* note 68; Hoenen, Kolympiris, Schoenmakers, & Kalaitzandonakes, *supra* note 68.

70. See Conti, Thursby, & Rothaermel, *supra* note 68.

71. See Daniel Hoenig & Joachim Henkel, *Quality Signals? The Role of Patents, Alliances, and Team Experience in Venture Capital Financing*, 44 RESEARCH POLICY 1049-64 (2015).

72. See Lemley, *supra* note 68; M. Diane Burton, Jesper B Sorensen, and Christine M. Beckman, *Coming From Good Stock: Career Histories and New Venture Formation*, IN SOCIAL STRUCTURE AND ORGANIZATIONS REVISITED, 229-62 (Emerald Group Publishing Limited 2002); Baum & Silverman, *supra* note 66; Christine M. Beckman, M. Diane Burton, and Charles O'Reilly, *Early Teams: The Impact of Team Demography on VC Financing and Going Public*, 22 JOURNAL OF BUSINESS VENTURING 147-73 (2007); Engel & Keilbach, *supra* note 68; Heeley, Matusik, and Jain, *supra* note 68; David H. Hsu, *Experienced Entrepreneurial Founders, Organizational Capital, and Venture Capital Funding*, 36 RESEARCH POLICY 722-41 (2007); Hsu & Ziedonis, *supra* note 68; Mann & Sager, *supra* note 68, at 193-208; Paul A. Gompers, Anna Kovner, Josh Lerner, and David S. Scharfstein, *Performance Persistence in Entrepreneurship*, 96 JOURNAL OF FINANCIAL ECONOMICS 18-32 (2010); Hoenen, Kolympiris, Schoenmakers, and Kalaitzandonakes, *supra* note 68; Hoenig & Henkel, *supra* note 71.

73. Mischa Hesse, Eva Lutz, and E. Talmor, *Patent Activity of Start-ups and the*

Further, the exuberance of labeling patents as signal of startup success has not yet reconciled how recent decisions from the Supreme Court will have a negative impact on patents procurement by startups in biopharma/life science, healthcare information, and software/internet sectors. The *Prometheus* and *Myriad* decisions relating to patentable subject matters have imposed restrictions in patenting genes, novel drugs, and diagnostic methods.⁷⁴ The *Alice* decision overhauls the patenting of software business method patents, causing companies in the software/internet industry to rely on the weaker protection under trade secrets and copyrights.⁷⁵ Thus, the impact of these decisions will cause startups in the relevant industries to no longer have as robust a patent portfolio with which to indicate quality.⁷⁶

Other scholars have identified indicators like prominent endorsements,⁷⁷ alliances with prominent industry groups,⁷⁸ and team experience,⁷⁹ as highly correlated with startup success. But some scholars have contradicted the indicators, revealing that they found team experience did not correlate with the success of the startup.⁸⁰

In summary, though the scholars suggested signaling, none provided analysis or models of incentive compatible support or separating equilibrium

Structuring of Venture Lending Contracts, 12 JOURNAL OF MODERN ACCOUNTING AND AUDITING 410-28 (2016); Gaetan deRassenfosse & Timo Fischer, *Venture Debt Financing: Determinants of the Lending Decision*, 10 STRATEGIC ENTREPRENEURSHIP JOURNAL 235-56 (2016); Audretsch & Mahagaonkar, *supra* note 68; Yael Hochberg, Carlos J. Serrano, and Rosemarie Ziedonis, *Patent Collateral, Investor Commitment, and the Market for Venture Lending*, TECHNICAL REPORT, NATIONAL BUREAU OF ECONOMIC RESEARCH, (2014); Yael Hochberg, Carlos J. Serrano, and Rosemarie Ziedonis, *Intangible but Bankable*, 348 SCIENCE 1202 (2015).

74. *Mayo v. Prometheus*, 132 S. Ct. 1289 (2012); *Assoc. for Molecular Pathology v. Myriad Genetics*, 133 S. Ct. 1747 (2013).

75. *Alice Corp. v. CLS Bank International*, 134 S. Ct. 2347 (2014). James E. Daily, *Alice's Aftermath: changes in Patentee Behavior Since Alice v. CLS Bank*, 23 B.U. J. SCI. & TECH. L. 284 (2017) (analyzing the impact of *Alice* in software patents and related industries).

76. Sanjesh P. Sharma, *Patent-Eligible Subject Matter in Light of Mayo v. Prometheus*, 24 INTEL. PROP. & TECH. L.J. 9, 9 (2012) (stating that the *Mayo* decision is “the death knell for patents relating to personalized medicine, diagnostics, and biotechnology.”); see Editorial, *Myriad Diagnostic Concerns*, 31 NATURE BIOTECH. 571 (2013) (attributing the decrease in investments in the diagnostic sectors is caused in part by the *Myriad* and *Prometheus* decisions, and that they are “the death knell for diagnostic innovation”).

77. Toby E. Stuart, Ha Hoang, and Ralph C. Hybels, *Interorganizational Endorsements and the Performance of Entrepreneurial Ventures*, 44 ADMIN. SCI. Q. 315 (1999); Hsu, *supra* note 68; Hoenig & Henkel, *supra* note 71.

78. Stuart, Hoang, and Hybels, *supra* note 77; Baum & Silverman, *supra* note 66; Hoenig & Henkel, *supra* note 71.

79. Burton, Sørensen, and Beckman, *supra* note 72; Long, *supra* note 68; Gompers, Kovner, Lerner, and Scharfstein, *supra* note 72; Beckman, Burton, and O'Reilly, *supra* note 72; Hsu, *supra* note 68; Hsu & Ziedonis, *supra* note 68; Hoenig & Henkel, *supra* note 71; Kaplan & Strömberg, *supra* note **Error! Bookmark not defined.**

80. Baum & Silverman, *supra* note 66.

support.

