Is Big Data a Challenge for Boards?

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"AI is going to be more important than humanity's mastery of fire or electricity"

– Sundar Pichai, CEO Google

**"Statistical information is currently accumulating at an unprecedented rate. But no amount of statistical information
… can by itself explain economic phenomena.
…we need the guidance and help of a powerful theoretical framework."**

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– Ragnar Frish,
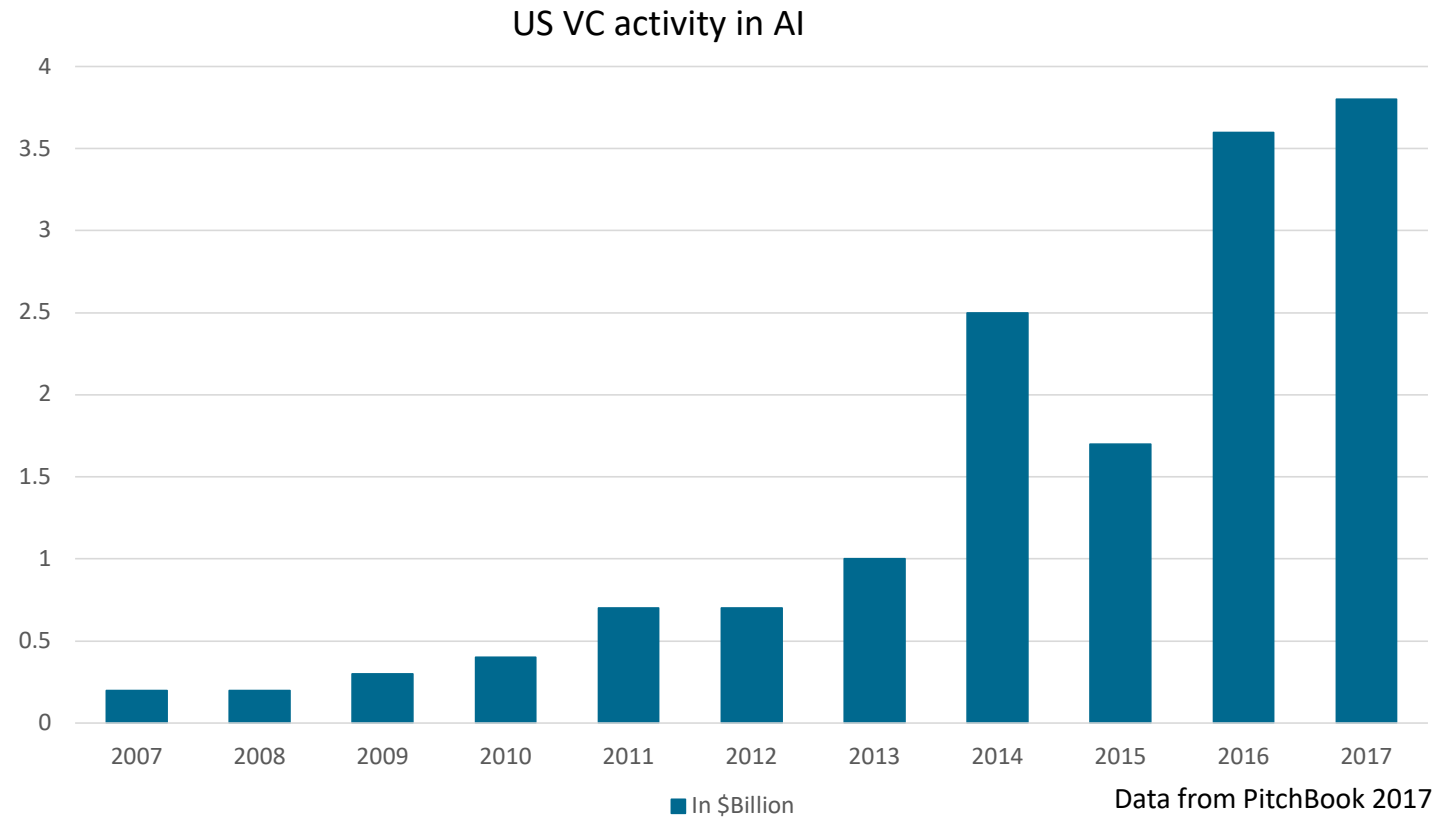*Econometrica, Vol 1. No. 1, 1933*

Why now?

