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The Importance of an Effective and Reliable Patent System to Investment in Critical Technologies

Agenda

1. Introduction to the study



2. The Study Results:

The data
The case studies



3. Key takeaways

Introduction to the Study

- How has venture capital investment in patent-intensive industries changed as U.S. patents has become less effective and reliable?
- Motivated by interest in specifying changes in investment patterns in patent-intensive industries that are difficult to discern due to large overall increases in venture capital investment.
- Methodology:
 - A policy study done with analytical and methodological rigor
 - Empirical data
 - Case studies

Thesis:

- As the patent system has changed, venture capital investment in patent-intensive industries has declined relative to venture capital investment in less patent-intensive industries
- Qualitative research – case studies of innovators and investors working in patent intensive industries – shows that they are highly sensitive to the effectiveness and reliability of patents

Challenges & Responses

Showing changes in investment patterns in a period when both investment and the economy grew dramatically.

- Examine relative share of investment in industries that rely on patents

Which industries are patent-intensive?

- Use USPTO definition
- Also use EUIPO definition (essentially the manufacturing industries) due to limitations in USPTO definition

Showing causation.

- Conduct case studies where key industry participants explain how their incentives, opportunities, and decisions have changed as the patent system has changed.

The Study Results

The Data

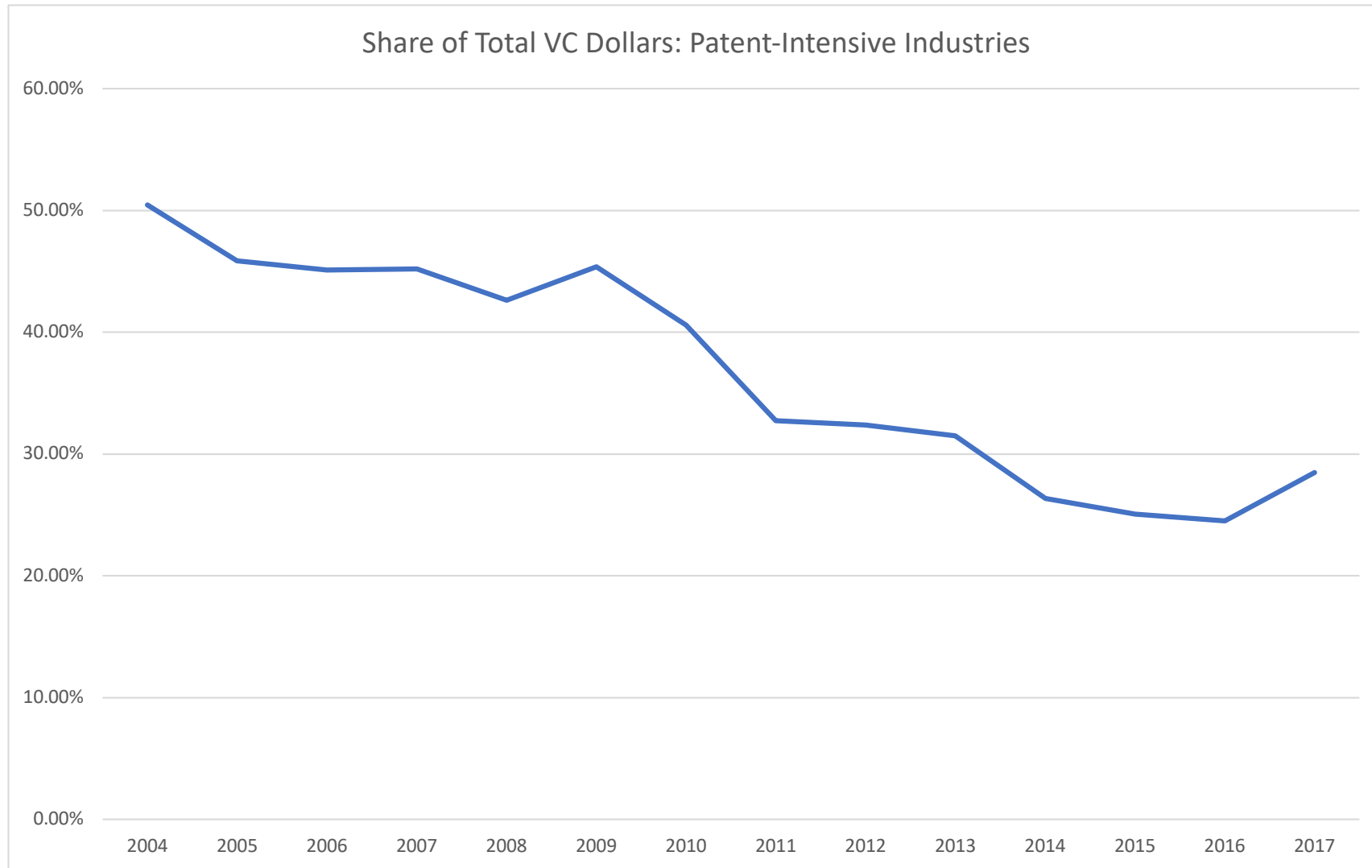
- Supplied by Pitchbook and NVCA: Aggregate numbers of deals and money invested in various industry sectors for 2004 through 2017.
 - The total amount of venture capital dollars invested in the U.S. each year
 - The total number of venture capital deals done in the U.S. each year
 - The total number of companies funded by venture capital money in the U.S. each year
- Each of the above numbers, broken down, by industry category. Pitchbook uses *its own unique* identification of industry, breaking them down into over 200 categories.