B. Patents as Signals in Venture Debts

Venture debts are loans provided by lenders to startups that have already received VC funding rounds.⁸¹ These lenders are typically non-banks and therefore they are not subject to banking regulations.⁸² With respect to venture debts, several scholars have asserted that patents are strong indicators for both venture debt lenders and banks to rely on in providing debt financing to companies.⁸³

These scholars have demonstrated through surveys of samples of mostly non-bank lenders that the presence of VC-backed capital funding serves as a substitute for cash flows and patents for tangible collateral in these lenders' decision in the early stages of the startup.⁸⁴ The scholars noted venture lenders demand warrants and credit spread as part of the pricing for the debts, in addition to taking a security interest in the startup's patents.⁸⁵ Additionally, some scholars have indicated that average venture lenders require 13.58 percent warrants and an eight percent credit spread.⁸⁶ These are considerably higher rates for a much higher risk pool than what banks in IP Venture Banking are targeting.⁸⁷ Moreover, the scholars' emphasized

81. See Patrick Gordan, *Venture Debt: A Capital Idea for Startups*, KAUFMAN FELLOWS PRESS, https://www.kauffmanfellows.org/journal_posts/venture-debt-a-capital-idea-for-startups/ [<https://perma.cc/HJ4W-DP5K>] (“Venture debt is a form of debt financing for venture equity-backed companies that lack the assets or cash flow for traditional debt financing, or that want greater flexibility. . . venture debt is generally structured as a three-year term loan (or series of loans).”).

82. Venture debt lenders are “private limited liability partnerships funded by pension funds, institutional investors, and private investors”. Samuel A. Waxman & Jordan L. Goldman, *Venture Debt: An Attractive Tool for Startup Companies*, PAUL HASTINGS (Feb. 2, 1027), <https://www.paulhastings.com/publications-items/details/?id=226eeb69-2334-6428-811c-ff00004cbded> [<https://perma.cc/MVT8-A2YF>] (Feb. 02, 2017). On the other hand, banks operate in “universally a regulated industry”. Takayuki Usui, *Corporate Governance of Banking Organizations in the United States and in Japan*, 28 DEL. J. CORP. L. 563, 564 (2003) (“The importance of banks to national economies is underscored by the fact that banking is virtually universally a regulated industry and that banks have access to government safety nets.”).

83. Darian M. Ibrahim, *Debt as Venture Capital*, 2010 U. ILL. L. REV. 1169 (2010); Hoenen, Kolympiris, Schoenmakers, and Kalaitzandonakes, *supra* note 68; Hochberg, Serrano, and Ziedonis, *supra* note 73; deRassenfosse & Fischer, *supra* note 73; Hesse, Lutz, and Talmor, *supra* note 73.

84. See generally Ibrahim, *supra* note 83.

85. Hesse, Lutz, and Talmor, *supra* note 73; deRassenfosse & Fischer, *supra* note 73; Ronald J. Mann, *Secured Credit and Software Financing*, 85 CORNELL L. REV. 134 (1999); Ibrahim, *supra* note 83.

86. Hesse, Lutz, and Talmor, *supra* note 73.

87. See Part I (B), *supra*.

patents as collateral are the key driver of the venture debts.⁸⁸ Some have even suggested that the only limitation in venture debts is patent valuation, as the methodology for patent valuation is still too expensive.⁸⁹

Overall, several scholars indicated that venture lenders (mostly non-banks mixed with banks) should use the presence of VC-backed Series A as a signal of quality.⁹⁰ In parallel, studies have demonstrated that startups backed by leading VCs tend to secure prestigious investment banks to syndicate their IPOs.⁹¹ Such startups reach IPO faster and earn greater valuations at IPO compared to startup without connection to leading VCs.

Existing studies on patents as signals in venture debts, though helpful, do not address what we are dealing with here: in the context of bank lending to startups, what are the credible signals? We assert that the presence of VC-backed funding in Series A, implicit promises to fund Series B, and patents are not credible signals for banks. These signals cannot serve as indicators for banks to ascertain the likelihood that the startup will obtain additional VC funding in the banks' decisions to lend to startups. Banks need better signals, and we turn first to the background on signaling equilibrium theory and model.

IV. BACKGROUND ON SIGNALING EQUILIBRIUM MODEL THEORY

The seminal work on information signaling by Michael Spence, who shared the Nobel Prize with Joseph Stiglitz and George Akerloff, paves the way for new understanding on solving informational asymmetry.⁹² Professor John Riley has elegantly summarized Spence's work:

Spence suggested that difficulties in observing human traits correlated

88. See generally Ibrahim, *supra* note 83; Yael Hochberg, Carlos J. Serrano, and Rosemarie Ziedonis, Intangible but Bankable, 348 SCIENCE 1202 (2015).

89. *Id.*; deRassenfosse & Fischer, *supra* note 73.

90. deRassenfosse & Fischer, *supra* note 73; Ibrahim, *supra* note 83; R. J. Mann, *supra* note 85; Paul Gompers & Josh Lerner, *The Venture Capital Revolution*, 15 THE JOURNAL OF ECONOMIC PERSPECTIVES 145-68 (2001); Mitchell A. Petersen & Raghuram G. Rajan, *The Benefits of Lending Relationships: Evidence from Small Business Data*, 49 THE JOURNAL OF FINANCE 3-37 (1994); Scott Shane & Daniel Cable, *Network Ties, Reputation, and the Financing of New Ventures*, 48 MANAGEMENT SCIENCE 364-81 (2002).

91. See Stuart, Hoang, and Hybels, *supra* note 77; Mann, *supra* note 85; Ibrahim, *supra* note 83.

92. See generally Michael Spence, *Job Market Signaling*, 87 Q. J. ECON. 355 (1973) (outlining the signaling model and some of its conclusions by analyzing markets in which signaling takes place and in which the primary signalers are relatively numerous). Spence later defined job market signals "activities or attributes of individuals in a market which, by design or accident, alter the beliefs of, or convey information to, other individuals in the market." Michael Spence, *Market Signaling: Informational Transfer in Hiring and Related Screening Processes I* (1974).

with labor productivity, and in monitoring productivity, would result in an equilibrium where wage offers were based on the educational credentials of the job seeker. That is, firms would use education as a screening device to sift out workers of lower productivity. As Spence emphasized, a crucial precondition for such an equilibrium is that those with greater productivity are also faster learners in school and hence have lower opportunity costs. Given this assumption, higher productivity individuals, facing wage offers contingent upon educational performance, find it in their interest to accumulate higher credentials, and thereby provide a signal to potential employers.⁹³

