

The Market for Software Innovation Through the Lens of Patent Licenses and Sales

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Hoover I2 Conference

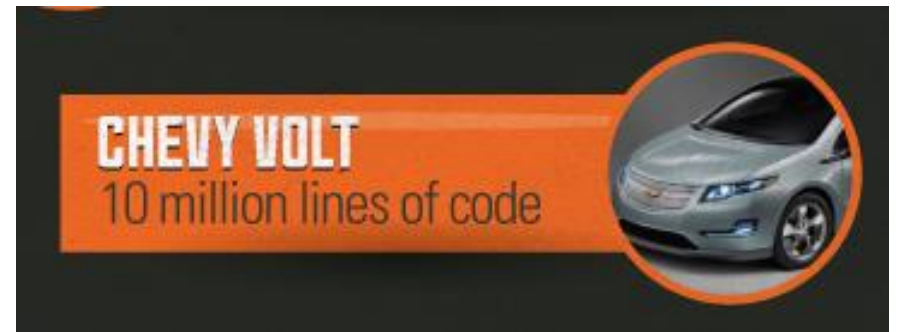
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“Software is
eating the world.”

Marc Andreessen



Software Eats the World: Transportation



Software Eats the World: Retail

amazon.com

The Amazon logo is a curved orange arrow pointing from the letter 'a' to the letter 'z'.

Walmart 

The Walmart logo is a yellow six-pointed starburst shape.

Software Eats the World: Medicine

IMPRECISION MEDICINE

For every person they do help (blue), the ten highest-grossing drugs in the United States fail to improve the conditions of between 3 and 24 people (red).

1. ABILIFY (aripiprazole)
Schizophrenia



2. NEXIUM (esomeprazole)
Heartburn



3. HUMIRA (adalimumab)
Arthritis



4. CRESTOR (rosuvastatin)
High cholesterol



Blue = drug helped
Red = drug didn't help

Software Eats the World: Medicine



PRESIDENT OBAMA'S PRECISION MEDICINE INITIATIVE WOULD
**HELP DEVELOP BETTER TREATMENTS
FOR DISEASES LIKE CANCER BY:**

- Accelerating the design and testing of effective **treatments tailored to individual patients**
- Expanding genetically based clinical cancer trials
- Establishing a national "**cancer knowledge network**" to guide treatment decisions

Software Eats the World

“We find strong statistical evidence for the growing importance of software-related technologies for successful innovation ..in auto and auto parts, aerospace and defense, medical devices, and pharmaceuticals”

Get With the Program: Software-Driven Innovation in Traditional Manufacturing

Lee G. Branstetter, Matej Drev, and Namho Kwon
NBER Working Paper No. 21752

**If software is eating the
world, does intellectual
property matter?**

If software is eating the world, do patents matter?

YES

- 1. Permissionless innovation | efficient infringement**
- 2. Bright side of acquisition | dark side of assertion**
- 3. Patents can disrupt traditional monopolies**
- 4. Problems of software patents and component liability are everyone's problems, not just "tech" problems.**
- 5. Distributional implications are important – patents facilitate specialization**

If software is eating the world, does intellectual property matter?

NO

- 1. Value proposition so compelling, we'll get there no matter where defaults are set.**
- 2. The patent system is too slow and too expensive, conferring advantages to incumbents/the moneyed/ well-lawyered**
- 3. Leading innovators are avoiding or “hacking” the patent system. See e.g. mobile apps market (0.04% patent rate), Tesla, OIN (2,000 pledges).**

If software is eating the world, does intellectual property matter?

NO

4. Monopoly is being sustained, not by IP, **but by:**
- marketing (pharma), scientific and regulatory barriers (biologics)
 - network effects, proprietary technology (often, built on data), economies of scale, loss-leading and “winner take all” business models.

See:

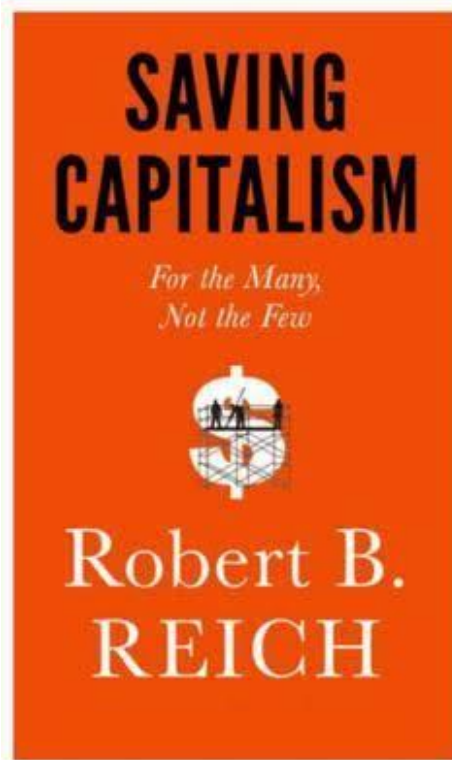
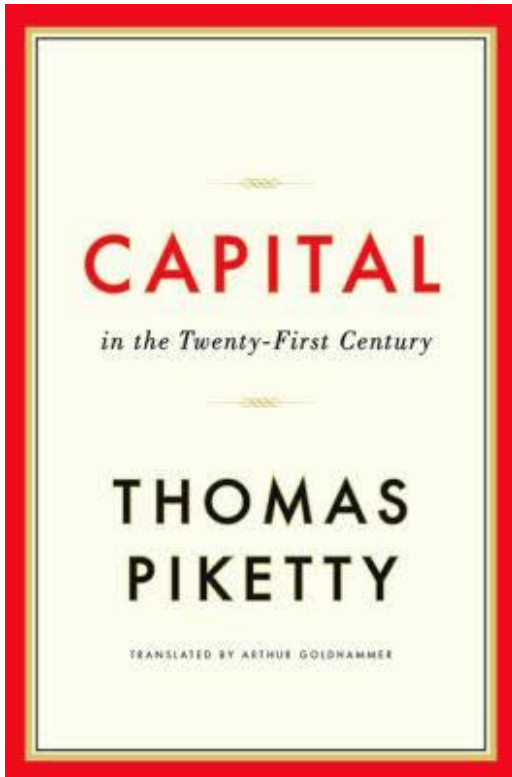