Cost of storage and global data availability 2009-2017
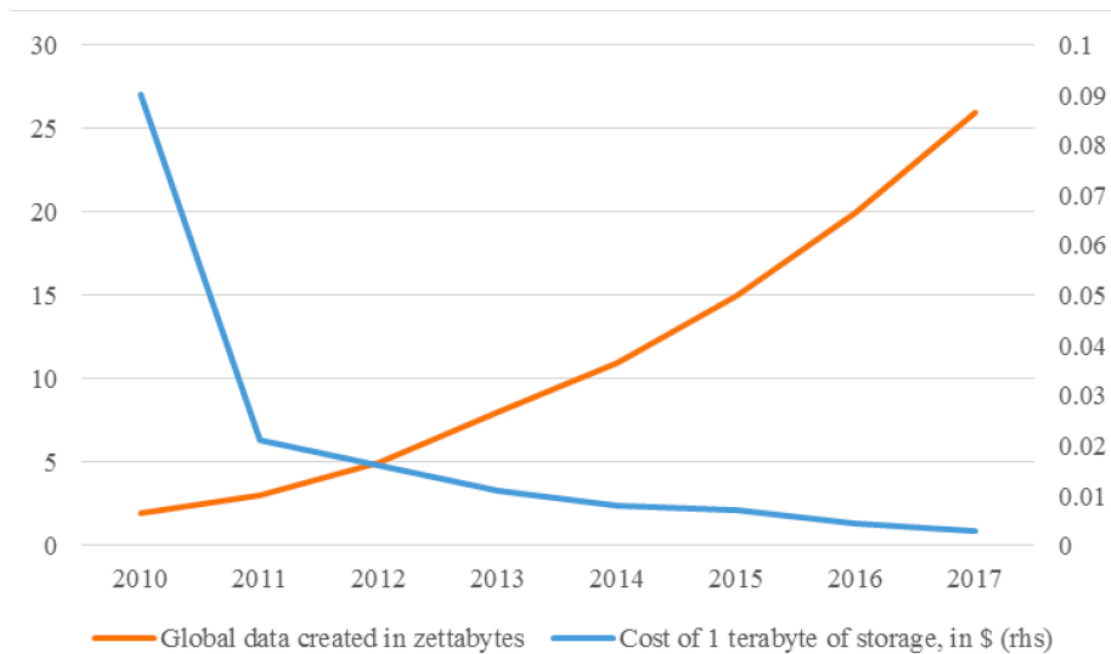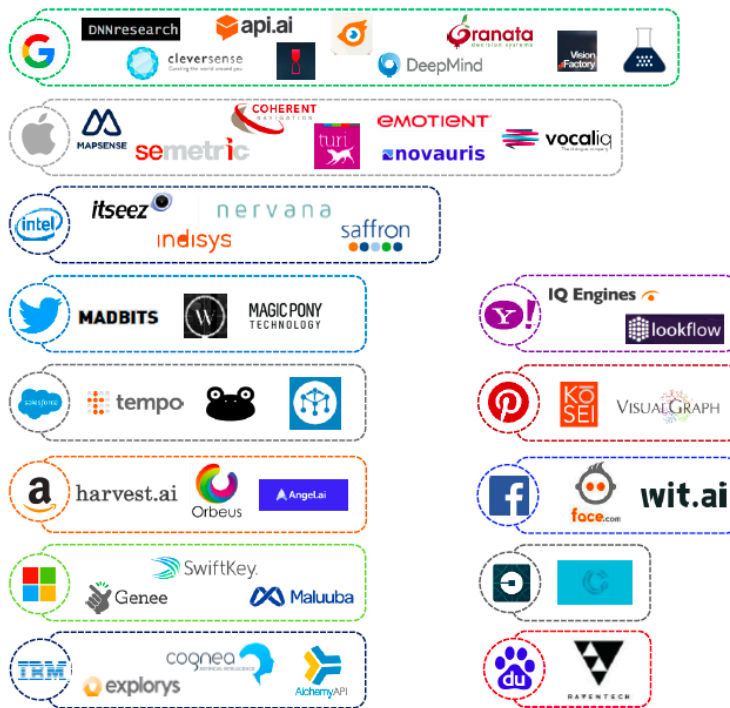

Source: Reinsel, Gantz and Rydning (2017); Klein (2017). One zettabyte is equal to one billion terabytes.