Spence created a mathematical model to illustrate how signals can reliably convey no verifiable information between parties based on their conduct or commitments.⁹⁴ The model assumes that there are two types of job applicants — the high-productivity or “good” type and the low-productivity or “bad” type — and that employers prefer high-productivity types and will pay higher salaries to them, and that all job applicants desire higher salaries.⁹⁵ To secure the higher salary job, the applicants want prospective employers to think that they are indeed the good types.⁹⁶ The truly good types must convey reliable signals indicating they are good types while the prospective employers must find a reliable way to separate good from bad types.⁹⁷ The Spence model illustrates that higher education credential functions as a truth-telling signal, separating applicant’s types in a job market.⁹⁸

The Spence model also assumes that education is costly, that is, obtaining an education requires substantial investment.⁹⁹ In addition, the costs for education are differential: high for low-productivity applicant but low for high-productivity applicant.¹⁰⁰ Due to the differential costs of obtaining education, a high-productivity applicant invests in securing the education, but not a low-productivity applicant (the cost is greater for the low-productivity applicant to obtain the education so the applicant rationally does not want to invest in having the education).¹⁰¹ In addition, prospective employers believe that the education correlates with high productivity, and thus they want to hire the applicant with the education.¹⁰² Consequently, the

93. John G. Riley, *Information Equilibrium*, 47 *ECONOMETRICA* 331, 331 (1979).

94. Spence, *supra* note 92.

95. *Id.* at 356-68.

96. *Id.*

97. *Id.*

98. *Id.* at 361-68.

99. *Id.* at 358.

100. *Id.* at 362.

101. *Id.*

102. *Id.*

applicant with the education receives higher salary, enjoying the benefits over the costs of investment in obtaining the education.

Spence showed that a signaling equilibrium can occur when the high productivity applicant type effectively signals to the prospective employer information about the true quality of the applicant type that the low productivity applicant cannot duplicate.¹⁰³ Spence's job marketing signaling model can be separating, semi-pooling, or pooling equilibria, depending on what market conditions are present.¹⁰⁴

Formally, in game theory relating to the issues of reputation from an incomplete information and the signaling games, a pooling equilibrium means "an equilibrium in which all types of sender send the same message."¹⁰⁵ A separating equilibrium is "an equilibrium in which all types of sender send different messages."¹⁰⁶ A semi-pooling or partial separating equilibrium means "an equilibrium in which some types of sender send the same message, while some others send some other messages."¹⁰⁷

Scholars have applied Spence's signaling model in many areas.¹⁰⁸ For example, Stiglitz developed a signaling model to demonstrate that payment of dividends is a credible signal of profitability to uninformed investors in investment decisions.¹⁰⁹ Because uninformed investors cannot separate good investments from bad investments and cannot confirm which firms indeed earn profits while all firms claim high-profit. Paying high dividends will cost the truly high-profit company less but cost the low-profit company more. A low-profit company cannot afford and does not want to pay the high cost of paying high dividends. Therefore, paying dividends is a creditable signal, effectively communicating to uninformed investors that the company is indeed a high-profit one.¹¹⁰

103. *Id.* at 361-68.

104. *See id.* (explaining when there are different market conditions for education as a signal in job market, different equilibria occur).

105. Muhamet Yildiz, *14.12 Game Theory Lecture Notes Reputation and Signaling*, 8 http://web.mit.edu/14.12/www/02F_lecture_rep.pdf [<https://perma.cc/UP8M-RYRC>].

106. *Id.*

107. *Id.*

108. *See generally* Russell D. Covey, *Signaling and Plea Bargaining's Innocence Problem*, 66 WASH. & LEE L. REV. 73, (2009) 97-103 (summarizing the wide application of Spence's signaling mechanism).

109. *See* Joseph E. Stiglitz, *Information and Capital Markets*, FINANCIAL ECONOMICS: ESSAYS IN HONOR OF PAUL COOTNER 96 (Cathryn M. Cootner, Paul H. Cootner & William F. Sharpe eds., 1982) (noting that uninformed investors view payment of dividend as a sign that the company is making profit).

110. Likewise, others demonstrate on how warranties can function as a signal of quality. Sanford J. Grossman, *The Informational Role of Warranties and Private Disclosure About Product Quality*, J.L. & ECON. 461 (1981); George L. Priest, *A Theory of the Consumer Product Warranty*, 90 YALE L.J. 1297 (1981).

V. MODELING CREDITABLE SIGNAL IN VENTURE LENDING BY BANKS

Building on Spence and others' works and insights from IP Venture Banking, we create our model. The model illustrates that an entrepreneur's costly efforts above and beyond essential fundraising, are credible signals for banks to rely on in differentiating startups for venture loans.¹¹¹

We note that some scholars have demonstrated that patent filing as signals because patents require a costly effort (or differential costs), that it costs less for higher quality startups and more for lower quality startups.¹¹² Meeting Spence model requirements for a separating equilibrium,¹¹³ the scholars constructed a full model of the separating equilibrium. Accordingly, patent filing can be a credible, truth-telling, costly effort signal that is able to inform VCs to fund Series A to the startups.

Patent filing, however, is not reliable signal for banks in lending decision to startups that have already received VC funding. Banks need to have certainty of whether its loan will get paid by the startup due to statutory and regulatory constraints in banking. The only way that the startup can pay back the bank loan is when the startup receives an infusion of cash. That cash infusion can only occur when the startup obtains additional rounds of capital from VCs.¹¹⁴

We now explain our model of entrepreneur's costly efforts partial separating signal in details. Please consult our proofs in the appendix.¹¹⁵

A. Objective of the Bank

It is important to take a moment and step back to look at the overall

111. In more technical terms, we assert that the information asymmetry problem related to bank lending to startups in the innovation economy sectors can be addressed through a partial separating equilibrium created by a credible, truth-telling, costly effort signal indicating the current health and outlook of a potential startup client.

112. See generally Conti, Thursby, & Rothaermel, *supra* note 68; Conti, Thursby, & Thursby, *supra* note 68; Long, *supra* note 68. These models met Spence's requirements. Michael Spence, *Competitive and Optimal Responses to Signals: An Analysis of Efficiency and Distribution*, 87 JOURNAL OF ECONOMIC THEORY 296-332 (1974) (showing that patent filing can be interpreted as signals).

113. *Id.*

114. See generally Jay Acunzo, *What Is Venture Debt and How Should Startups Use It?*, NEXTVIEW, (April 30, 2015) (demonstrating that cash injection from VC is required for startup to pay back bank debt), <https://nextviewventures.com/blog/what-is-venture-debt/> [<https://perma.cc/G2GH-A84N>].

