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Goldman Sachs

VENTURE CAPITAL HORIZONS

The Global Venture Landscape: Decrypting FinTech

The Global VC Landscape

Global VC funding grew +65% yoy (vs. 18% in 2Q) to just over $43bn in 3Q17, marking a multi-year high for investment, led by accelerating growth in Technology, Healthcare, FinTech, and Industrials (see pg. 2 dashboard). 3Q marks the second quarter in a row to surpass $40bn in funding, the only two quarters to do so in the last 5 years. With a record amount of dry powder still sitting in funds and larger rounds for more mature companies increasingly common, we expect funding records will continue to be broken.

FinTech VC Moves On from Lending

FinTech venture has begun to recover from the lows set in 2H16 following the hard reset in the personal and SMB online lending markets in 1H16. Funding levels have risen by ~25% sequentially for two quarters in a row with a focus on funding early efforts in Blockchain and Payments, as the largest rounds go to regulatory compliance and other operational technologies, particularly in Capital Markets. Growth in consumer facing efforts seems to be limited to Wealth Management as Retail Banking & Lending decline.

Decrypting the Initial Coin Offering (ICO)

With potentially much broader implications, we have seen growth in ICO-based funding spike to $2.7bn in the past 6 months compared to less than $100mn in the prior period.

Asset Managers, AI, & Big Data

In response to building structural pressures, asset managers are increasingly looking to alternative ways to generate alpha, such as using big data and machine learning – further deepening competitive moats between stronger and weaker players. Inside we profile Enigma (data infrastructure provider) and Numerai (machine learning hedge fund).

Spotlight On: FinTech

$58bn

Venture investment in FinTech companies over the last 5 years, on a 40% 5-year CAGR

$1.2tn

The 2017YTD AUM in quant funds ex. hedge funds vs. $612bn in 2011

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Global VC Snapshot - 3Q2017

Deal volume

3,991

(+16% yoy)

Investment

$43BN

(+65% yoy)

VC funding growth by sector

- Technology +74% yoy
- Consumer (ex-eCommerce) +54% yoy
- Healthcare +44% yoy
- Industrials +146% yoy
- Financials/FinTech +34% yoy
- Energy -56% yoy

Where the Dollars Are Going in…FinTech (p. 18)

We use our vertical analysis framework to highlight subsector opportunities and representative companies across the VC funding spectrum.

VC Funding Growth

Stage 1

Rapidly growing on both a dollar and deal count basis; low capital base

Blockchain
R3
Coinbase

Billing, Expense Mgmt & Procurement
AvidXchange
ServiceChannel

Stage 2

Faster growing verticals on a larger capital base

Regulatory Tech
ForgeRock
Druva

Wealth Tech
Futu Securities
Addepar
Robinhood

Stage 3

Modest growth within large investment verticals

Capital Markets Tech
Blend
Cadre
Symphony Communications

Accounting & Finance: Software Services
Kabbage
DianRong

Stage 4

Declining growth off a large capital base

Real Estate Tech
OpenDoor Labs
Convene

Startups Disrupting Retail Banking
SoFi
DianRong

VC Capital Base

Spotlight on… Initial Coin Offerings (p. 23)

$2BN+ Amount of ICO fundraising in the last 6 months

vs.

$100MN Amount of ICO fundraising in the 6 months prior

1. **Filecoin**
2. **Tezos**
3. **EOS Stage 1**
4. **Bancor**

ICOs raising over $100mn in capital through 3Q 2017. Avg. capital raised per round YTD across all venture categories was $21mn.

Profiles on pg. 30

PM Summary – Focus on FinTech

VENTURE CAPITAL HORIZONS

This is the third report in our **VCH series**.

For our previous reports see:
Consumer edition…
Healthcare spotlight…

Venture capital is playing an increasingly important role in the investment process regardless of the investor or investment. As more money moves into Venture as an asset class, private companies grow larger and become more impactful to larger parts of the economic landscape, and both public companies and public market investors invest more into private companies understanding the trends in venture capital and the new technologies and business models they help create is critical. In the Venture Capital Horizons series, we attempt to monitor venture capital broadly, while choosing in each edition to focus on a specific area of investment that our industry analysts believe is among the most important as well as the companies and investors leading it.

In this edition we look at venture investment within FinTech, before taking an in depth look at the growing influence of artificial intelligence & data in asset management. The evolving use of data by asset managers is an extremely broad theme, ranging from the process of making investment decisions to executing trades and evolving compliance systems. We believe that AI and big data are revolutionizing the competitive landscape for asset managers and that we are reaching an inflection point in the way that institutions large and small are thinking about the investment process.

Exhibit 1: 3Q Global Update: Where is the money going?
$ millions; TTM

Industry	3Q17 TTM	yoy	3Q16 TTM	3Q17 Key Deals	3Q16 Key Deals
Internet	55,644	-4%	58,053	Flipkart, Tokopedia, Deliveroo	Best Logistics Technologies, Airbnb ,Qudian
Mobile & Telecommunications	26,575	31%	20,227	Grab, Ofo, DotC United Group	Grab, GO-JEK, 51Xinyongka
Healthcare	20,212	14%	17,686	United Imaging Healthcare, Auris Surgical Robots, 23andMe	Moderna Therapeutics, Intarcia Therapeutics, Cstone Pharma
Automotive & Transportation	8,047	462%	1,433	Beijing Electric Vehicle Co., Gogoro, Future Mobility Corp.	WM Motor, Protean Electric, XTI Aircraft Company
Computer Hardware & Services	6,534	150%	2,613	Royole Corporation, Desktop Metal, Pi Datacenters	Carbon3D, Neusoft Xikang Healthcare Tech., Druva
Software (non-internet/mobile)	5,409	11%	4,867	SenseTime, NAUTO, Brain Corp	Unity Technologies, Quanergy Systems, Darktrace
Energy & Utilities	4,724	36%	3,484	Sunseap, Advnaced MicroGrid Solutions (AMS), JLM Energy	Howard Energy Partners, Heliatek, ecobee
Consumer Products & Services	3,603	14%	3,149	Vets First Choice, Smartisan Technology, Baofeng TV	Thalmic Labs, UBTECH Robotics, ROOBO
Business Products & Services	3,129	43%	2,193	WeWork, Hero Sports Management, URWork	Yisheng Jinfu Holding Group, Hero Sports Management, Galvanize
Financial	2,922	-52%	6,083	Janalakshmi Financial Services, NewSpring Holdings, Harbour Apartments	Yixin Cpaital, Utkarsh Micro Finance, NeoGrowth Credit
Industrial	2,691	49%	1,807	SpaceX, StoreDot, Geek+	Roboteam, Project Frog, FRX Polymers
Electronics	1,997	28%	1,560	LeddarTech, Cambricon, Aneak	Ostendo Technologies, Celeno Communications, Phononic
Metals & Mining	1,663	29%	1,286	Jetti Resources	N/A
Food & Beverages	1,530	183%	541	Impossible Foods, MycoTechnology, Xinliangji	Ripple Foods, CMS Technology, Drums Food International
Leisure	1,524	-21%	1,918	ONE Championship, DOING NOW, Banana Gaming & Media	Hongyuan Era Sports Industry Group, Philz Coffee, Sliderz
Media (Traditional)	1,280	-9%	1406	Yuanyu Radio, Motie, LiuBai Entertainment	N/A
Agriculture	701	-60%	1739	Agricool, Nextalim, Sfera WaterFood	BrightFarms, Open Blue Sea Farms, Agrivida
Environmental Services & Equipment	200	33%	150	Rubicon Global Holdings, Roadrunner Recycling, Inventys Thermal Tech.	Rubicon Global Holdings
Risk & Security	83	137%	35	CommandScape, Sunflower Labs, Idein	N/A
Retail (non-internet/mobile)	32	-72%	113	WIT Fitness, SWC Enterprise, SirPlus	WithMe, Charming Charlie