VC Funding for AI has grown significantly
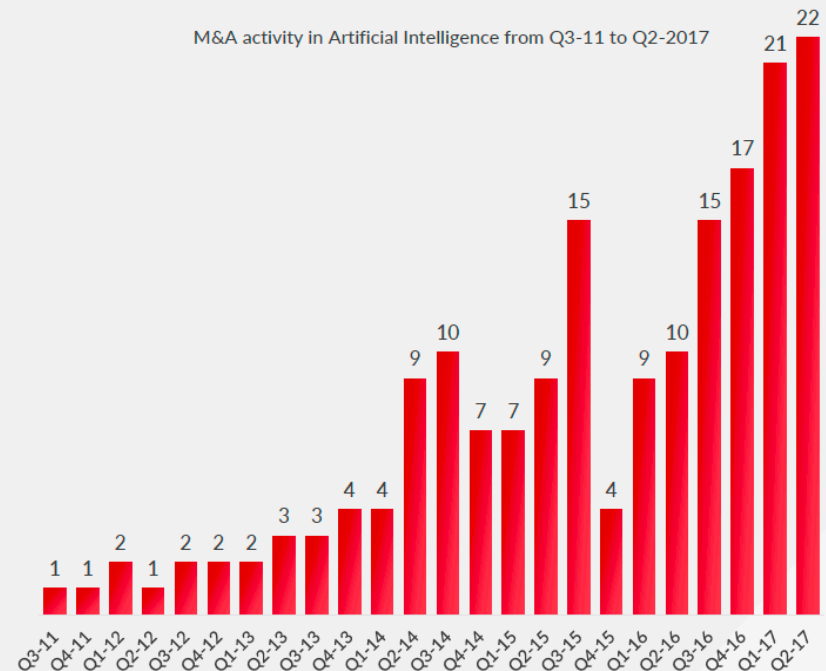
US VC activity in AI

In $Billion

Data from PitchBook 2017

M&A trends in AI

AI LARGEST ACQUIRERS

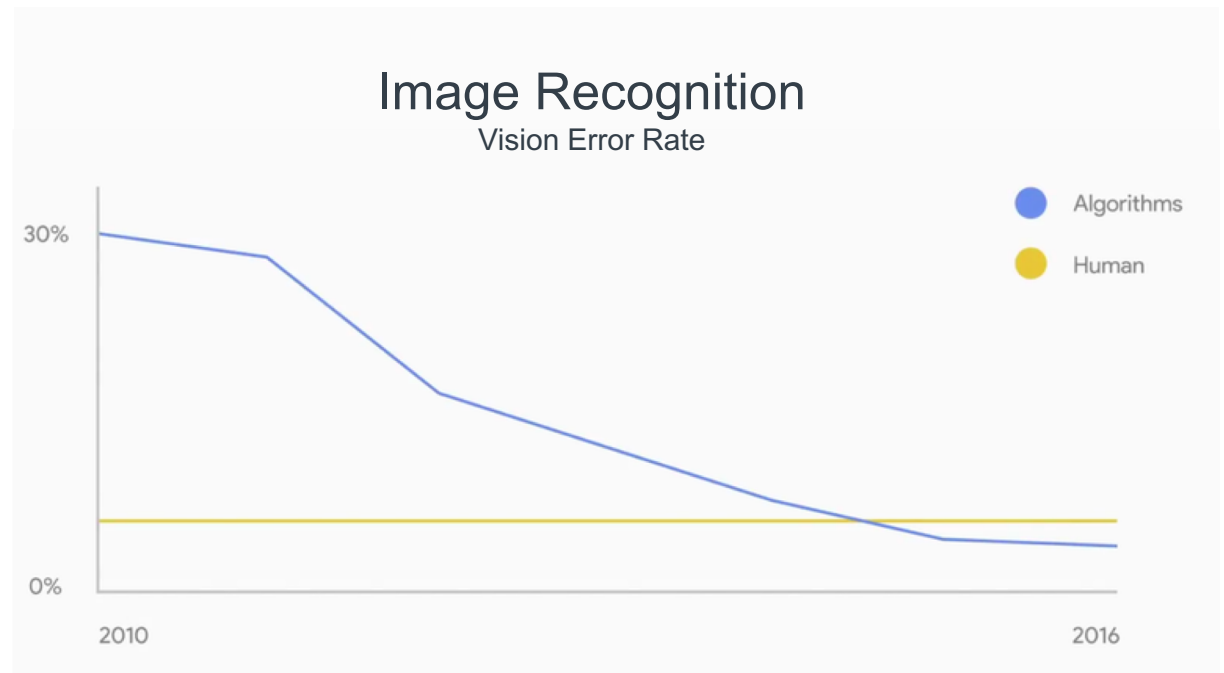## M&A DEAL COUNT

M&A activity in Artificial Intelligence from Q3-11 to Q2-2017

AI now better than humans at facial recognition

Where are we going?