Classification of Patent-Intensity for Manufacturing Industries 2009 – 2013
USPTO, Intellectual Property and the U.S. Economy: 2016 Update

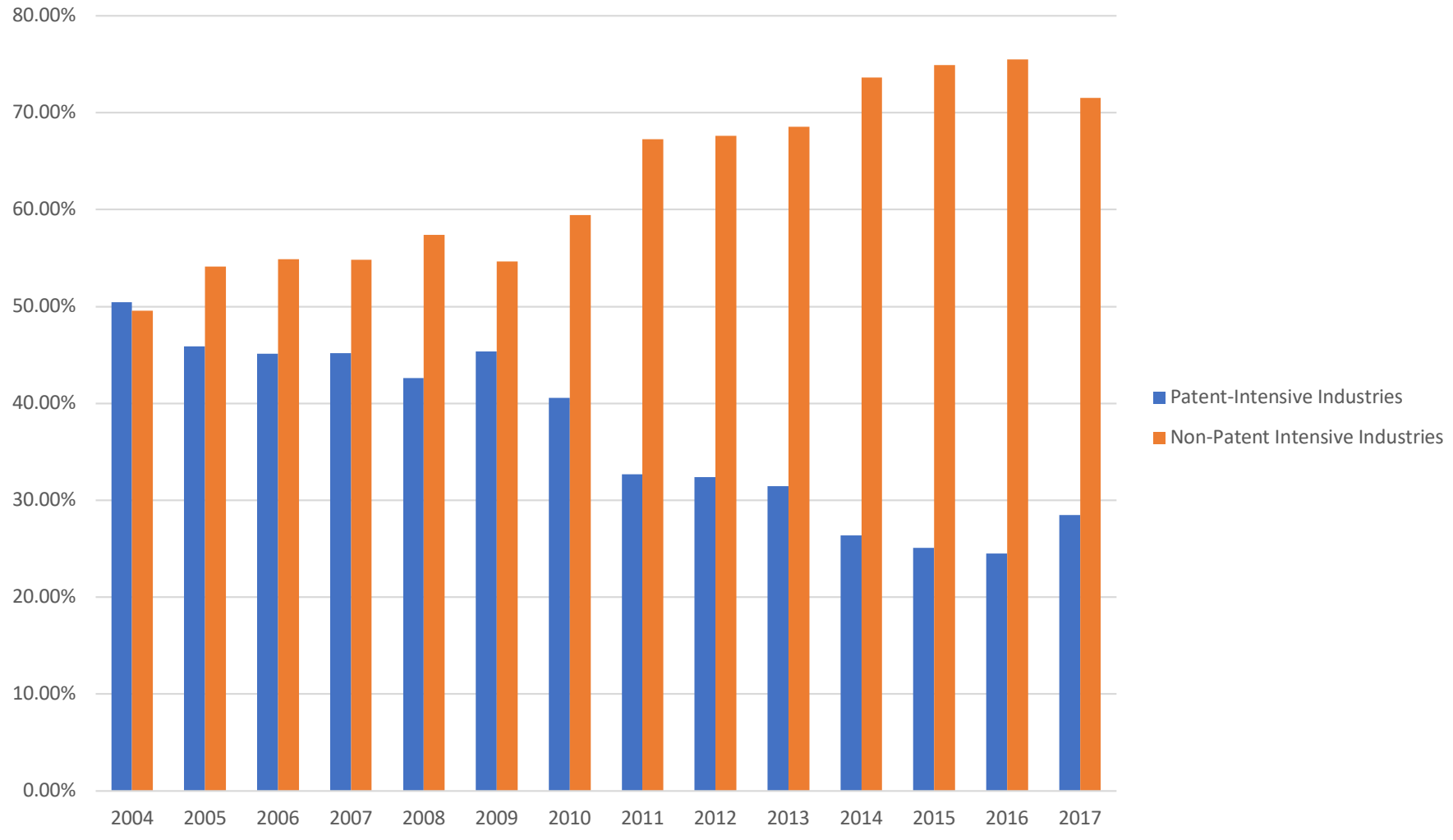
Patent-Intensive (above mean patents/1000 jobs)	Non-Patent-Intensive (below mean patents/1000 jobs)
Computer and peripheral equipment	Plastics and rubber products
Communications equipment	Fabricated metal products
Other computer and electronic products	Other transportation equipment
Navigational, measuring, electromedical, and control Instruments	Motor vehicles, trailers and parts
Semiconductors and other electronic components	Nonmetallic mineral products
Basic chemicals	Textiles, apparel and leather
Other miscellaneous	Aerospace product and parts
Electrical equipment, appliances, and components	Furniture and related products
Medical equipment and supplies	Primary metal
Pharmaceutical and medicines	Wood products
Other chemical product and preparation	Paper, printing and support activities