Source: CB Insights

Key themes we address in this edition:

1. **A Global Update: VC funding hits consecutive multi-year highs in 2Q, 3Q respectively.**

   Global VC funding grew +65% yoy to just over $43bn in 3Q17, marking a multi-year high for investment and led by accelerating growth in Technology, Healthcare, FinTech, and Industrials. This is vs. 2Q which grew +18% yoy to $42.4bn. These two quarters are the only in the last 5-years to eclipse the $40bn mark.

2. **Corporate Venture: Despite private valuations at Uber, Lyft, and others, AutoTech and connected cars remain hot.**

   2017 to date has been a record period for corporate venture investments in AutoTech and connected cars, with deals including CVC participants eclipsing $1.7bn on 35+ deals. Overall corporate venture activity also remains at its highest levels in terms of total deals, averaging over 400 deals per quarter this year vs. no quarter reaching 400 in the prior 5 years.

3. **A story of age: 1-year venture capital vintages underperforming the public market.**

   As private investment vintages from 3-years to 30-years perform in-line or exceed stock indexes, 1-year vintages are providing returns well below U.S. public index averages, according to Cambridge Associates.

4. **Global verticals: Public investment implications from AI, eSports, cybersecurity, and online travel.**

   Artificial intelligence is a $9bn annualized category for the first time ever, up 122% yoy on a TTM basis. In our vertical analysis framework (pg. 12-16) we highlight public market implications for the noteworthy funding movements out of consumer hardware and into niche verticals like online travel, eSports, cybersecurity, and disease diagnostics.

5. **FinTech verticals: Blockchain, regulatory tech and capital markets tech highlight up and coming categories; real estate tech, retail banking on the decline.**

   While data-driven personal finance and capital markets startups Robinhood, Stash Invest, Addepar and Mint highlight mature and steadily growing categories in FinTech, efforts by banking incumbents to thwart retail banking disrupters along with executions issues at some leading startups has led to a decline of VC funding to the category.

   The evidence is in the app-traffic. Traditional banking apps have maintained nearly 10X the unique visitor traffic of non-traditional banking apps like Mint Bills and Simple. Niche personal finance apps like Credit Karma, Mint, Stash Invest, Personal Capital, Qapital, Digit, and YNAB have ~10% penetration on U.S. mobile devices (18mn unique visitors).

6. **Decrypting the Initial Coin Offering (ICO): What is the appeal for investors?**

   In each of the last four months, ICOs have raised more capital than angel & seed VC investments in Internet. While there are certainly risks to investing in what is largely an unregulated, still developing process, the opportunity to possess a value stake in a potentially innovative project, similar to the development of the Ethereum platform a few years ago, has driven investors to commit capital to ICOs. See page 23 for more.

7. **Data-driven asset management: The latest arms race in the search for alpha.**

   Public traditional asset managers are increasingly citing big data, machine learning and artificial intelligence as a key area of investment on company earnings calls. As active performance remains challenged (across both hedge funds and traditional mutual funds), fee rates continue to work lower and passive continues to take market share, active managers are being forced to find new ways to gain insight. Enigma and Numerai are two examples of innovative companies shaking up the *status quo*. While we see potential for select managers to improve topline dynamics through improving performance and the bottom line through data-driven back office optimization, we also see several challenges that could limit the number of "winners" in the big data arms race. With the help of our GS data works team, we highlight the growing trend of mentions of phrases like "artificial intelligence," "machine learning," and "big data" by publically traded asset managers on earnings calls (pg. 27).

Putting VCH to work: The GS vertical analysis framework

VCH is not meant to simply provide a backward looking scorecard. We believe that by analyzing the shifting flow of investment on a macro and micro level we will be able to expose the emergence of threats to public company profit pools, the creation of future M&A targets and public market competitors, and the development of new technologies and business models. To capture markets that are showing the greatest potential within the private company landscape, we isolate 8 of the fastest growing/declining verticals, categorize them based on stage of growth/decline, and identify key VC-backed players in the space in our proprietary vertical analysis framework for venture as a whole (Exhibit 15) and in this edition, Fintech (Exhibit 26).