DECEMBER 30, 2015

IN SILICON VALLEY NOW, IT'S ALMOST ALWAYS
WINNER TAKES ALL

BY OM MALIK

techdirt



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YES

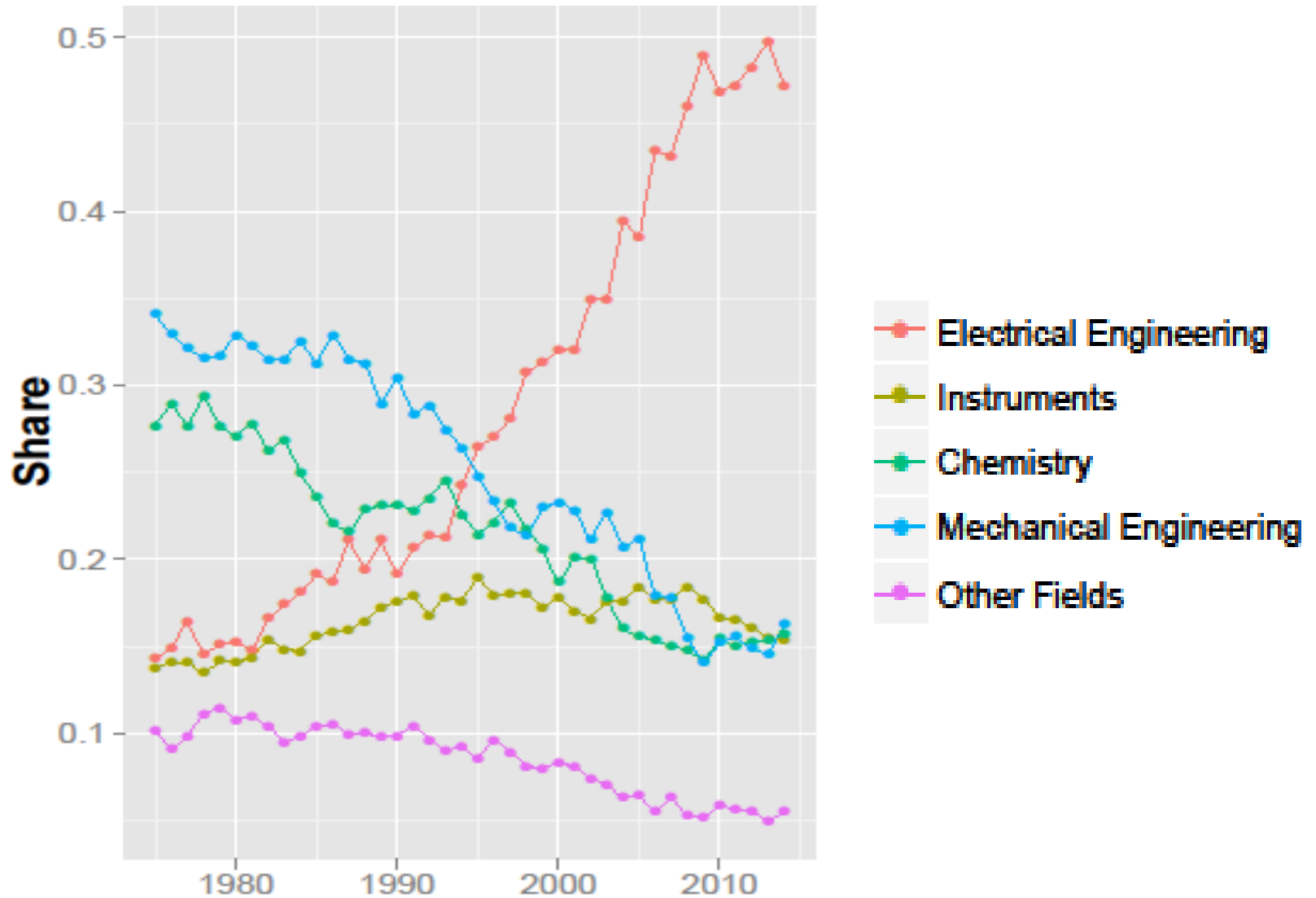


Colleen Chien @colleen_chien · 11 May 2012

New patent fact #1 I'll be presenting @ Princeton today: Google and Apple spent more on patents last year than on R&D.

The Rise of Silicon and Decline of Carbon and Steel

Shares of US Patents by Industry 1970-2015



Source: Opening the Patent System, Colleen V. Chien, Southern Cal. L. Rev. 2016

The Market for Innovation Also Matters

“[Based on surveying 6,000 manufacturing firms] **49%** [of innovating firms] report that their most important new product had originated from an outside source, notably customers, suppliers and technology specialists (i.e., universities, independent inventors and R&D contractors).”