Machinery	Beverage and tobacco products
	Food

USPTO Patent-Intensive Industries

Share of Total VC Dollars: Patent-Intensive Industries



Share of Money Invested Each Year by Patent Intensity



Examining Share of Investment Across All Industries

Key fact: Manufacturing is the most patent-intensive sector

	2004	2005	2006
Manufacturing	41.59%	38.76%	37.21%
Services	19.31%	21.26%	22.03%
Software	32.41%	33.19%	34.27%
Other	6.70%	6.79%	6.49%

	2015	2016	2017
Manufacturing	26.23%	27.74%	29.05%
Services	25.55%	23.05%	19.70%
Software	41.16%	41.33%	40.69%
Other	7.07%	7.88%	10.56%



Winners and Losers

Patent Intensive vs. Non-Patent Intensive Industries

Creating Representative Comparisons

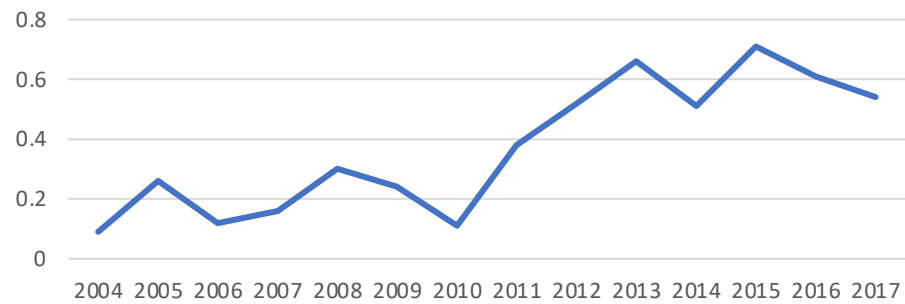
- Industries that started or finished with at least 1% share of funding
- Conservative approach to avoid single year results skewing comparisons
 - Averaged first 5 years, last 5 years
- Represent over 60% of funding for periods examined