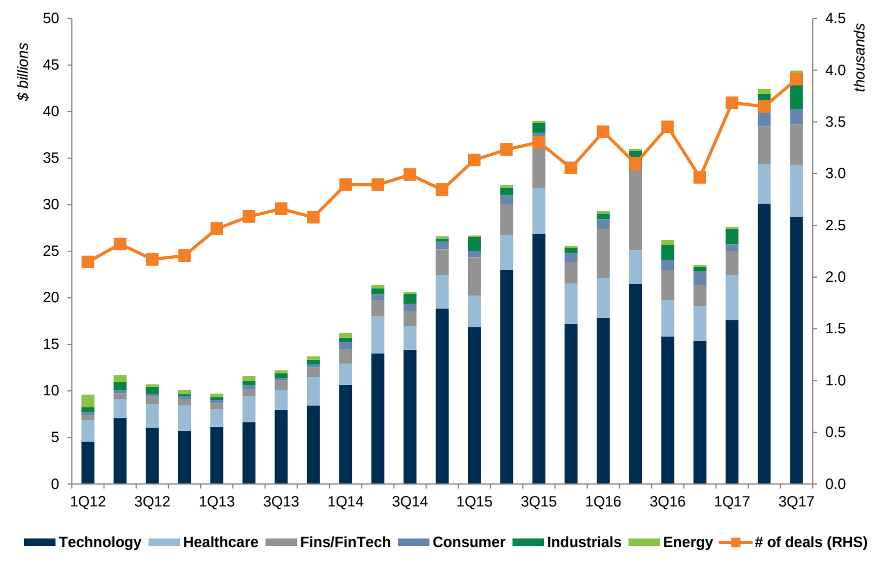
1. The Global Venture Landscape

Global backdrop

Venture capital funding has eclipsed multi-year highs in 3Q after a slow start to the year, with 3Q VC investment +65% yoy (nearly doubling 4Q16 investment) to reach $43bn, while growth in deals continued to be positive (+16% vs. +18% in 2Q) (Exhibit 2 & 3). Looking across verticals we see key categories such as Internet, mobile & telco, and healthcare rebounding from the double digit declines we saw on a TTM basis in 1Q17, while automotive & transportation and computer hardware & services, fourth and fifth in size by macro-category, continued to gain ground on other categories and both grew 100+% yoy vs. 3Q16 TTM.

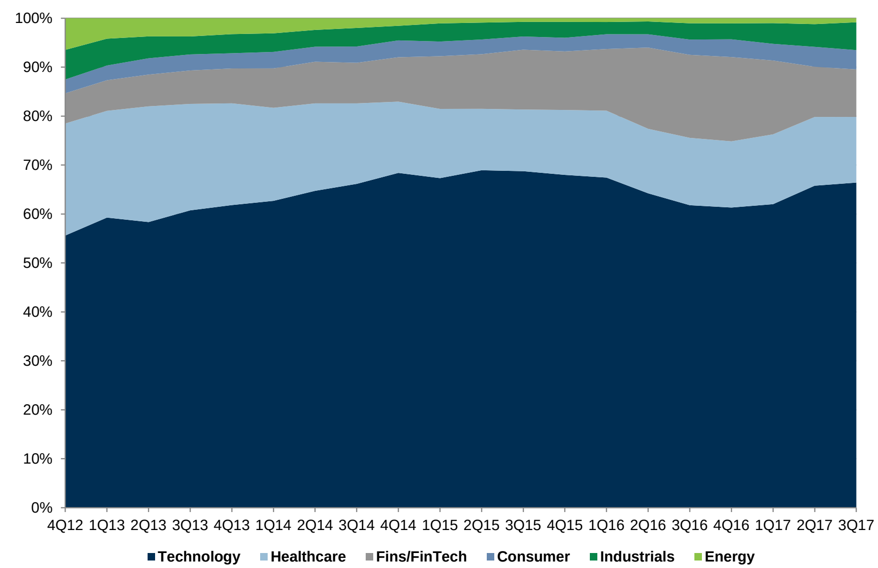
Technology's share of total VC investment has rebounded to previous levels of ~2/3, largely driven by declines in share within FinTech due to lapping the $4.5bn ANT Financial Series B from 2Q16. Industrials is seeing the fastest growth on a sector basis, doubling in share of investment from 3% to 6% in the last 9 months. The surge in industrials funding has come off the back of technology enabling use-cases from smart buildings to vehicles and materials.

Exhibit 2: Global VC investment by sector
$ billions



Source: CB Insights

Exhibit 3: Share of VC Investment by sector
Annualized Share (%)



Source: CB Insights

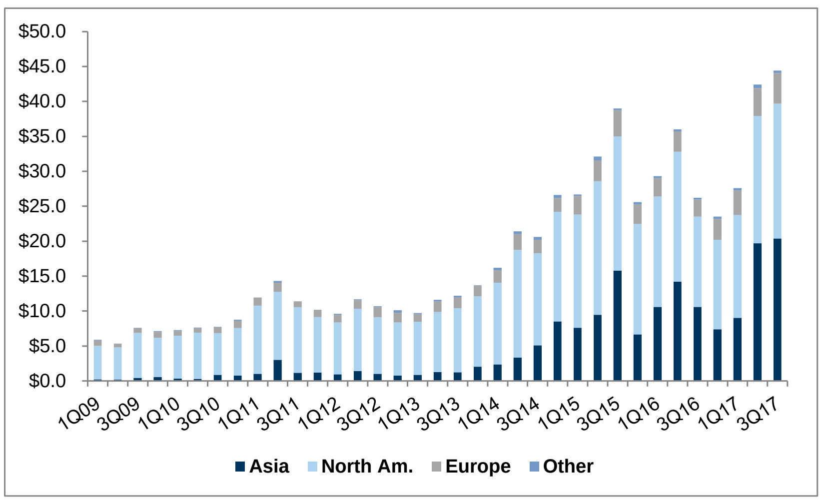
Asia continues to gain share of regional funding

North America-based VC investments continue to hold the majority of total global VC funding (47% LTM funding), though APAC has gained meaningful share. As of 3Q17, Asia represented 41% share of VC funding over the trailing twelve month period vs. 33%/18%/10% in 2015/'14/'13. In particular we saw a 118% qoq growth in 2Q-17, driven by continued increase in VC funding in China. Average deal size in Asia has trended meaningfully higher since the beginning of 2013, exceeding the average deal size in North Am. each quarter since 2Q14. By region, NA saw funding grow 59% yoy in 3Q versus +17% in 2Q, while Asia increased 92% vs +39% in 2Q and Europe grew 78% vs 37% in 2Q.China's crucial role in the overall VC growth is evident with companies receiving 67% of the overall VC funding in the Asia market in 3Q17. While this share is down on a TTM basis from 3Q16 when it was 77%, total deal count (which reduces the effect of larger one off deals like ANT Financial and Didi Chuxing) more than tripled from 1Q to 3Q, reaching 559.