MIT MANAGEMENT EXECUTIVE EDUCATION

Interactive Consumer interfaces

- Natural language processing is moving to the next level
- "Talking" chatbots, not scripted lines
- Example: Google "WaveNet" can compose like Chopin

Radical Personalization

- Personalized messages, images, mood detection
- Air B&B: Personalized photos – Architectural digest vs. your home

Customer Screening and Targeting

- Use historical information to increase the accuracy of predictive scenarios
- Example: Sofy uses credit scoring algorithms with social media data

Will big data reshape (financial) services?

Massive reductions in transaction costs

Customized (just-in-time) delivery of financial products

Elimination of human error and discretion

Better screening for credit risk and customer types

Dynamic credit scoring

Transaction based assessment of credit risks

Increased ability to model consumers' behavioral biases and financial sophistication

Personal data allows to predict consumer's "behavioral types", e.g. myopia, self control issues, ability to process financial information

Affects distribution of rents in financial markets

Self-Control …

The soft touch…

The Marshmallow Experiment

Inattention…

Why is this Relevant for Finance?

Banks, consumer product firms are starting to embrace behavioral finance and psychology to shape products

New opportunities, new tools

Credit card companies are screening and targeting customers not only by credit type but also by financial sophistication

- Sophisticated customers know their spending behavior and want transparent, competitive products
- Myopic consumers or those with self-control issues are less able to assess full cost of credit, difficult to shop for best product

Ru and Schoar (2017) "Do Companies Screen for Behavioral Biases?"

Credit Card Experiment

Obtained data from Compremedia on all credit card mailers sent in the US from 1999 to 2015

> 1 million different credit card mailers sent to consumers

Represent demographic and economic distribution of US credit card owning population

Images of every page in credit card offers

Build algorithm to classify all features of the offers

Visual dimension of mailers: Colors, font, photos, amount of info and where displayed

Hard features: Fees, interest rate, reward programs

- Pricing of card: APR, late fees, penalty payments, low intro APR with increasing payments after
- Rewards: Points, cash back, miles

Example:

Finding I: Targeting of Consumers

Issuers target less sophisticated consumers with more complex and back-loaded fee structure

(Low) intro APR programs targeted at unsophisticated consumers

But high late fees, default APR, and over- limit fees

Typically no annual fees

Offer letters are designed to differentiate consumers

More complex language hidden in the back and fine print

Differential shrouding for unsophisticated consumers

Shrouding of Unattractive Terms

Descriptive Statistics for Format Design of Credit Card Offers								
Panel A								
	Late fee	Default APR	Over limit fee	Annual fee	CASH	POINT	MILE	Intro APR
Percentage of cards that have this term	100.00%	100.00%	100.00%	100.00%	17.53%	22.44%	8.23%	67.86%
Term mentioned on 1st page	6.06%	3.87%	7.27%	78.02%	100%	93.68%	100%	89.69%
Font size if mentioned on 1st page	9.56	9.39	9.82	13.39	12.12	10.98	16.56	13.43
Font size if NOT mentioned on first page	9.56	9.64	9.52	14.47	10.62	10.80	9.91	11.50
Font color if mentioned on first page	32.92%	32.29%	25.53%	64.42%	44.97%	41.40%	60.89%	58.30%
Font color if NOT mentioned on 1st page	23.69%	24.96%	21.82%	44.53%	37.24%	38.45%	29.47%	43.84%
Font bold if mentioned on first page	38.91%	25.58%	34.18%	77.82%	53.84%	39.06%	72.70%	75.78%
Font bold if NOT mentioned on first page	42.71%	10.66%	32.97%	53.78%	36.58%	29.97%	18.08%	63.09%
# Obs	611,797	611,797	611,797	611,797	611,797	611,797	611,797	611,797
Panel B								
	Late fee	Default APR	Over limit fee	Annual fee				
if term is on first page	27.89	27.56%	28.38	5.95				
if term is in the back (schumer box)	34.63	27.75%	30.62	26.12				