Industries Winning
& Losing Share of
Venture Capital
Funding Since
2004

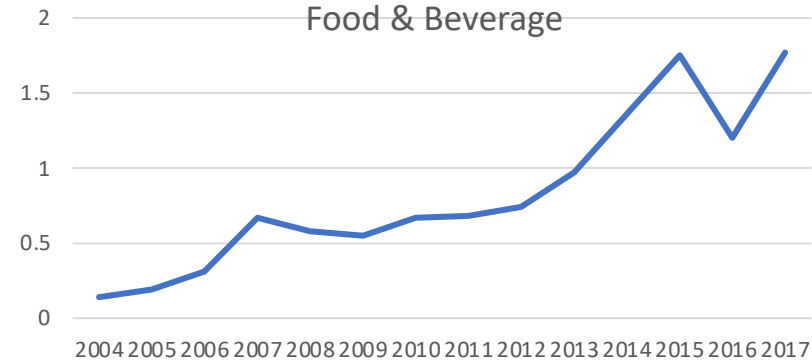
Industry Sector	Share of All VC Funding 2004 -2008	Share of All VC Funding 2013 - 2017	Percentage Change
Industry Sectors Gaining Share			
Financial Services	1.6%	4.1%	147.1%
Food and Beverage	.4%	1.5%	248.5%
Healthcare Technology Systems	1.2%	2.6%	112.6%
Restaurants, Hotels and Leisure	.4%	1.4%	266.5%
Software	25%	40%	57.6%
Total	28.6%	49.6%	
Industry Sectors Losing Share			
Computer Hardware	3.4%	1.2%	-63%
Healthcare Devices and Supplies	10.7%	6.2%	-42.6%
Pharmaceuticals and Biotechnology	15.6%	12.4%	-20.1%
Semiconductors	3.4%	.6%	-82.7%
Total	33.1%	20.4%	