The Acquisition and Commercialization of Invention
in American Manufacturing: Incidence and Impact
Ashish Arora, Wesley M. Cohen, John P. Walsh
NBER Working Paper No. 20264

The Market for Innovation Also Matters

“Biopharmaceutical companies signed nearly \$32 billion worth of licenses in 2014, **76 %** of biotech companies license university technology, and the majority of revenues from the best-performing drug companies are from products that were not developed in-house.”

(Chien, Opening the Patent System citing BCG 2014, Loise & Stevens 2010, Behnke 2014)

This paper: how do the sales and licensing of patents support software innovation?

This paper: how do the sales and licensing of patents support software [and other forms of] innovation?

[bonus material]

This paper: how do the sales and licensing of patents support software innovation?

PRELIMINARY
FINDINGS

Databases

- Material licenses reported by public companies to the SEC collected by ktMine
- Recorded assignments reflective of stand-alone patent sales (“sales”) collected by Innography PMT*
- COMPUSTAT, ReferenceUSA, Bloomberg



Scope of analysis/Definitions

- Material technology licenses effective 2000-2015
- Sales of US “software” patents registered at the PTO 2012-2015
- “Software” by Graham & Mowery 2003, Bessen & Mauer 2007, Graham et al 2009, [biotechnology and pharmaceutical \(“biopharma”\) patent counts by Schmoch \(WIPO\)](#), [license counts by industry by ktMine](#)

**(patent sales analysis from forthcoming study by Esmail Khaskari & Colleen Chien)*

Read & interpret data with caution given selection effects, limits of analysis.

- SEC Licenses (by ktMine)
 - includes only “material” agreements signed by public companies, excludes private-private licenses, non-material licenses by public companies
- “Cleaned” Patent Sales data (by PMT Innography)
 - Excludes name changes, intracompany transfers, M&A, other types of conveyances
 - But recording of name changes, UPE identification challenges, “spin outs” etc. can impact coding
- Proprietary Datasets, SIC v. CPC, Schmoch v. Lybbert v. Graham & Mowery v. Bessen
 - Challenge of proprietary datasets, having SEC (SIC) and PTO (CPC) data talk to each other
 - Lack of consensus industry codings

This paper: how do the sales and licensing of patents support software [and where data available, other] innovation?

Questions probed

- 1. How often and broadly is software part of technology agreements?**
- 2. What role are patents playing in the market for software and other innovation based on looking at material technology agreements filed at the SEC?**
- 3. How do patent sales support software and biopharma innovation with respect to the redistribution of rights and capital?**

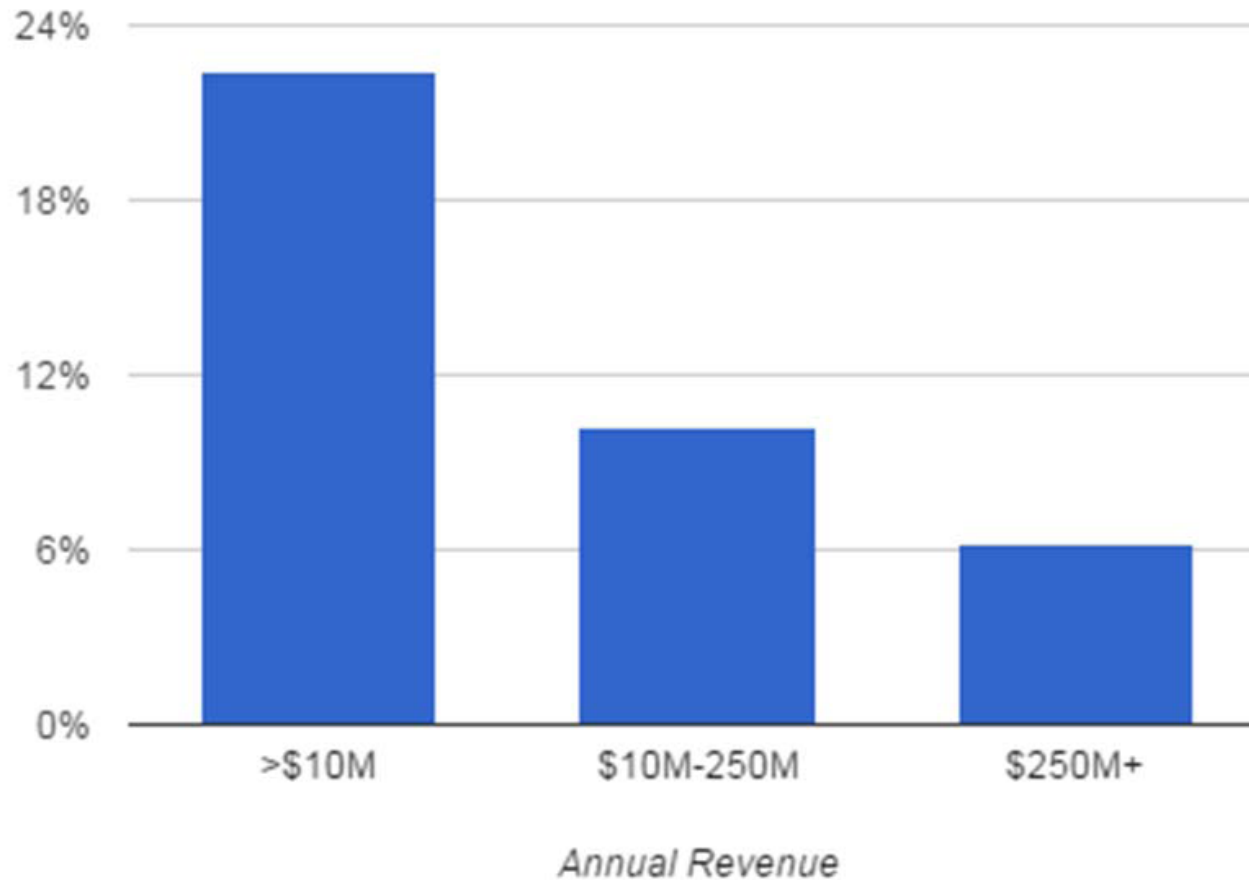
1. How often and broadly is software part of technology agreements?