MINDCRAFT

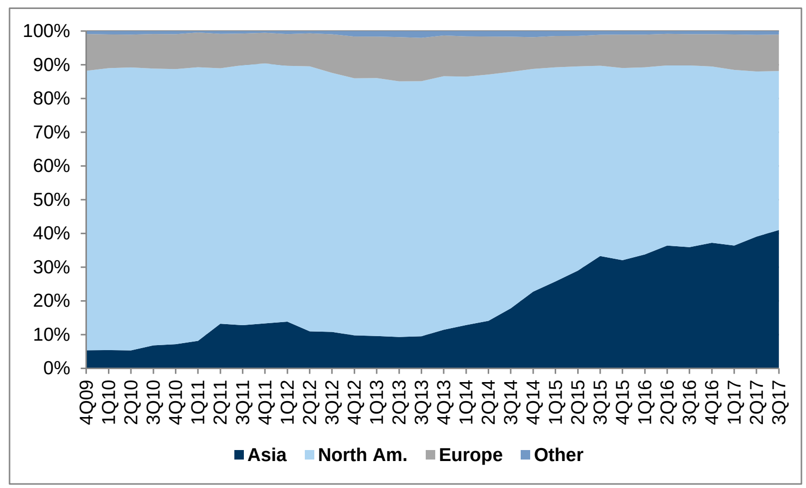
Related reads from the Mindcraft thematic bookshelf

Exhibit 4: VC investment by region
$ billions



Source: CB Insights

Exhibit 5: Share of total global VC investment by region
$ millions per deal



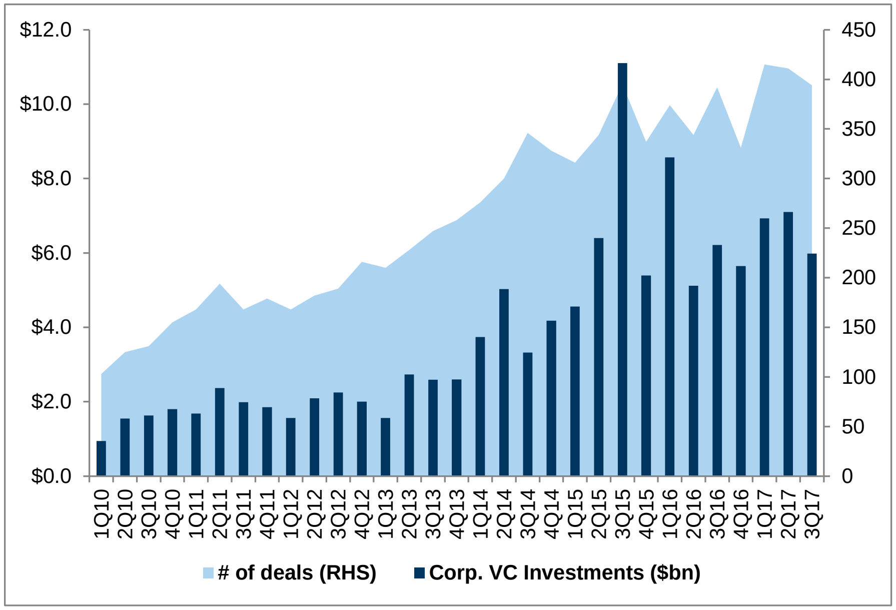
Source: CB Insights

2. Corporate VC investments: Focus on AutoTech

In this edition we also highlight corporate VC and its influence on investments. Corporates have increasingly entered the venture landscape through corporate venture capital (CVC) arms in the last decade. CVC interest has increased, in our view, due to returns, exposure to new innovative technologies, market knowledge, new business models, and eventual acquisition in a few cases.

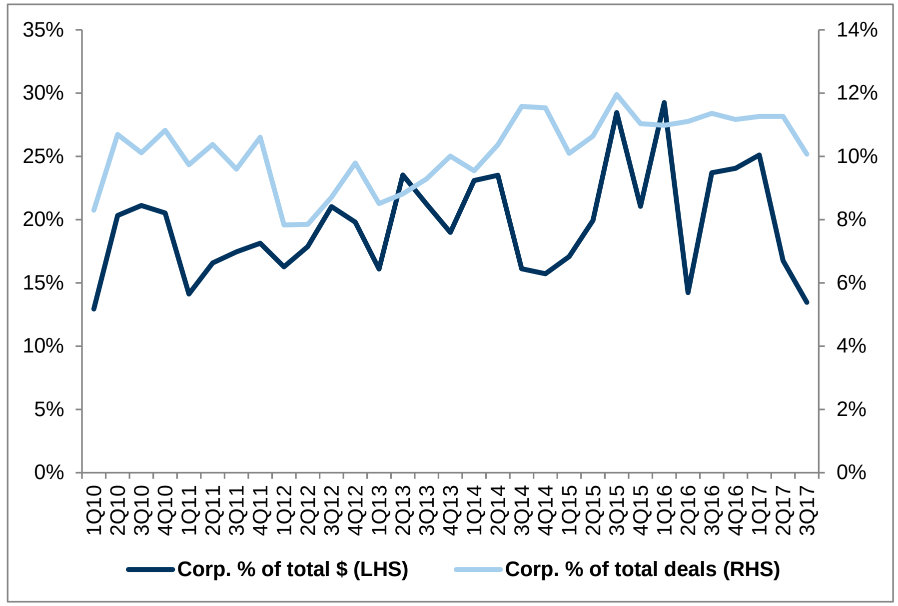
In 3Q17, corporate VCs participated in nearly $6bn of funding globally (14% share of total VC investment) across 394 deals, or 10.1% share (Exhibit 7). Corporate VC investment declined 4% yoy in 3Q17 (vs. versus +39% growth in 2Q), on the heels of fewer $100mn+ deals in the quarter.

Exhibit 6: Global VC activity by corporates
$ billions



Source: CB Insights
Note: Only includes investment by Corporate VC funds. Strategic investments made directly are not included.