Year to year industry trends: Winners

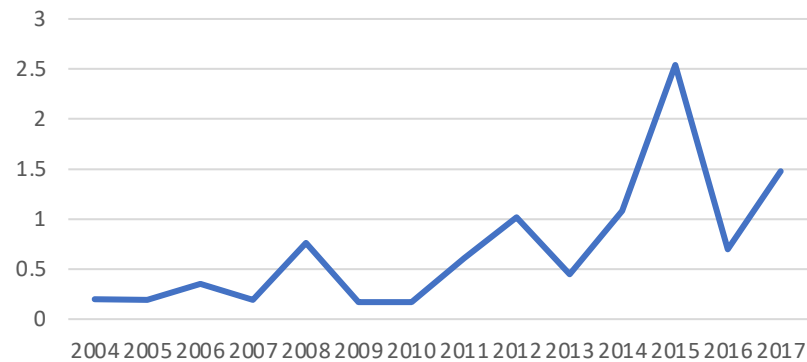
Apparel and Accessories



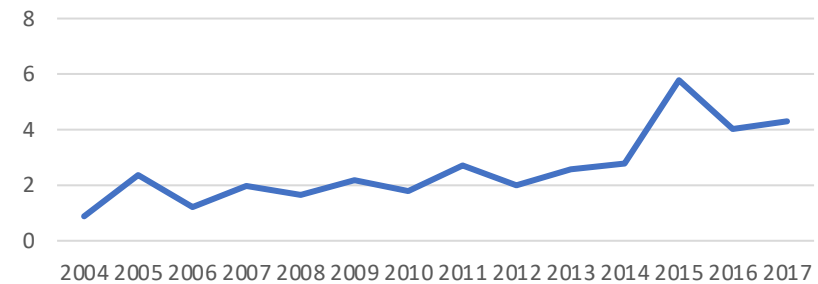
Food & Beverage



Restaurants, Hotels and Leisure

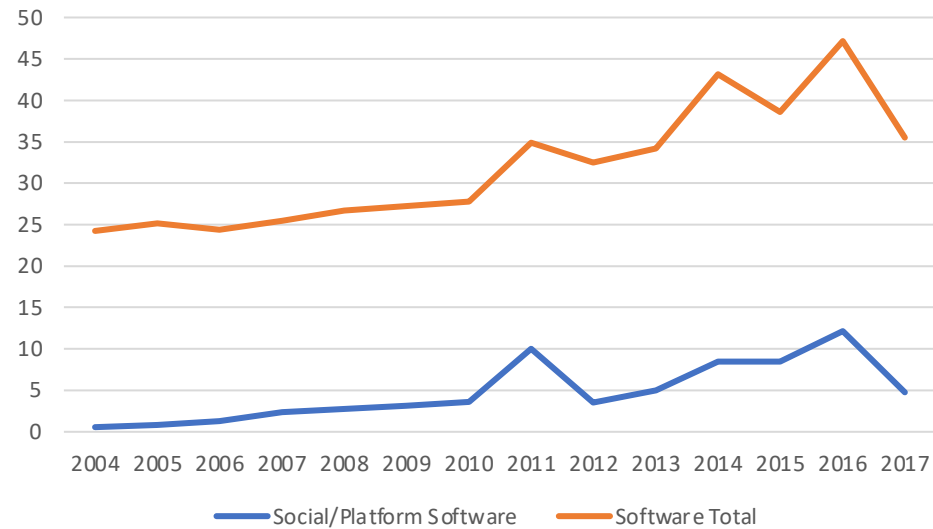


Financial Services

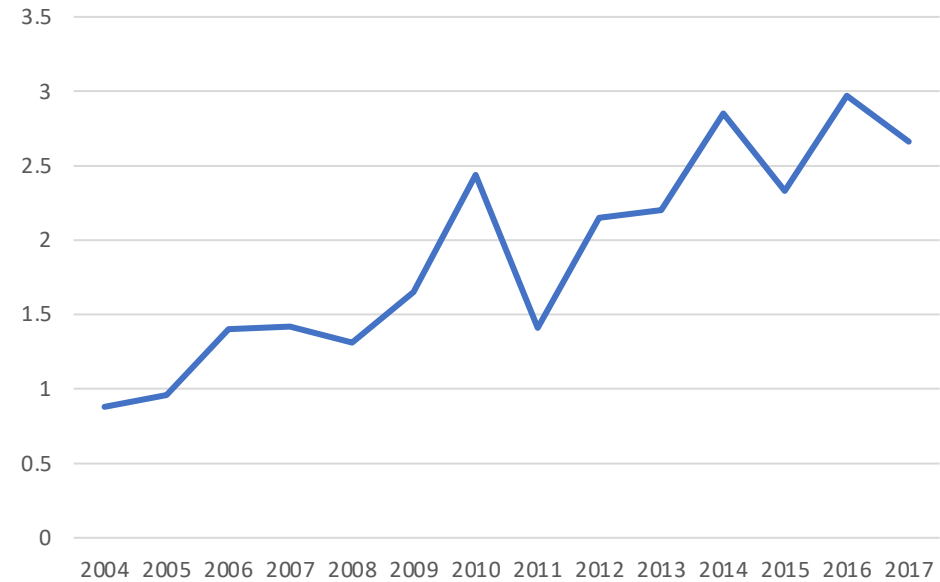


Year to year industry trends: Winners

Software

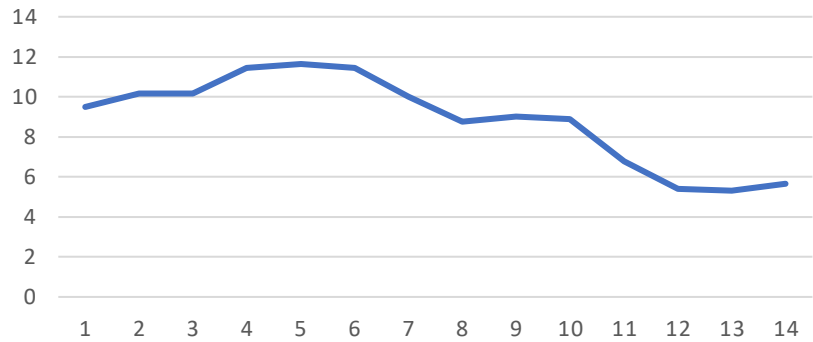


Healthcare Technology Systems

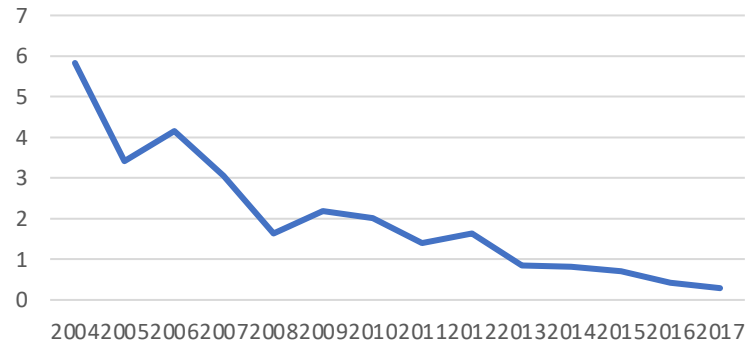


Year to year industry trends: Losers

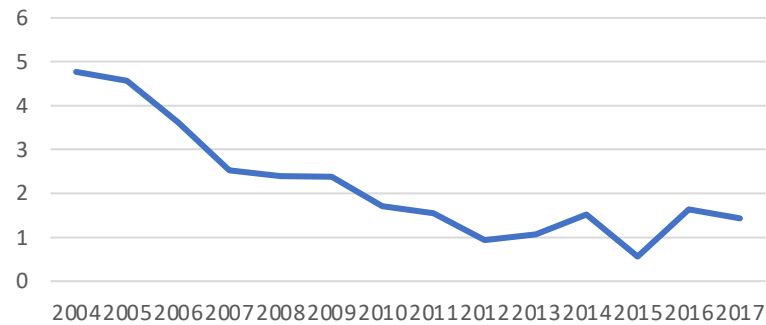
Healthcare Devices and Supplies



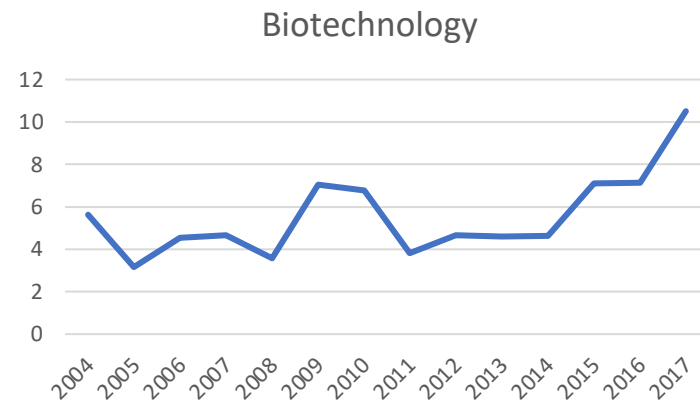
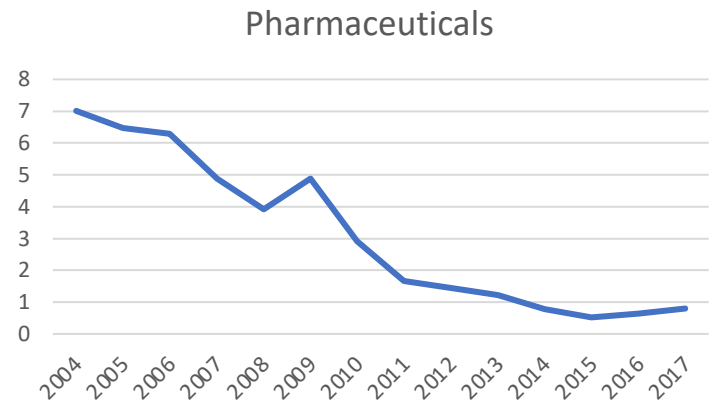
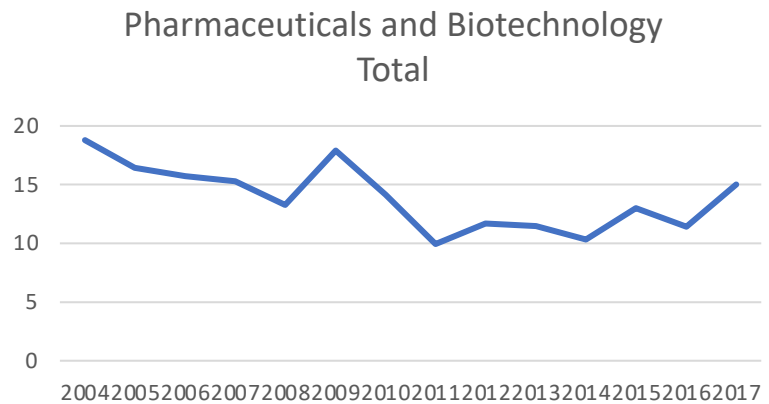
Semiconductors



Computer Hardware



Year to year industry trends: Losers



The Case Studies

- Interviews with successful innovators and investors
- Key limitations:
 - Availability
 - Willingness and ability to make meaningful statements
- Conducted according to protocol where we asked a standard set of questions
 - Their work
 - Importance of patents to their work
 - Effect of changes to patent system on their work
 - Whether alternates to patent system (government funding and management) would work