A. Software (licenses) eat the world

- Software is part of an estimated 42% of material technology agreements registered at the SEC since 2000 (2,645 out of 6,019), and is core to about 24% of these agreements (1,451 out of 6,019).
- But these agreements are only being filed by a small percentage of companies per year.

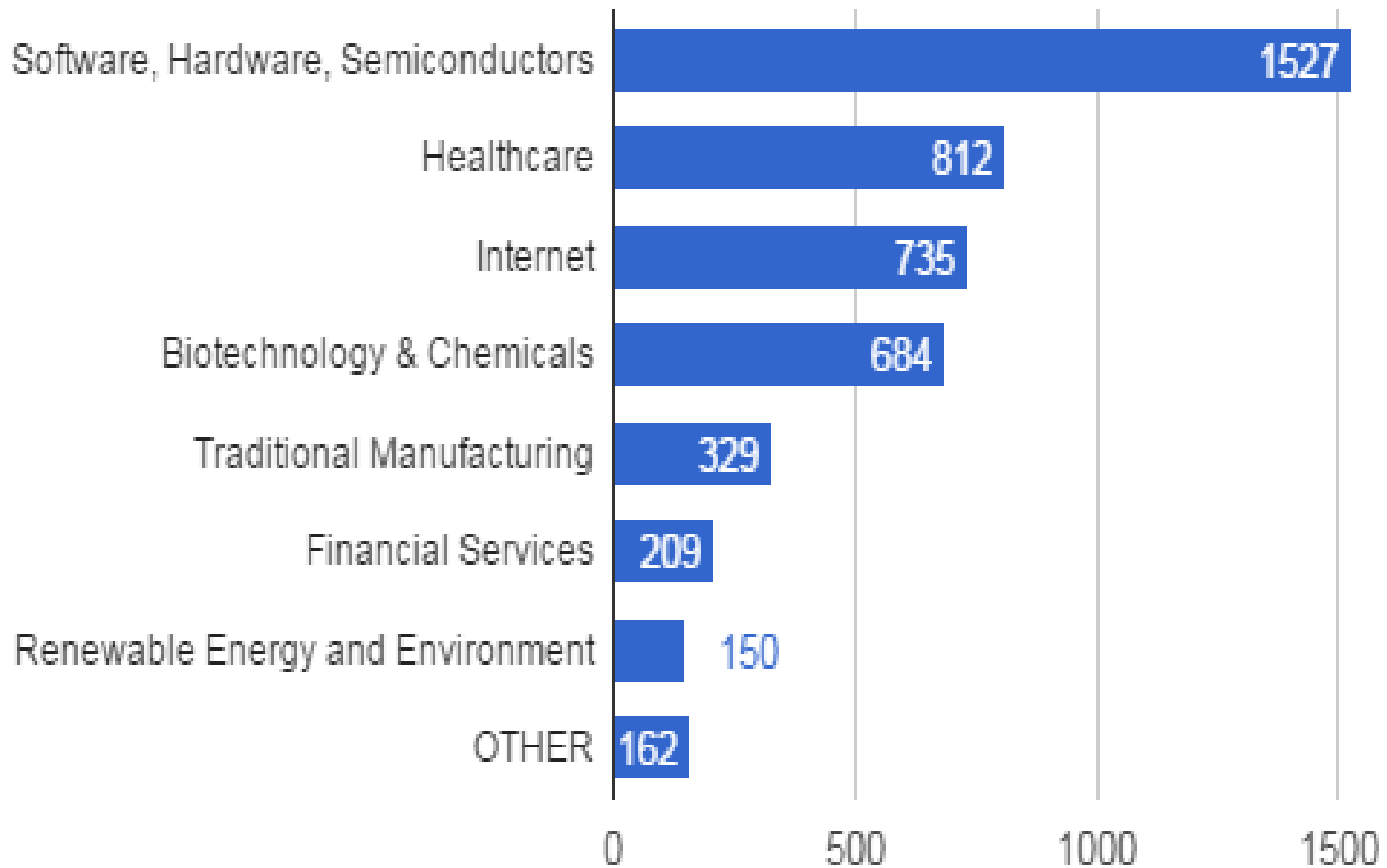
But only among the smallest public companies were agreements reported by a 10%+ share

FIG. ____ . Share of Software Companies Reporting Material Technology Agreements (2000-2015 effective dates)



B. Material technology agreements involving software span tech and non-tech industries

Material Software Technology Agreements* by Industry (2000-2015) (N=2,564)



*Technology agreements that include software clauses

2. What role are patents playing in the market for software and other innovation based on looking at material technology agreements filed at the SEC?

Hypothesized role of patent market - supporting the transfer of technology or transfer of liability?