Differential Targeting of Consumers

	1	2	3	6	7
Dependent Variable	APR	Late Fee	Default APR	Intro_APR	Backward
FFR	0.736∗∗∗	0.067∗∗∗	1.495∗∗∗	-0.013∗∗∗	0.007∗∗∗
	(0.004)	(0.007)	(0.004)	(0.000)	(0.001)
Education_2	-0.156∗∗∗	-0.169∗∗∗	-0.151∗∗∗	-0.007∗∗	0.008
	(0.030)	(0.048)	(0.025)	(0.003)	(0.008)
Education_3	-0.072∗∗	-0.395∗∗∗	-0.144∗∗∗	-0.019∗∗∗	-0.008
	(0.032)	(0.048)	(0.027)	(0.003)	(0.008)
Education_4	-0.234∗∗∗	-0.366∗∗∗	-0.217∗∗∗	-0.030∗∗∗	-0.036∗∗∗
	(0.032)	(0.050)	(0.028)	(0.003)	(0.009)
Education_5	-0.137∗∗∗	-0.652∗∗∗	-0.279∗∗∗	-0.048∗∗∗	-0.087∗∗∗
	(0.034)	(0.056)	(0.030)	(0.003)	(0.010)
Fixed Effects	Y	Y	Y	Y	Y
Observations	785,950	798,936	586,259	808,430	746,656
R-squared	0.341	0.151	0.507	0.151	0.038

Targeting and Shocks to Credit Risk

Use changes in state level unemployment insurance (UI)

Reduces exposure to one of the largest negative shocks customers might suffer

UI increased in staggered way across US states during 2000s

Standard Difference in Difference estimator

$$Y_{i,t} = UI_{dummy} + UI_{pre-trend} + CellFE + BankFE + TimeFE + \varepsilon$$

UI dummy for states where the change in UI is >10% (first jump)

Checked many other cut-offs as well

Unemployment Insurance Shock

Unemployment Insurance and Credit Card Terms								
Panel A								
	1	2	3	4	5	6	8	9
Dependent Variable	APR	Default APR Dummy	Late Fee	Annual Fee	Intro_APR	Backward	DefaultAPR MainPage	LateFee MainPage
FFR	0.421***	-0.048***						
	(0.043)	(0.003)						
UI	-0.276	0.044	0.909**	0.271	0.123**	0.080**	-0.011***	-0.012**
	(0.353)	(0.028)	(0.389)	(0.454)	(0.056)	(0.036)	(0.003)	(0.005)
UI_Pre_3M	-0.005	0.022	0.655***	-0.036	0.140*	0.059	-0.005	-0.010
	(0.120)	(0.021)	(0.185)	(0.361)	(0.077)	(0.037)	(0.005)	(0.009)
UI_Pre_6M	0.156	-0.068***	-0.204	-0.159	0.066	0.071***	-0.004	-0.001
	(0.269)	(0.024)	(0.450)	(0.714)	(0.043)	(0.024)	(0.004)	(0.010)
UI_Small	-0.052	-0.015	0.125	-1.321	0.065	0.017	-0.006	0.012
	(0.158)	(0.015)	(0.402)	(0.925)	(0.042)	(0.034)	(0.004)	(0.010)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cell Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	93,224	93,491	92,876	93,215	93,940	92,629	46,161	46,161
R-squared	0.263	0.410	0.179	0.193	0.121	0.121	0.054	0.029

	Unemployment Insurance and Credit Card Design						
Panel A							
	1	2	3	4	5	6	7
Dependent Variable	Color	ComplexRatio_Front	ARI_Front	ColemanLiauFront	Grade Front	Readability_Front	Readability (Front-Back)
UI	0.027**	-0.003*	-0.267*	-0.263**	-0.103*	-0.036*	-0.019*
	(0.012)	(0.002)	(0.144)	(0.123)	(0.052)	(0.021)	(0.010)
UI_Pre_3M	0.015	-0.003	-0.354*	-0.303	-0.077*	-0.054*	0.030
	(0.017)	(0.002)	(0.195)	(0.201)	(0.039)	(0.030)	(0.020)
UI_Pre_6M	0.012	-0.003	-0.066	-0.037	0.007	-0.007	0.019
	(0.008)	(0.002)	(0.145)	(0.084)	(0.078)	(0.019)	(0.016)
UI_Small	0.010	-0.005**	-0.418	-0.277	-0.212	-0.069*	0.006
	(0.012)	(0.003)	(0.247)	(0.196)	(0.137)	(0.040)	(0.025)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cell Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	81,968	43,938	43,938	43,938	43,764	43,938	43,122
R-squared	0.038	0.091	0.098	0.056	0.058	0.049	0.051

Summing up

- **Fintech provides enormous opportunities for companies**
  - Cheaper more convenient access to services
  - More customized and personalized services to a larger fraction of consumers
  - Products that used to be on affordable to HNW individuals can now become affordable in mass-market

- **But it will also create new challenges for firms**
  - Financially less sophisticated consumers might be unprepared for the disruptions in the market
  - Short term gains from more competitive targeting
  - Long term risks for reputation and consumer back lash

Thank You