115. The appendix is on file with the Authors.

objective here. Banks seek to identify and lend to value. A bank's reward is repayment of the principal plus interest costs plus a risk premium – which includes the potential profits or losses reflecting the quality of the bank's decision tools and the alternative sources of capital that its clients have.¹¹⁶ The low cost of capital gives banks the competitive advantage.¹¹⁷ Regulations and restrictions on the risk can disadvantage banks, although these regulations also facilitate the low cost of capital.¹¹⁸

Banks, in deciding whether to extend relatively low-cost venture loans to startups, cannot tolerate the risk levels of higher-cost that non-bank lenders can withstand.¹¹⁹ Banks need to identify and only extend credit to the higher quality and higher value startup clients.¹²⁰

B. Value Identification

Banks that limit themselves to traditional lending practices understand that startups do not have established brick and mortar assets, inventory, or cash flow.¹²¹ As noted, many scholars have emphasized the intellectual property assets held by startups and recommended taking security interests

116. The risk premium benefits for venture banks are the inclusion of warrants in the pricing of the loan. Ridgley, *supra* note **Error! Bookmark not defined.** (“Venture debt is markedly riskier when compared to cash flow lending. Addressing these risks strictly by charging an appropriate risk-adjusted interest rate would consume too much of a young company’s precious cash to make sense. Warrant pricing seeks to true up the risk/return associated with venture debt while keeping debt payments manageable. Warrant pricing reduces the cash cost of repaying the loan and provides potential upside for the lender.”).

117. Non-banks provide venture debts at higher prices compared to banks. Weyer, *supra* note **Error! Bookmark not defined.** (stating that nonbanks charge “a higher overall cost of capital” with “interest rates over 10%, upfront fees over 1%, and warrants over 5%”, and banks charge a lower overall cost of capital with “interest rates at 4%-8%, upfront fees at 0.25%-0.50% and warrants at 3%-5%”).

118. Ridgley, *supra* note **Error! Bookmark not defined.** (“Banks use deposits to fund their lending activities. In exchange for access to this relatively cheap source of funds, banks are heavily regulated in terms of the types of lending and the amount of risk they can take. Debts funds, like venture capital firms, use equity invested by their shareholders or limited partners to fund lending activity. This source of capital is subject to much less regulation, but the cost is much higher.”).

119. *Id.*; Weyer, *supra* note **Error! Bookmark not defined.** (noting that while nonbanks do not require financial covenants, venture banks require financial covenants of “minimum revenue at 75% plan, maximum net loss at 125% plan or minimum equity raise by a certain date”).

120. Ridgley, *supra* note **Error! Bookmark not defined.** (“Venture debt emphasizes the borrower’s ability to raise additional capital to fund growth and repay the debt.”).

121. George W. Dent, Jr., *Venture Capital and the Future of Corporate Finance*, 70 WASH. U. L.Q. 1029, 1032-34 (1992) (“Loans are unavailable to most start-up and growth companies because of the high risk of loss Moreover, few start-up companies generate sufficient cash flow to service high interest charges. For these companies, such a loan would rapidly lead to insolvency.”).

in patents and other IP.¹²² However, we are proposing that the value of the startup is not limited to discrete patents. Rather, the intellectual property value of the startup is tied to the realization of the enterprise value of its IP through the implementation of an ongoing viable business.¹²³ Banks enjoy this value in the form of demanding warrants in the pricing of the venture loan.¹²⁴ Banks extend the venture loans to startups based on the startup's enterprise value. For a startup between Series A and Series B rounds of funding, the Series A round has already assessed the enterprise value. Here is an illustration:

If a Series A round of \$10 million provides the new investor with 20 percent ownership (on a fully diluted basis), then the stake held by the existing shareholders is valued at \$50 million. Assume the company has a monthly cash burn of \$1 million, meaning the Series A proceeds provide a 10-month runway. A venture debt loan of \$3 million in this scenario might require warrants with dilution equivalent to 25-50 basis points (fully diluted). In this example, the venture debt would extend the operating runway by another three months. The venture debt loan provides roughly 30 percent additional runway but carries only 1/40th the dilution, even with a 50-bps warrant in the pricing.¹²⁵

To minimize their exposure, banks are primarily interested in lending to startups between VC rounds.¹²⁶ Thus, we focus on startups between Series A and Series B rounds where the enterprise value is determined by the prior and next rounds of funding. This analysis is also applicable to other later funding rounds as well as late growth companies wishing to expand into newly identified markets, since the enterprise value also depends on the last

122. See generally Ibrahim, *supra* note 83; Hochberg, Serrano and Ziedonis, *Intangible but Bankable*, 348 SCIENCE 1202 (2015).

123. See *supra* Part I (B) (discussing warrants). See also SVB presentation on file with the authors.

124. See *supra* Part I (B).

125. Ridgley, *supra* note **Error! Bookmark not defined.**, Ridgley, *supra* note **Error! Bookmark not defined.**, and Anderson, *supra* note **Error! Bookmark not defined.** (noting that venture debt is 20-35% of the most recent equity round and provides an additional three to nine months of runway.).

126. Jay Acunzo, *What is Venture Debt and How Should Startups Use It?* NEXT VIEW VENTURES: VENTURE DEBT 101 (Apr. 30, 2015), <https://nextviewventures.com/blog/what-is-venture-debt/>. Glen Mello's explanation of why venture loans occur between VC rounds is instructive: "[I]t often happens when a company is fresh off of an equity raise, usually within three or four months. The reason it happens this way is that, again, there's a buy-in from all the parties. . . . For the investors, there's a plan they just invested in. For the founding team, there's a strategy in place. And then the question becomes, 'How do I complement the capital I just raised, either to buy more time in case I slip or to accelerate my spending if t?'" Venture debt gives you those options, and particularly for companies that wind up doing well, then on your same cash-out date, you'd likely have achieved a better milestone thanks to fueling you spend, which would translate into a better valuation." *Id.*

and next rounds of VC funding or a valuation event.¹²⁷

Therefore, since it is the next round that will pay the bank, the bank must rely on signals to determine the likelihood that the startup will be able to obtain additional future rounds of VC funding in deciding whether to lend to the startup.

C. Signals

In venture lending, the bank will assess data for variables that correlate strongly with the most desirable outcome: a successful startup reaching a realized valuation as a high return acquisition or initial public offering.¹²⁸ When making a lending decision to a startup that just received Series A funding, the bank faces the question of “Is this a higher or lower quality startup?”