Liability Transfer

Lemley and Feldman 2015:
“88%-99% of [requested] licenses rarely, if ever, included any technology transfer”

Usselman (patent sharks)

Technology Transfer

Varner 2011: 56% of patent licenses filed with the SEC included know-how

Berkeley Patent Survey 2008:
70% of surveyed startups licensed in order to gain technology

Lamoreaux, Sokoloff

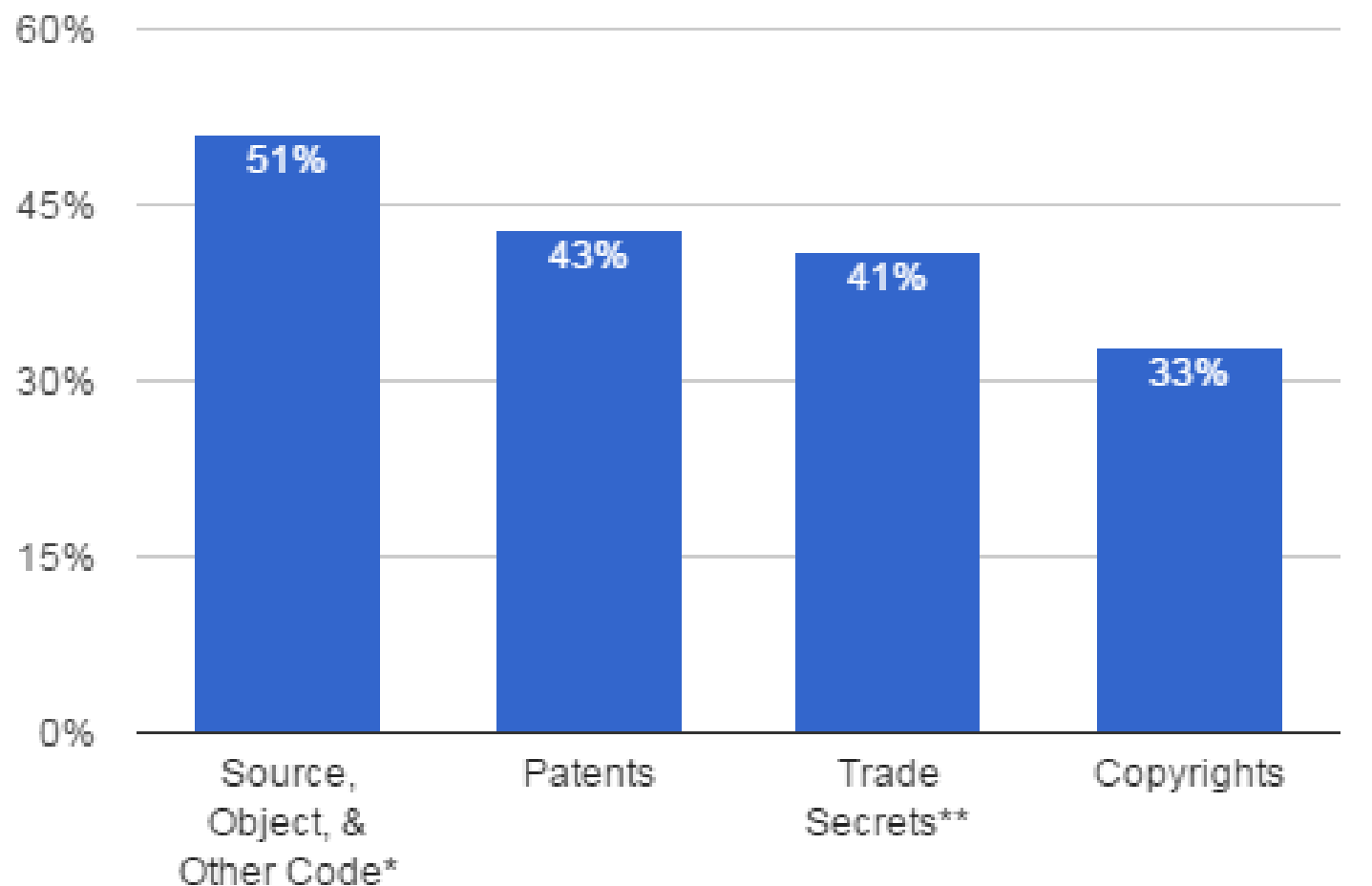
A. Patents are “core” to about 2/3 of software agreements that mention patents,* in the remaining 1/3, patents are mentioned only incidentally, (e.g. in the context of indemnity, warranty, etc.).

In a majority of these cases, then, tech, rather than liability transfers are happening