Subjects

- Eb Bright: Medical devices inventor, investor, entrepreneur, manager
- Josh Makower: Medical devices inventor, investor, entrepreneur, manager, venture capitalist
- Dr. Derrick Rossi: Innovator and entrepreneur
- Barney Cassidy: GC, Juno Therapeutics
- Cleveland Clinic: Mary Kander, manager of tech transfer

Some generalizations of case studies

- Patents were essential to risk-taking and decision-making
- Most had seen a negative impact
- All viewed patents as irreplaceable
- All continued to be successful, but changes to the patent system shifted their interest away from riskier investments, some of which were socially desirable
 - Diagnostics
 - Bioelectronic medicine
 - Personalized medicine

Key Takeaways

- While VC funding grew the share of money invested in patent-intensive startups that develop critical technologies such as medical devices and supplies and pharmaceuticals and biotechnology declined.
- Less patent-intensive sectors such as social networking, consumer finance, food and beverage, and restaurants, hotels and leisure attracted a significantly larger share of venture capital in recent years.
- The share of venture capital funding received by the most patent-intensive businesses dropped from over 50% in 2004 to about 28% in 2017.

Key Takeaways

- The data show a precipitous decline in the relative share of funding going to companies developing products in the pharmaceutical and biotech sectors. Overall, the sector has experienced a 20% decline in share of funding.
- VC investment in pharmaceuticals went from a 7% share of all investments in 2004 to a 0.79% share in 2017.
- In 2008, the share of all VC funding going to medical devices was nearly 12% of all VC funding. By 2015, the share halved, dropping to less than 6%, where it remains.
- The share of funding for businesses developing patent-intensive high-tech hardware, such as computer hardware and semiconductors, has dropped significantly.
- Interviews with leading inventors and investors indicate that changes to the patent system are causing VC investment to flow away from key life sciences investments. As one said, “we are less likely to address issues such as cardiovascular disease and chronic diseases such as diabetes and kidney conditions. . . These high-impact types of diseases are not being addressed like they would have been previously. Everybody is less well off.”