The key determinant is Series B venture funding. Without it, the startup will plunge off the cash-burn runway into liquidation. If there is a VC firm or, even better, two VC firms, one *inside* VC and one *outside* VC, interested in funding Series B, this will be highly correlated with the success of Series B and the continuation of the startup towards realized valuation.¹²⁹ Two VCs can examine and determine the enterprise business fundamentals and execution to be investment worthy. Furthermore, two VCs are likely to increase funds to the startup as well as enhance contacts, expertise, and guidance.¹³⁰

127. The venture loan amounts change significantly between early stage, expansion stage, and late stage: “For early stage companies (i.e., pre-revenue, Series A-B), lenders will typically commit 25%-50% of debt relative to the last round of equity (e.g., \$1,000,000-\$2,000,000 of debt for a Company that recently raised a \$4,000,000 Series A). Expansion stage companies (i.e., post-revenue, Series C-D) may be able to obtain upwards of \$7,500,000 of debt. Later stage companies (i.e., early profitability, Series E+) typically garner as much debt as collateral coverage or cash flow can support (similar to middle market lending, but venture lenders generally provide it sooner than others).”

Weyer, *supra* note **Error! Bookmark not defined.** Likewise, the loan terms differ based on the company stage, as expectations of what the company must achieve as it matures change. See Ridgley, *supra* note **Error! Bookmark not defined.**

128. The ultimate prize of the loan pricing is for the bank to cash in on the warrant when the firm reaches IPO. See *supra* Part I (B). Having a lion’s share of clients reaching IPO is a bragging right for outlier banks in venture banking. See *Get to Know Us*, SILICON VALLEY BANK, <https://www.svb.com/newsroom/facts-at-a-glance/> [<https://perma.cc/H6VW-5E2J>] (last visited Sept. 25, 2018).

129. Ridgley, *supra* note **Error! Bookmark not defined.** (noting that the leading bank in IP Venture Banking states that they focus “on the probability and the capacity of the existing ‘inside’ investors to independently close one or more follow-on rounds, should the company prove unable to attract a new ‘outside’ investors.”).

130. See, e.g., Mira Ganor, *Improving the Legal Environment for Start-Up Financing By Rationalizing Rule 144*, 33 WM. MITCHELL L. REV. 1447, 1448 (2007) (noting that VCs

Can banks trust the VCs for reliable signal? One scholar has argued that once the VC round of funding occurs, venture loan will soon follow because VCs make an implicit promise to repay the loan with the present and future investments.¹³¹ Contrary to the scholar's assertion, the durability of any implicit promise is tenuous because VCs continually update their funding evaluation based on new performance information about the startup.¹³² Due to the high rate of failure in between each VC round, there is a high probability that the VC's evaluation of the startup will change. This change is indistinguishable from untruthful behavior, and there is no legal contract guaranteeing this implicit promise. For all these reasons, the implicit promise is akin to cheap talk.¹³³ In other words, using reputation in

mentor and monitor their portfolio companies, offer assistance and provide access to expertise).

131. See Ibrahim, *supra* note 83, at 1184.

132. For example, not all startups with Series A funding advance to Series B. Only half makes it to Series B. That means VCs abandon their investments when the startups fail to meet expectations. In fact, Series B is “the most challenging” stage for startups to survive to Series B. See Tomasz Tunguz, *The Challenges of Raising Your Series B*, <http://tomtunguz.com/challenges-of-the-series-b/> [<https://perma.cc/VC8H-C6M3>] (May 14, 2018); Maddy Suresh, *Series B Funding—Why Raising It Is Difficult?*, THE TECH BULLETIN, (Dec. 28, 2015), <https://www.thetechbulletin.com/series-b-33488/> [<https://perma.cc/4LHM-53ES>]. Likewise, Fred Destin explains why Series B is the hardest for startups to advance: “When you to go raise your Series B, you’ve driven burn up as you needed to fully staff engineering (these damned “enterprise” features. . .), start hiring a commercial team that takes its time scaling, get a few hires wrong usually to top it off and have hired a full layer of VP’s to show that you have the basis for scale. This makes the company particularly fragile. Your revenue numbers are low, you’re dripping a ton of red ink and show a plan reliant on achieving serious revenue progress right when you’re about to run low on cash. There are no excuses for not having a rock solid execution plan, because that’s usually all you have. . . . Series B is usually that painful phase when you are “Building” team and product (i.e. spending a lot of money industrializing your company) but are still quite a ways away from Scale. So there you have it: a tough risk profile, a tough financial plan, and a lukewarm funding market. Series B in my experience truly separates the boys from the men in terms of fundraising ability.”

Fred Destin, *Why Series B is Usually the Hardest*, (Mar. 31, 2014), <http://freddestin.com/2014/03/raising-series-hardest.html> [<https://perma.cc/6LDQ-SG6A>]. Moreover, firms with Series B funding don’t automatically receive Series C funding. See Sonya Mann, *Series C and Beyond: How Growth Investing Is Different*, MATTERMARK, (Dec. 8, 2016), <https://mattermark.com/series-c-versus-series-growth-investing-different/> [<https://perma.cc/72H2-Y6J2>]. “Investment firms don’t compose their investment portfolios at random; they will keenly scrutinize a startup’s progress and evaluate its future chances. Every step on the venture capital ladder has different requirements. . . . To get an investor to write you a Series A check, you need a solid product. To make it to Series B, the company will have to display real traction. To survive to their C round, a solid business is required. Later rounds of capital need all of the above, plus flourishing metrics.”

133. Talk is cheap and cannot be a signaling device. Low-quality sellers can always brag that “my product is the best” and that talking signal is not credible. Credible signal is costly and low-quality sellers cannot easily replicate. See generally George A. Akerlof, *The Market for “Lemons”: Quality Uncertainty and the Market Mechanism*, 84 Q. J. ECON. 488 (1970)

soliciting truthfulness is not reliable when about half the startups are expected to fail.