***based on reading of ~206 out of 1081 licenses**

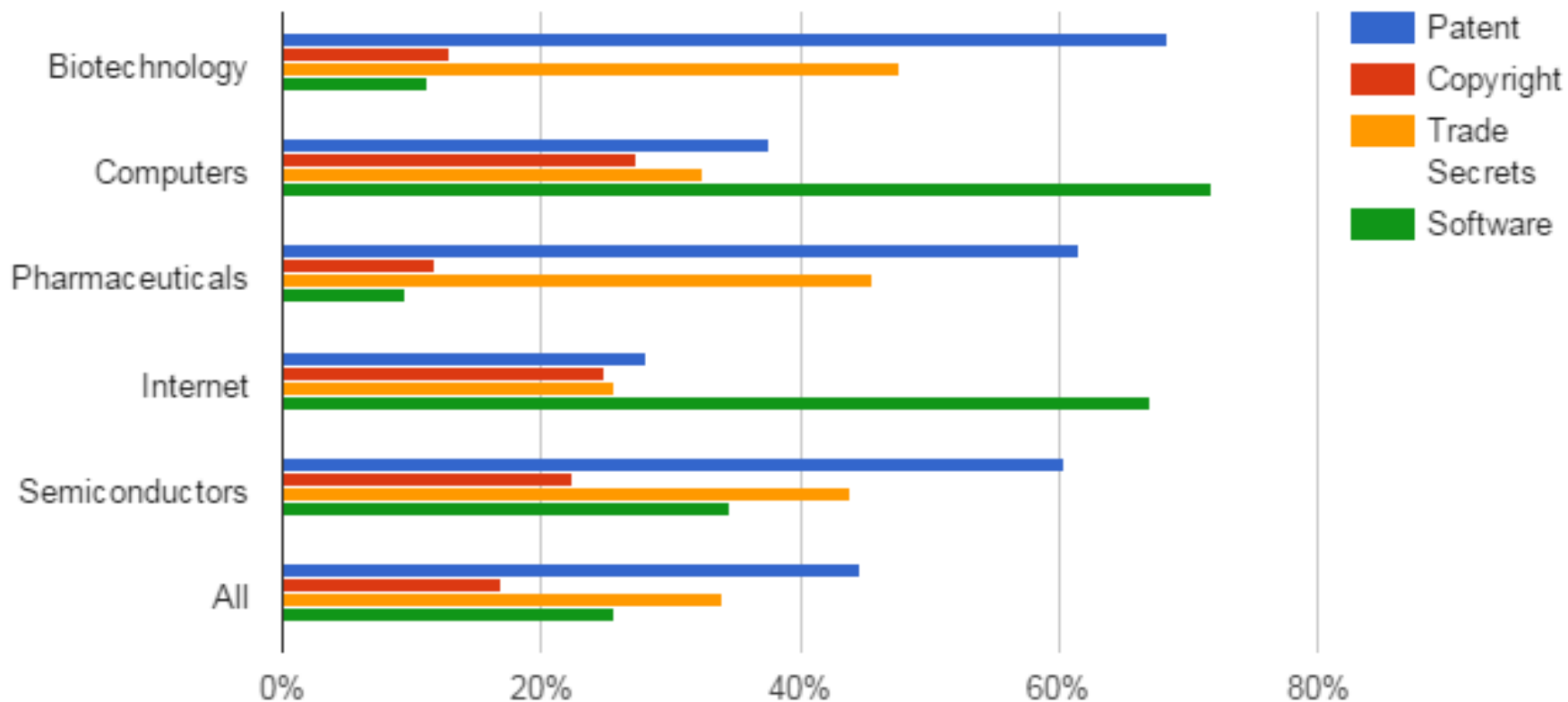
B. But, transfer of S/W innovation is supported by much more than patents

Key Components of Material Software Agreements (N=1,451)



C. In general, patents are more important to biopharma and semiconductor agreements than computer and internet agreements (N=6,167 licenses)

Core IP Across Tech Agts by Sector



Hypothesized role of patents - supporting transacting by overcoming the Arrow Information Paradox?

Exclusive Licensing

Anand and Khanna 2000: 50% of Chemistry licenses are exclusive (worldwide and other).

Drivas et al 2014: 88% of UC licenses are exclusive.

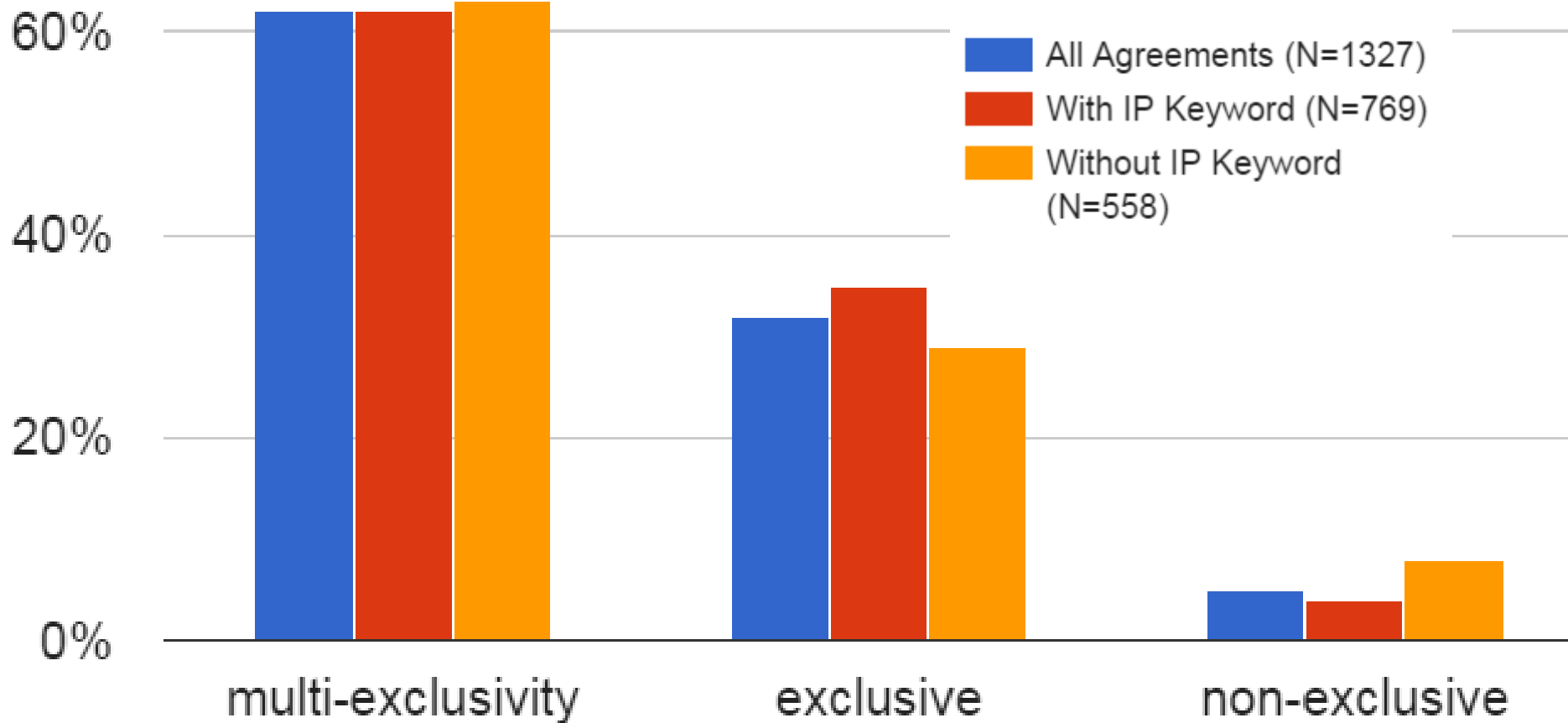
Pressman 2006: the smaller the licensee, the more likely the license was exclusive, among DNA licenses.