Exhibit 7: Corporate VC share of total VC
% of total investment deals



Source: CB Insights

Connected Cars & AutoTech: Continuing to be a CVC focus

With the concept of driverless vehicles approaching reality, CVCs have been investing heavily in the connected car and AutoTech segment. 2017 YTD has been a record-breaking period for the category with a total of $1.7bn (vs. $517 mn in 2016). A contributor to this funding activity was Peloton Technology, which is a company that has raised $84 mn to date and is working on truck platooning, which enables communication between trucks to optimize fuel consumption and reduce road traffic. These corporate venture investments are in addition to continued corporate investments in tech-enabled mobile travel platforms (i.e. Lyft, Didi) as well as direct corporate investments in the period to companies such as Grab, which raised $2bn and is planning to collaborate with Toyota, a round investor, in installing driving recording devices in Grab's vehicles under a pilot program to analyze the driving patterns of users and then accordingly make recommendations to improve the experience for Grab's drivers. Despite private valuations at Uber, Lyft, and others, we see further investment potential in the category as vehicular technology evolves.

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Related reads from the Mindcraft thematic bookshelf

EV Boom | Future of Oil Demand | Rethinking Mobility | From Pump to Plug | Cars: The Road Ahead

Exhibit 8: Top 25 VC deals with Corporate VC participants

Largest deals 1Q16-3Q17

Company	Company Description	Deal Size ($mn)	Date	Round	Total Funding ($mn)
Lu.com	Operates two online lending & financing platforms for small and medium enterprises and individual clients.	$1,216.00	1/8/2016	Series B	$1,701.00
OneWeb	Plans to put more than 600 satellites in orbit to provide low-cost global Internet access.	$1,200.00	12/19/2016	Unattributed VC	$1,719.10
GRAIL	Aims to detect cancer early when it can be cured.	$914.02	3/1/2017	Series B	$1,073.25
Magic Leap	Magic Leap is a developer of novel human computing interfaces and software.	$793.50	2/2/2016	Series C	$1,390.50
NIO	A China-based manufacturer of smart, electronic, and autonomous vehicles.	$600.00	3/15/2017	Series D	$1,200.00
Lyft	Online social rideshare community building a marketplace for drivers to sell empty seats in cars.	$600.00	4/6/2017	Series G	$2,462.50
Airbnb	Ccommunity marketplace for people to list, discover, and book accommodations.	$555.46	8/8/2016	Series F	$4,398.13
GO-JEK	Social enterprise that deliver a one-stop-shop convenience service for Indonesians.	$550.00	8/4/2016	Series B	$1,750.00
Oscar Insurance Corporation	Aims to offer unlimited telemedicine consultations and free generic medications to its members.	$400.00	2/22/2016	Series C	$727.50
Gogoro	Designer and manufacturer of smart electric scooters as well as battery swiping infrastructure	$300.00	9/19/2017	Series C	$480.00
Essential Products	Company focused on creating consumer technology products for the 21st century.	$300.00	6/7/2017	Series B	$330.00
Deliveroo	End-to-end food delivery service using proprietary technology and logistics platform.	$275.00	8/5/2016	Series E	$474.68
Innovent Biologics	China based company focused on the development and manufacturing of complex, high-end biologics.	$260.00	11/29/2016	Series D	$385.00
Human Longevity	Building a comprehensive database of human genotypes for a variety of commercialization opportunities.	$220.00	4/4/2016	Series B	$300.00
OpenDoor Labs	Homeowners can visit Opendoor.com, receive a guaranteed Opendoor offer and complete their sale in a few clicks.	$210.00	11/30/2016	Series D	$319.95
Slack Technologies	Offers a team communication platform in one place that is instantly searchable and available wherever.	$200.00	4/1/2016	Series F	$540.20
Souche Holdings	Provides C2C platform allowing used-car sellers to dictate their prices	$180.00	4/6/2017	Series D	$290.00
Flatiron Health	Health care technology company and operator of the OncologyCloud platform.	$175.00	1/6/2016	Series C	$313.00
Casper	Aims to launch a single mattress designed and engineered to contour to the body and avoid overheating.	$170.00	5/25/2017	Series C	$239.70
Tricentis	Provide integrated software testing solution, test data management and provisioning.	$165.00	1/23/2017	Series B	$174.00
SigFox	Provider of dedicated cellular connectivity for Internet of Things and Machine-to-Machine communications.	$160.00	11/18/2016	Series E	$311.04
NAUTO	A device, network and app that is an affordable way to upgrade cars to get network and safety features.	$159.00	7/19/2017	Series B	$182.60
Huochebang	Huochebang is an online truck logistics platform that provides integrated services to truckers and shippers in China.	$156.00	5/2/2017	Series B - III	$306.00
Shanghai Star48 Culture & Media Co.	It represents over 300 artists across the entertainment industry, including music, movies, and television programs.	$150.00	5/9/2017	Series C	$150.00
CStone Pharma	Covering areas, including oncology, cardiovascular diseases, rheumatoid arthritis, hematology and autoimmune diseases.	$150.00	7/6/2016	Series A	$150.00

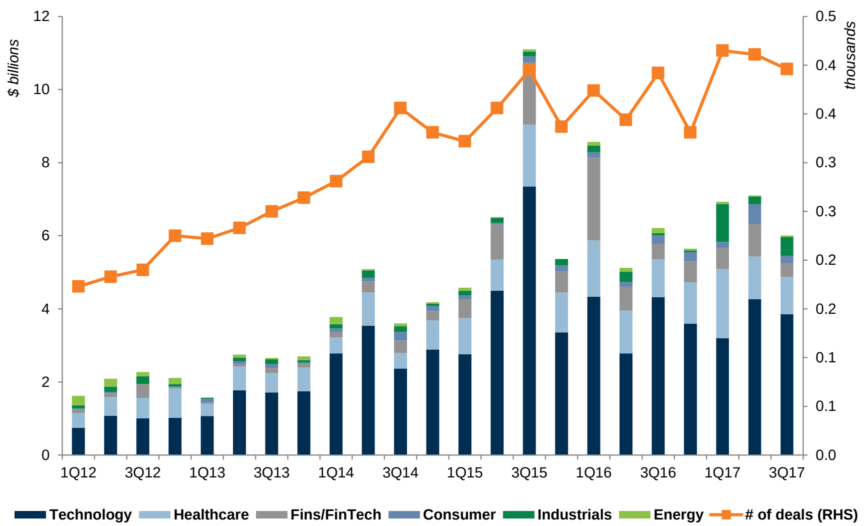
Source: CB Insights

Note: Only includes investment by Corporate VC funds. Strategic investments made directly are not included.

Where are corporates investing differently?