In this case, even if there are two VCs considering participation in Series B funding, an *insider* and an *outsider*, their response to questions about the likelihood of participating in Series B may well change if this is the criterion used by the bank to extend a loan. Unfortunately, because *inside* VCs are already a part owner in the startup, they have an incentive to encourage the loan. As the success of the startup, and thus the success of the *inside* VC's ownership stake, is contingent on the startup receiving additional funds, the VC has an incentive to encourage the bank's lending, regardless of the VC's assessment of the company. Likewise, the *outside* VCs are considering ownership in the high-risk startup. To the extent that their risk can be reduced when time reveals more information about the success or failure of the startup, the *outside* VC has an incentive to encourage the venture bank loan to extend the time on the cash burn runway, allowing for a later, more informed start of Series B funding. Again, the VC's talk is cheap.

The above scenarios demonstrate that if endogenous variables determined by the actions in an environment suddenly become linked to a decision that significantly changes the rewards for the participants in that environment, the variables' actions may also change as their incentives change. Thus, finding a variable that correlates with success is insufficient to identify a valid signal that can be used for decisions without potentially distorting the validity of a signal. The interactive structure of the market will distort the informational content, if any, of the potential signal.¹³⁴ There is no veracity in a cheap talk weak signal.

The lack of veracity in the signal does not mean that the success of the startup is not strongly correlated with having two VCs interested in participating in Series B funding. It might just be that this is the wrong signal for an event that still contains valuable information.

Consider the origin of this correlated factor – how do two VCs become interested in Series B funding? Clearly, the VCs' interest stems from the characteristics of the startup and the actions of the entrepreneur and employees of the startup, which can be broken into two actions by the entrepreneur. The first necessary action for the continuation of any startup is to obtain at least one source of funding for the next Series B funding. Without this funding, any startup on the cash burn runway would end. The second decision will be either to continue expending resources on additional fundraising even though the runway is well stocked or to allocate more

(exploring the various ways that consumers judge quality).

134. Spence, *supra* note 112.

resources to development.

D. First Implicit VC Commitment to Series B

With respect to Series B funding, some startups will be better at fundraising, and an important factor correlating with the ease of fundraising will be the quality of the intellectual property enterprise value they are selling. However, some startups may have rich *inside* VCs whose capacity can fund both Series A and Series B.¹³⁵ Because they are on the startup's Board and continually monitoring and mentoring the startup to protect their Series A investment, these *inside* VCs are the most knowledgeable and most susceptible to fundraising if the VCs still have the capacity. Not all startups will be in this favorable position. Thus, despite the negative correlation between fundraising ability and quality of the startup, the effort required for fundraising the first VCs' commitment to Series B funding will be quite variable and will be related to the circumstances of the VCs and not just related to the quality of the startup. *Inside* VC fundraising will generally be easier, while *outside* VC fundraising will generally be harder.¹³⁶

E. Second Implicit VC Commitment to Series B

A second VC commitment to Series B funding is originated by the startup making an allocation of resource decisions. All startups are extremely resource constrained and will need to make strategic decisions about the allocation of resources and expenditure on their remaining cash runway.

The choice is between continuing to expend resources on additional fundraising or to invest these resources elsewhere in the company. The startup must decide whether to gain a second VC commitment to Series B funding, even though the runway is well-stocked. For high-quality startups, this fundraising will take less effort than for low-quality startups. The

135. See Ridgley, *supra* note **Error! Bookmark not defined.** (stating that banks in venture lending “focus their underwriting on the probability and the capacity of the existing ‘inside’ investors to independently close one or more follow-on rounds, should the company prove unable to attract a new ‘outside’ investors.”).

136. Acunzo, *supra* note 114. For the venture banks, their typical process for a venture loan emphasizes the probability that a company will attract outside VCs: “We’ll also dig into the model, dig into the product, dig into their go-to-market, and really try to understand and evaluate the milestones associated with getting to their next round of funding. These are value-creation milestones. We’re essentially looking to understand the probability of a company attracting more outside capital. If they can’t, then we want to know more about the existing investor syndicate, so we’re not the only ones at the table.”

alternative is to allocate more resources to development. Allocating additional resources to development could provide more assurance of meeting the next development milestone (a condition that must be met in order to receive the next series of funding).

This is precisely the choice of action and costly signal, with signaling cost negatively correlated with the desired quality, which is described by Spence where there exists a family of separating equilibria reward (wage) functions.¹³⁷ This family of equilibria defines partial separating equilibria. Let us further examine the choice of low- and high-quality startups.

F. Low Quality Startups

Lower quality startups will be in need of development results. Thus, they will value the benefits of development. Fundraising efforts will require more resources for a low-quality startup, as VCs are attracted to and knowledgeable of how to use due diligence to distinguish higher quality from lower quality startups.¹³⁸

Low-quality startups will need to devote more time to developing business fundamentals. In order to maintain the implicit VC's commitment to Series B funding that the startup has already secured, the startup must meet the business and development milestones.¹³⁹ Misallocating would hasten liquidation.¹⁴⁰ There is little benefit to a second commitment if it jeopardizes the continuation of the startup.

G. High Quality Startups

Higher quality startups will be able to meet milestone deadlines. The more attractive and higher quality the startup, the easier it will be to attract VCs. Thus, the fundraising will require less costly effort for higher quality startups. Gaining more VCs' interest and commitment early for Series B is about investing in the future of the company before it is necessary to do so. The startup will benefit from having a more assured, diverse VC funding base with additional funds as well as the benefits from unlocking access to a venture loan from banks.

137. *Id.*; Spence, *supra* note 112.

138. See Andrew A. Schwartz, *The Digital Shareholder*, 100 MINN. L. REV. 609, 644 (2015) (stating that geographic proximity enhances VCs' ability to conduct due diligence and respond to uncertainty in monitoring their investments in startups).

139. Ibrahim, *supra* note 83, at 1184.

140. *Id.*

H. Separating

As in Spence's job market signaling papers, the above decision process by startups meets the incentive compatibility constraints where the optimal behaviors for high and low-quality startups are different.¹⁴¹ Further, the signal is incentive compatible and elicits truth-telling; each type – high and low – prefers the outcome where they signal their own type. Therefore, they would not benefit from imitating the other type.

Can a bank use this as a loan decision signal? Although using a signal will alter the behavior generating the signal, it is precisely this type of costly effort signal with signaling cost that is negatively correlated with the desired quality which is described by Spence, where there exists a family of separating equilibria reward (wage) functions.¹⁴² This discrete family of equilibria also composes partial separating equilibria of continuous abilities. The existing VC startup's interaction is one of the members of this family of separating equilibria. Adding the additional rewards of a potential venture bank loan will change the participants' behavior. However, as there is a family of separating equilibria functions, the bank will attempt to add this reward of a loan in a way that still results in maintaining a partial separating equilibrium. The nature of the new incentive structure with the addition of the bank loan (that is not too large) will slightly shift the equilibria quality cutoff between what determines which startups join the high-quality and the low-quality pools.