Non-Exclusive Licensing

Anand and Khanna 2000: 15% of “electronic” industry licenses are exclusive (worldwide and other).

D. Few agreements were non-exclusive, but the exclusivity did not depend on IP, suggesting that contracts are doing substantial work

Exclusivity Provisions in Software Agreements



(This finding appears to be robust across technology sectors)

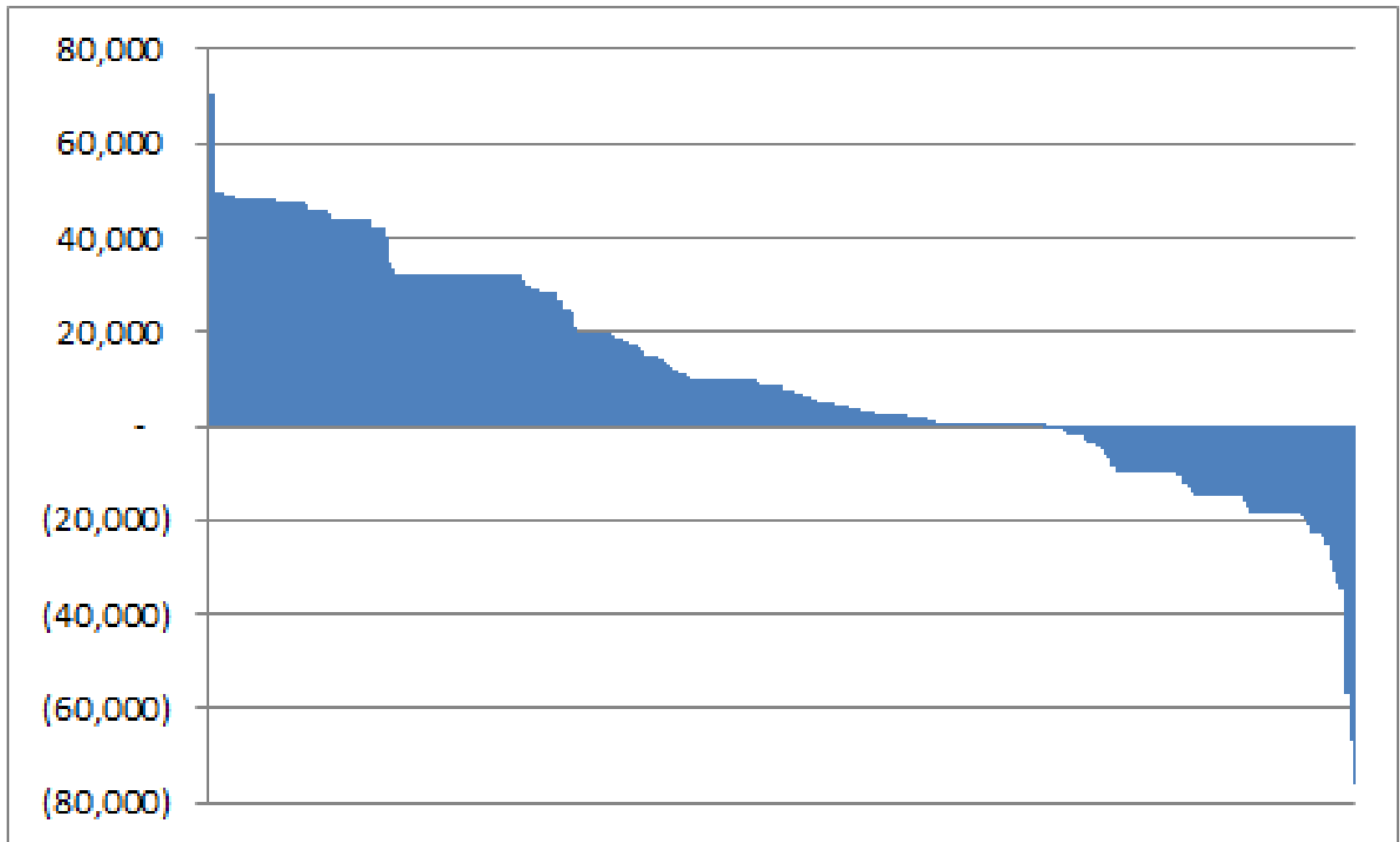
3. How do patent sales support software and biopharma innovation with respect to the redistribution of rights and capital?

A. Sales of software patents are supporting transfers of technology and legal liability; the largest transactions are from old companies to young companies.