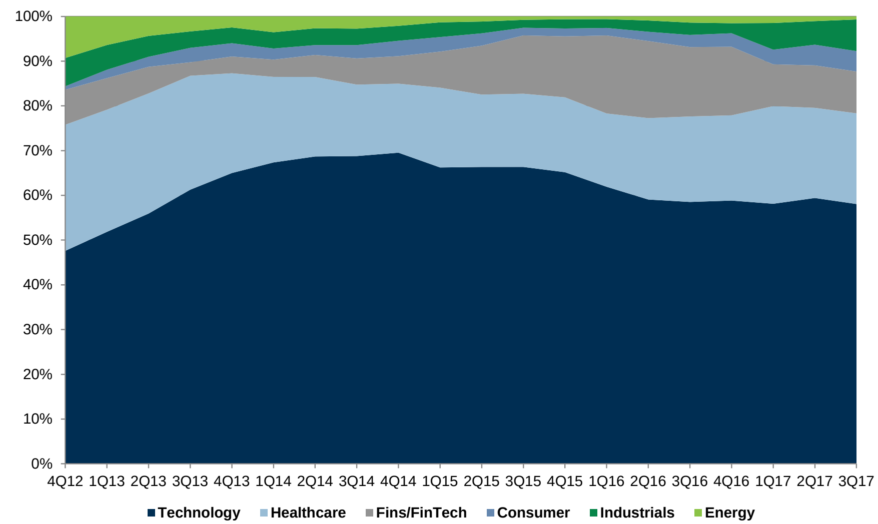
Looking at the distribution of CVC across sectors (Exhibit 10) and comparing to overall VC investment (Exhibit 2), the largest difference in sector breakdown is Technology, with a reduced investment share of 58% (3Q17 TTM) vs. 67% in total VC, and Healthcare with a higher investment share of 20% 3Q17 TTM share vs. 13% total VC. This differentiation is supported by the relative strength of healthcare corporates in VC investments; with J&J, Pfizer, Celgene, Roche, and Novartis being active players in the space.

Exhibit 9: Global corporate VC investment by sector
$ billions



Source: CB Insights, Goldman Sachs Global Investment Research

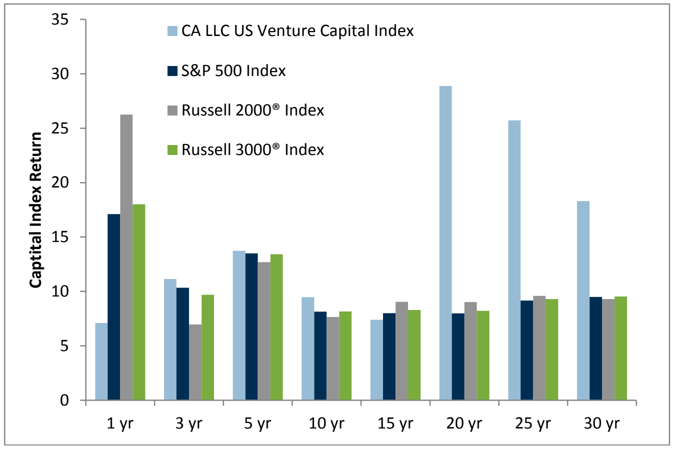
Exhibit 10: Share of corporate VC investment by sector
Annualized share (%)



Source: CB Insights, Goldman Sachs Global Investment Research

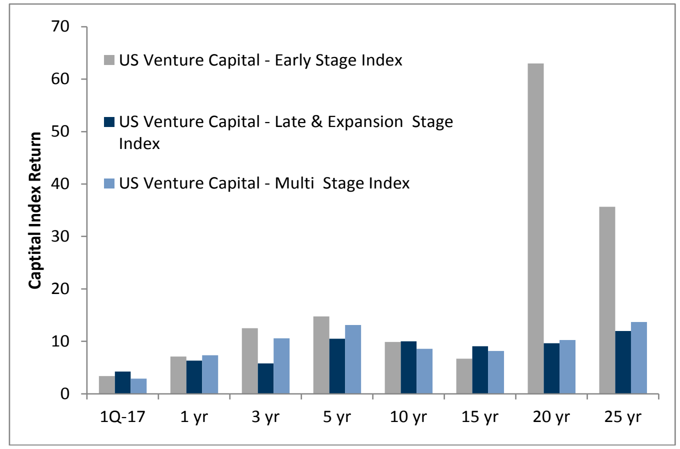
3. VC ROI: 1-year vintages underperform in the U.S.

Exhibit 11: US Venture Capital Index and Selected Benchmark Statistics
Horizon Pooled Return Compared to CA Modified Public Market Equivalent*



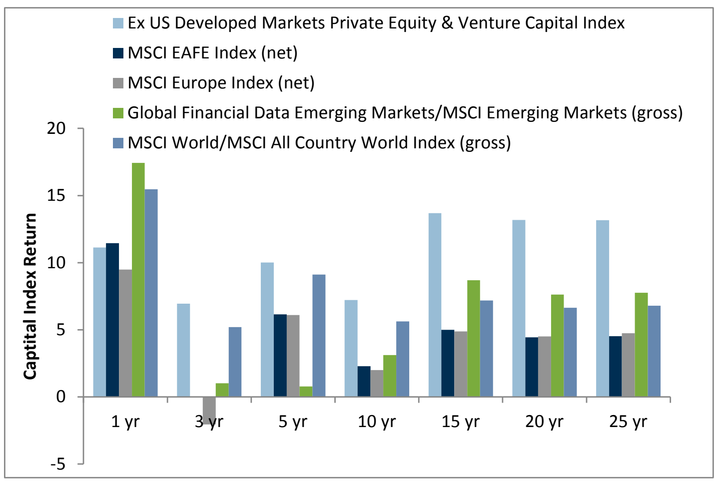
Source: Cambridge Associates LLC

Exhibit 12: US Venture Capital Index



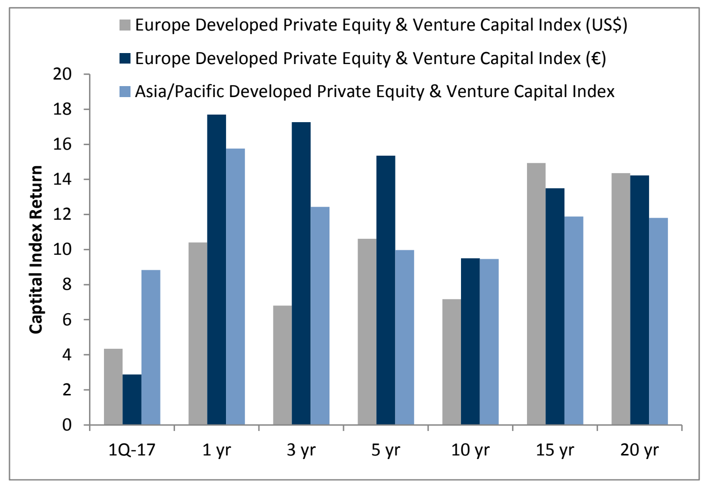
Source: Cambridge Associates LLC

Exhibit 13: International VC & PE Index /Selected Benchmark Statistics
Horizon Pooled Return Compared to CA Modified Public Market Equivalent*