There will be some nuances to verify that a second funding commitment for Series B funding and the effort behind it is not a disguised effort to find a primary commitment for Series B funding, but there are distinguishing features. The bank can request and evaluate information about the startup's efforts to gain funding from both the entrepreneur and VCs. Depending on the quality of the VC firms that the entrepreneurs give their sales pitch to, there is an expectation that the higher quality startups need less effort to obtain a sale at each quality level of VC firms. If there is a long hard process to obtain an outside commitment from a lower level VC firm, an existing *inside* investor commitment may not be very credible.

Additionally, successfully obtaining an outside commitment from a top-ranking VC firm may be a very strong indicator of quality. Even if the inside VCs are unable to make commitments as they reach the end of their current funds, their decline is not due to the startup's quality. Ultimately, this costly entrepreneur's effort separating signal will be the strongest, most recent information the bank will be able to obtain without exerting a too

141. *Id.*; Spence, *supra* note 112.

142. Spence, *supra* note 112.

costly, more exhaustive due diligence investigation.¹⁴³

VI. BEYOND THEORY: EVIDENCE FROM OUTLIER BANKS IN IP VENTURE LENDING

Our signaling model does not reside in the theoretical realm. Concrete evidence supporting the model is available. Outlier banks have been providing capital to startups in the form of venture loans. With the lower cost loans, the startup continues its growth acceleration before its next round of capital funding from VCs. The outlier banks reap the benefits of the startup's next round of VC funding: having the loan repaid, collecting interest payments, and cashing in on the warrant based on the upswing valuation of the startup's enterprise.¹⁴⁴ The leaders among outlier banks include Silicon Valley Bank (SVB), Square 1 Bank, and CommericA.¹⁴⁵

As one of the top commercial banks in the United States, SVB has long separated itself from the traditional banking practices.¹⁴⁶ SVB has strategically rooted its branches in all technologically innovative centers across the United States.¹⁴⁷ Since its inception in 1983, SVB has been providing loans to more than 30,000 startups. The Bank boldly dedicates six percent of its loan portfolio to startups.¹⁴⁸ Its success in IP Venture lending is the envy among outlier banks. SVB counts fifty percent of all VC-backed companies in the tech and life sciences as clients in its lending portfolio.¹⁴⁹ Also, it counts fifty percent of all U.S. VC-backed with an IPO in 2017 as clients.¹⁵⁰ The bank currently has fifty-one billion dollars in assets, extends twenty-three billion dollars in loans to high-growth companies, and takes \$105 billion in deposits and investments.¹⁵¹

Contrary to academic literature espousing the important role of patents

143. Our proofs support our model illustrating that the entrepreneur's costly efforts beyond the necessary fundraising all startups must do are credible signals for banks to rely on in screening startups for the IP Venture loans. A copy of our proofs is on file with the Authors.

144. See Acunzo, *supra* note 114 (reporting on Silicon Valley Bank's venture debt business model).

145. See *supra* note **Error! Bookmark not defined.**

146. See generally *Silicon Valley Bank Oral History Panel Robert "Bob" Medearis and Roger Smith*, COMPUTER HISTORY MUSEUM CHM REFERENCE NO. X7274.2015, (Nov. 11, 2014) (discussing the origins of SVB as having a unique technology focus) (a copy of the transcription is on file with the authors).

147. See Reckard, *supra* note **Error! Bookmark not defined.** (reporting that SVB has offices in twenty-seven technology centers in the United States, in addition to offices in London, Beijing, Shanghai and Herzliya Pituach, a neighborhood near Tel Aviv).

148. *Facts at a Glance*, *supra* note **Error! Bookmark not defined.**

149. *Id.*

150. *Id.*

151. *Id.*

as collateral in venture debt, SVB's clients have very few patents. For example, SVB has recorded only 626 total patents as collateral with the USPTO for all deals with IP assets in 2016.¹⁵² That modest total patents number represents seventy-one deals, yielding a ratio of 8.8 patents for each deal.¹⁵³ That means SVB's clients are mostly startups or high growth companies, and these companies are not the established, mature corporations with large patent portfolios. Most importantly, SVB does not require valuation of the client's intellectual property assets. Again, this unorthodox practice is contrary to the assertion that valuation of patent and valuation methodology are necessary for banking on patents.¹⁵⁴

While SVB does not require valuation of the startup's intellectual property assets, the Bank pays more attention to the intellectual property as a key driver of the enterprise value.¹⁵⁵ That means the Bank will conduct due diligence and leverage its knowledge about the startup and its relationship with VCs to determine whether the Bank is likely to reap the benefits of the startup's enterprise value when the startup exits through subsequent acquisition or IPO.¹⁵⁶ The Bank wants to seize the right to purchase equity in the startup at the time it makes loans to the startup, so it can later cash in on the warrant to purchase the startup's stock.¹⁵⁷ In other words, the Bank understands that the startup's intellectual property assets alone are not that valuable but as the key drivers of the startup's enterprise value, are worth much more when there are later rounds of VC funding, acquisition, or IPO.¹⁵⁸

152. USPTO patent collateral filing data is on file with the authors.

153. *Id.*

154. See generally deRassenfosse & T.Fischer, *supra* note 73 (arguing that providing patents as collateral is as important as providing tangible assets to lenders); Yael Hochberg, Carlos J. Serrano, and Rosemarie Ziedonis, *Intangible but Bankable*, 348 *SCIENCE* 1202 (2015) (discussing the active market for intangibles such as patents for venture lenders in certain sectors); Ibrahim, *supra* note 83 (finding that IP can function as a substitute for tangible collateral).