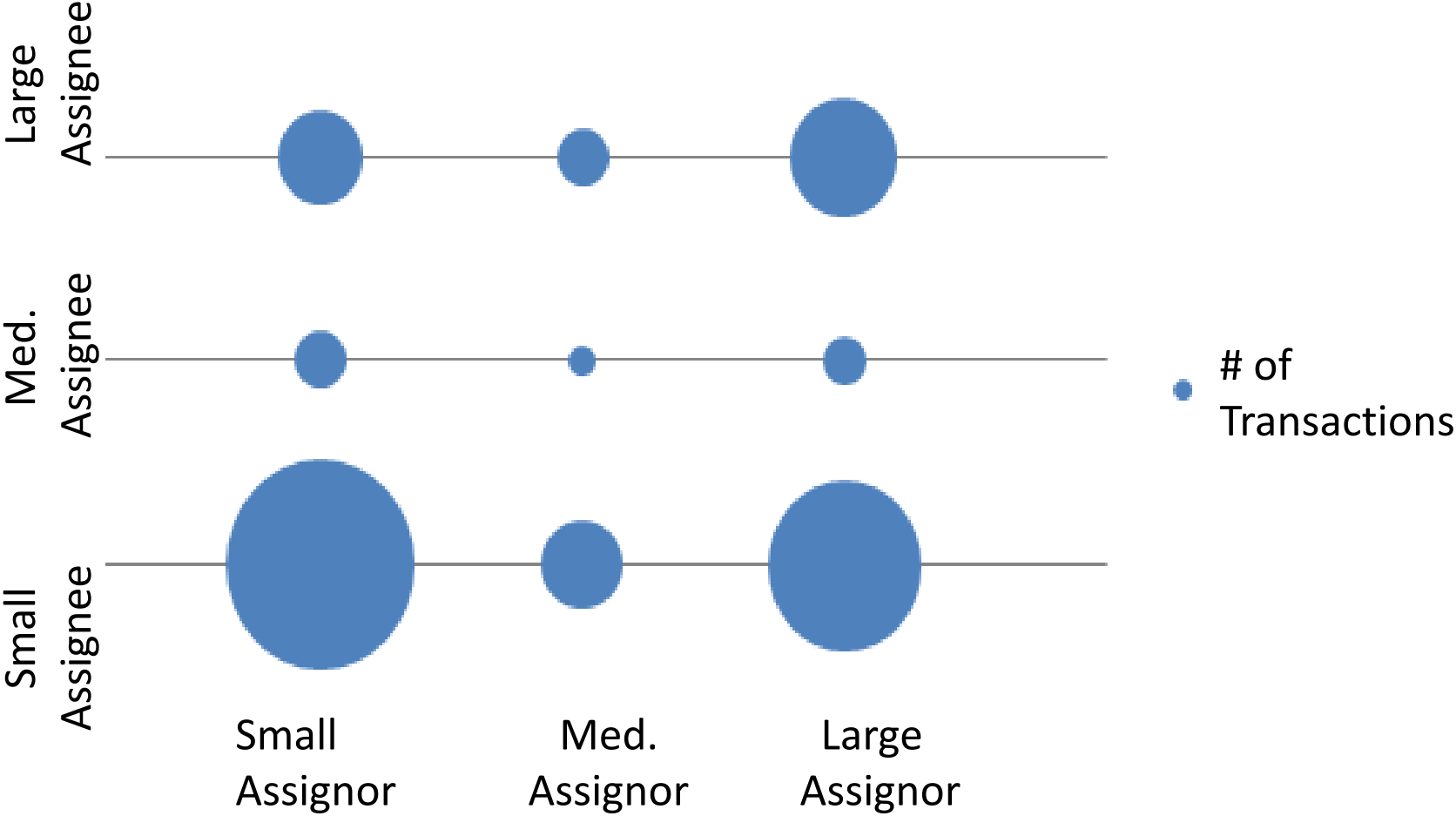
Top S/W Patent Xfers 2013-2015	Patents	Old to Young?
IBM to Globalfoundries Inc.	2240	Y
HP Inc. to TCL Corporation	1123	Y
Lenovo Group to Alphabet Inc.	834	Y
Fujitsu and Panasonic to Socionext	820	Y
IBM to Lenovo Group	783	Y
HP to Qualcomm	599	Y
IBM to LinkedIn	516	Y
IBM to Twitter	495	Y
IBM to Facebook	414	Y
Eastman Kodak to Intellectual Ventures	310	Y

B. 73% of the time, the transfer was from a larger to a smaller patentholder, resulting in a redistribution upward of capital but redistribution downward of patents.

Differences between Patent Assignor and Patent Assignee Patent Portfolios (N=31,134 patents)



The Redistribution of Software Patents (N = 14,788 transactions)



Size based on patentholding. Small = <15 patents; medium = 15-100 patents; large = 101+ patents.

C. In contrast, the top biopharma transfers were from younger to older company

Top Biopharma Patent Xfers 2013-2015	Patents	Old to Young?
KKR & Co. L.P. to Panasonic Corporation	141	N
Edt Pharma Holdings Ltd to Perrigo Company plc	137	N
Gearbox Software, LLC to Intellectual Ventures	100	N
BioTime, Inc. to Geron Corporation	99	-
Aniona ApS to NeuroSearch A/S	92	N
Mariel Therapeutics, Inc. to Stryker Corporation	90	N
MESOBLAST INTERNATIONAL SRL to Osiris Therapeutics, Inc.	85	N
Arrowhead Research Corporation to Novartis AG	82	N
Novartis AG to GlaxoSmithKline plc	77	Y
Deep Science, LLC to Intellectual Ventures	66	N

Additional biopharma views in progress...