Source: Cambridge Associates LLC
Note:*The mPME calculation is a private-to-public comparison that seeks to replicate private investment performance under public market conditions. For further information see Cambridge Associates.

Exhibit 14: International VC & PE Index



Source: Cambridge Associates LLC

4. Global Venture: Updating our vertical analysis framework

Vertical Analysis Framework: Global Venture

We identify smaller subsets of categories/companies in various growth stages that are driving the Global VC narrative and highlight eight sub-verticals within our vertical framework analysis (Exhibit 15). Top deals refer to largest deals by venture capital dollars invested 3Q17 TTM.

- **Stage I**: Rapidly growing verticals on a dollar / deal count basis vs. a relatively low base
- **Stage II**: Verticals growing at a strong pace vs. a slightly higher base. Generally a higher share of overall funding vs. Stage I.
- **Stage III**: Modestly growing, mature categories with more established annual funding. Generally exhibits growth in exits.
- **Stage IV**: Verticals with declining investment growth vs. a generally high base

Exhibit 15: Select verticals by stage
TTM: % change yoy

		$ millions			# of deals				
Stage	Verticals	3Q17	3Q16	yoy	3Q17	3Q16	yoy	Sub-verticals in focus	Top deals
I	Travel Software/Services	$1,086	$298	264%	89	67	33%	Search platforms, rental platforms	Treveloka Indonesia, EasyLife Fin. Svcs.
	Disease Diagnosis	$1,824	$343	432%	61	34	79%	Genetics platforms, diagnostic testing	GRAIL, 23andMe
II	eSports	$1,805	$1,360	33%	89	78	14%	Gaming platforms, live streaming networks	Sea, Hero Sports Management
	Internet: Monitoring & Security	$1,947	$1,698	15%	245	238	3%	Fraud protection, cloud security	Illumio, CrowdStrike
III	Artificial Intelligence	$9,010	$4,053	122%	881	616	43%	Big data, democratized AI	Bytedance, NIO
	Ecommerce: marketplace	$4,701	$3,400	38%	538	558	-4%	P2P lending, online retail	Tokopedia, SoFi
IV	Consumer Hardware	$2,146	$4,683	-54%	444	588	-24%	Smart Home, robotics devices	Essential Products, Haier U-home
	Internet of Things (IoT)	$3,921	$3,724	5%	324	514	-37%	Cloud-based robotics, device protection	SigFox, Desktop Metal

Source: CB Insights, Goldman Sachs Global Investment Research.

*Note: Some companies overlap between categories.

Stage I: Hyper-growth, early stage verticals

Travel Software/Services

The online travel industry has faced increasing pressure from competitors for online traffic, whether it be Google, metasearch, OTAs, chain hotels, or independents. In our view, the category has become more and more about math; with companies increasingly competing for the same traffic and needing to sacrifice margin to generate growth (see Peak travel: Crowding & competition; PCLN to Neutral, TRIP to Sell). The rapid funding growth to travel search & booking platforms across Asia and Europe highlights optimism in the macro travel environment (global ADRs and occupancy rates continue to be strong), yet we believe this only further contributes to the competitive headwinds for public incumbents that compress commissions and increase costs of customer acquisition. As a result, we have seen efforts to thwart this competition through acquisition. TTM M&A exits in the category have grown +73% yoy to 52, with Priceline, Booking.com, and Ctrip each acquiring companies in the last year.

- **Top Investors by deal count:** Gobi Partners, NFX, 500 Accelerator, Innovation Works

Disease Diagnosis

From both a VC investment and deal count perspective, disease diagnosis is among the fastest growing categories in Venture. Over the last year, growth in health technology and use of AI in healthcare has spurred a number of mid-to-late stage rounds at genomics companies like 23andMe and Color Genomics, while medtech companies like Freenome and Werlabs are revolutionizing diagnostics, screenings, and other detection mechanisms. Healthcare corporates J&J, Bristol-Myers Squibb, Celgene, and Merck have taken notice, each participating in investment rounds for disease diagnosis companies in the last year. In 3Q, the category saw multi-year highs in number of IPOs (4) and M&A exits (5).

- **Top Investors by deal count:** Data Collective, Khosla Ventures, Y Combinator

Exhibit 16: Travel Software/Services – TTM largest deals
$ millions

Company	Company Description	Round	Date	Amount	Total Funding
Traveloka Indonesia	Indonesian online travel	Series B - II	Jul-17	$350.0	$500.0
EasyLife Financial Services	Travel financial services unit	Series B	Dec-16	$273.0	$273.0
Traveloka Indonesia	Indonesian online travel	Series B	Jan-17	$150.0	$500.0
GoEuro	European travel search platform	Series C	Oct-16	$70.0	$146.0
Huangbaoche	Tour packages and travel guide booking	Series B	Jan-17	$30.0	$61.5
Woqu	China-based travel site focused on U.S. market	Series B - II	Mar-17	$25.0	$45.0
TurnKey Vacation Rentals	Vacation rental manager	Series C	Mar-17	$21.0	$35.5
Haoqiao	Hotel searching and booking platform	Series B - II	Feb-17	$17.0	$26.0
Danke Gongyu	Apartment rental platform	Series A	Jun-17	$14.0	$14.0
Remote Year Holdings	Working remotely while traveling	Series A	Oct-16	$12.0	$12.2

Source: CB Insights, Goldman Sachs Global Investment Research.