155. A copy of SVB's presentation is on file with the authors.

156. See Acunzo, *supra* note 114; Reckard, *supra* note **Error! Bookmark not defined.**

157. Examples of warrants issued by SVB's clients for the benefit of SVB are abundant. See *Warrant to Purchase Stock from Xoom Corporation issued to Silicon Valley Bank*, SEC, <https://www.sec.gov/Archives/edgar/data/1315657/000119312513010596/d364901dex45.htm> [<https://perma.cc/LHN7-CQVC>]; *Warrant to Purchase Stock from 3Pardata, Inc. issued to SVB for 53,187 shares at \$0.94 per share and June 30, 2015 as the expiration date*, <https://www.sec.gov/Archives/edgar/data/1408501/000119312507207554/dex1022.htm> [<https://perma.cc/AN7H-Y8QS>]; *Warrant to Purchase Stock from Alphatech Holdings, Inc. for 190,476 shares at \$1.89 per share and Dec. 5, 2018 as the expiration date*, <https://www.sec.gov/Archives/edgar/data/1350653/000119312509044992/dex43.htm> [<https://perma.cc/4W3Q-466V>].

158. Illustratively, SVB received the warrant to purchase stock issued by Xoom Corporation for 100,000 shares at \$1.71 per share, as part of the loan pricing to Xoom on April 30, 2012. Three years later, Paypal acquired Xoom at \$25 per share in cash in 2015. See Ryan Mac, *PayPal to Acquire Digital Money Transfer Company Xoom Before eBay Split*,

Illustratively, SVB received the warrant to purchase stock issued by Xoom Corporation, a digital payment services firm, for 100,000 shares at \$1.71 per share, as part of the loan pricing to Xoom on April 30, 2012.¹⁵⁹ At the time of the loan, Xoom had no patent issued in its name. The startup had filed only one patent application in 2009 and which was still pending in the USPTO.¹⁶⁰ Xoom obviously possessed other proprietary assets like trade secrets and copyrights related to its digital payment services. Three years later, Paypal acquired Xoom at \$25 per share in cash in 2015.¹⁶¹ SVB's warrant constituted a handsome return on the loan, in addition to the origination fee, interest and principal repayments.

Moreover, Silicon Valley Bank typically conducts the following in its venture lending to startups:¹⁶²

1. Understand that technology companies develop IP as key business operation, model, and strategy, and the IP is the primary driver of the enterprise value. The enterprise has identified unmet needs and utilizes the IP/innovation to meet them in very creative ways, leading to disrupting the existing sector/industry or creating a new one.

2. Conduct the typical bank's due diligence, including cash flow and collateral assessment, competitive landscape, barriers to entry, regulatory risk, revenue concentrations, operating performance, amount/structure of other debt, and overall financial health and ability to survive business disruption.

3. Understand and assess the entrepreneur's background and experience to gauge the likelihood of success. Understand investors' (VC's) expectations of enterprise milestones, IP development, revenue growth, and profits.

4. Know (form relationship, networking with) the players in the enterprise's industry, including VCs, tech executives, competitors, other entrepreneurs, and companies in the industry.

FORBES, (Jul. 1, 2015), <https://www.forbes.com/sites/ryanmac/2015/07/01/paypal-acquires-digital-money-transfer-company-xoom-before-ebay-split/#283a2bf82663> [<https://perma.cc/7KJG-KJH8>] (demonstrating how SVB's warrant constituted a handsome return on the loan).

159. See *Warrant to Purchase Stock Issued to Silicon Valley Bank*, *supra* note 157.

160. The application later matured to patent 8,688,550 granted on April 1, 2014.

161. Mac, *supra* note 158.

162. See Reckard, *supra* note **Error! Bookmark not defined.** (explaining how SVB is different from other banks in its relationship with startups and VCs, making SVB a "part lender, part consultant, part cheerleader and part investor", a "nursemaid to startups" and "banking the venture capitalists who fund them"); Acunzo, *supra* note 114 (reporting an interview with Glen Mello, Managing Director of Silicon Valley Bank Boston office and explaining SVB's venture lending business model); Ridgley, *supra* note **Error! Bookmark not defined.**; Weyer, *supra* note **Error! Bookmark not defined.** SVB Presentation on file with the authors.

5. Monitor the enterprise's IP development. Monitor commercialization/milestone achievement, including client growth, and product or service adoption, among others.

6. Assess the likelihood the company can obtain outside VC investment. Assess the probability and capacity of inside VCs to provide additional rounds, if the company cannot obtain outside VC funding.

7. Understand and assess IP's unique and defensible features that would attract potential purchasers in the event the bank must foreclose. Knowledge and relationship in #4 are also useful in liquidation.¹⁶³

8. Structure the loan deal, pricing, and warrant.

Overall, SVB's venture lending business activities, as described in items 1-8 above, is consistent with our partial separating equilibrium model. Our model indicates that the Bank should be observing the fundraising capability and behavior of the startup in determining the likelihood the startup would be able to obtain additional rounds of VC funding. Moreover, our model is also consistent with prior empirical studies showing that lending success is correlated with Series B venture capital funding.¹⁶⁴ We have expanded on this indicator by finding an incentive compatible costly effort truth telling signal in the fundraising efforts of startups.

Clearly, Silicon Valley Bank has beat its competitors for many years in its ability to discern and observe updated signal through its in-depth knowledge and relationship with venture capitalists, tech executives, entrepreneurs, clients, former clients, academics, researchers, and other players in innovation economy sectors.¹⁶⁵ We certainly do not expect the 6,000 banks to replicate Silicon Valley Bank. We do hope that some of the banks will.

CONCLUSION

Outlier banks operating in the inherently risky area of IP Venture Banking have developed lending practices to leverage the intellectual property as key drivers of enterprise value. Reaping the benefits of the enterprise value at later valuation events, the banks require warrants as part of the back-loaded loan pricing. Our signaling model with partial separating

163. An example of how SVB leveraged its relationship in liquidation is in the facts of *Sky Techs. LLC v. SAP AG*, 576 F.3d 1374, 1376-78 (Fed. Cir. 2009). *See also* Reckard, *supra* note 38 (discussing how SVB was able to recover on its security interest in the patents by selling its right to a third party who then foreclosed on the patents and sold the patents at public auction).

164. *See generally* Ibrahim, *supra* note 83.

165. *See* Facts at a Glance, *supra* note **Error! Bookmark not defined.**; *see also* Reckard, *supra* note **Error! Bookmark not defined.**; Acunzo, *supra* note 114.

equilibria demonstrates how the banks address information asymmetry problems by relying on a truth telling signal in assessing the likelihood the potential borrowers can obtain subsequent rounds of capital funding. Based on our model, perhaps some of the 6,000 banks would soon embrace lending to the innovation economy sectors and unlock patents and other intellectual property assets as key drivers of the enterprise value.