Exhibit 17: Disease Diagnosis – TTM largest deals
$ millions

Company	Company Description	Round	Date	Amount	Total Funding
GRAIL	Life sciences company; cancer detection	Series B	Mar-17	$914.0	$1,073.3
23andMe	Personal genetics company	Series F	Sep-17	$250.0	$494.1
Freenome	Patient Disease screenings	Series A	Mar-17	$65.0	$79.1
GRAIL	Life sciences company; cancer detection	Series B - II	Apr-17	$59.2	$1,073.3
Goldfinch Bio	Precision therapies for kidney disease	Series A	Dec-16	$55.0	$55.0
Color Genomics	Democratizing access to genetic information	Series C	Aug-17	$52.0	$112.0
Karius	Life sciences company; infectious diseases	Series A	Aug-17	$50.0	$50.0
Sera Prognostics	Diagnostic tests for pregnancy complications	Series C	Jan-17	$40.0	$100.3
Genalyte	Rapid diagnostic testing	Series D	Nov-16	$36.0	$91.8
Exosome Diagnostics	Bio-fluid based diagnostics	Series C	Jul-17	$30.0	$117.0

Source: CB Insights, Goldman Sachs Global Investment Research.

Stage II: Fast growing verticals on a larger capital base

eSports

In his initiation of Video Games stocks, GS Analyst Chris Merwin highlighted the 191mn person audience globally that participates in the growing eSports trend on a monthly basis, which he believes is set to far surpass major pro leagues in the United States (see Entering the halcyon days of Gaming's digital age; initiate with an Attractive view, Buy EA). He further outlined the $1bn revenue opportunity in 2017, generating future upside from distribution of premium content through eSports channels by IP owners of eSports titles. The venture money is certainly following the traffic growth, with a variety of companies from visual technology developers (Unity Technologies), gaming platforms (Sea) and live streaming/broadcasting platforms (Huya, Chushou TV) driving growth in deal count and VC funding in the last 12 months, especially in Asia. In the last two years, Tencent, Activision, and Microsoft have all acquired eSports companies, while TTM M&A exits are +15% yoy to 23.

- **Top Investors by deal count:** March Capital Partners, Greycroft Partners, Index Ventures, Play Labs, startup300

Monitoring & Security

Amidst a tightening regulatory environment and an increasing frequency of data breaches across corporations, monitoring and security has become an increasing focus for companies across verticals including e-commerce, payments, industrials, and even advertising. Especially in hybrid cloud scenarios where seamlessly integrating workloads may prove more difficult, securing a larger number of diverse data pieces has become increasingly more challenging as it is important. Cloud-services company j2 Global leads acquirers with 8 acquisitions in the last two years, while Accenture, Akamai, IBM, Cisco, Oracle, Microsoft, Salesforce, MasterCard and Juniper have each made an acquisition in the same time frame, with TTM M&A exits up +44% yoy to 79. See GS Analyst Gabriella Borges' piece on Artificial Intelligence in Cybersecurity for more on the evolution of the space.

- **Top Investors by deal count:** New Enterprise Associates, Bessemer Venture Partners, Cyber London Accelerator, Google Ventures, Kleiner Perkins Caufield & Byers, Paladin Capital Group

Exhibit 18: eSports – TTM largest deals
$ millions

Company	Company Description	Round	Date	Amount	Total Funding
Sea	Online gaming platform	Series E	May-17	$550.0	$722.0
Hero Sports Management	Organizes and manages sports events	Series B	Sep-17	$255.7	$336.7
Unity Technologies	Development platform for 2D, 3D, VR and AR exp.	Series D	May-17	$250.0	$448.5
DraftKings	Daily fantasy sports gaming	Series E - II	Mar-17	$100.0	$727.6
Huya	Live game broadcasting platform	Series A	May-17	$75.0	$75.0
Scopely	Mobile gaming network	Series C	Jun-17	$60.0	$158.5
Chushou TV	Mobile live streaming network	Unatt. VC	Jan-17	$58.0	$58.0
Hammer & Chisel	Game development studio	Series E	Jan-17	$50.0	$79.3
Razer	Computer peripherals manufacturer	Series D	May-17	$50.0	$175.0
RFRSH Entertainment	eSports media company	Series A	Dec-16	$28.1	$40.6

Source: CB Insights, Goldman Sachs Global Investment Research.

Exhibit 19: Internet: Monitoring & Security – TTM largest deals
$ millions

Company	Company Description	Round	Date	Amount	Total Funding
Illumio	Controlling unauthorized communications	Series D	Jun-17	$125.2	$267.2
CrowdStrike	Endpoint protection and threat intelligence	Series D	May-17	$100.0	$256.0
Cybereason	Tracking actions of cyber attackers	Series D	Jun-17	$100.0	$188.6
Signifyd	Guaranteed fraud protection	Series C	May-17	$56.0	$106.2
Netwrix	Governance platform for hybrid cloud security	Series A	Feb-17	$51.0	$51.0
Bitglass	Data protection for enterprise in cloud	Series C	Jan-17	$45.0	$80.0
Threat Stack	Identifies and verifies insider threats	Series C	Sep-17	$45.0	$72.2
HackerOne	Vulnerability management platform	Series C	Feb-17	$40.0	$74.3
Qadium	Global internet intelligence company	Series B	Aug-17	$40.0	$66.0
HyTrust	Cloud infrastructure security	Series E	Jul-17	$36.0	$103.5

Source: CB Insights, Goldman Sachs Global Investment Research.

Stage III: Modest growth within larger investment verticals

Artificial Intelligence

AI as an investment category continues to grow to unprecedented levels. After reaching $1bn annually in late 2014, TTM VC investment has reached $9bn driven by both the emergence of new disruptors in early-stage rounds as well as mid to late stage rounds at companies such as NIO and SenseTime. Large corporate acquirers have driven TTM M&A exits +45% yoy to 113, with Apple, Intel, Google, Baidu, Facebook, Microsoft, Salesforce, Amazon, eBay, Ford, GE, and Oracle all acquiring 2 or more AI companies in the last 2 years. One of the big keys for corporates amidst growing interest in AI is talent acquisition, and often times acquiring AI startups provides human capital that can take a company to the next level. With continued hyper-growth in VC investment and M&A exits on an already high base of investment capital, recent growth only provides further evidence that companies perceive AI as the apex technology of the information age.

- **Top Investors by deal count:** Y Combinator, New Enterprise Associates, Intel Capital, Accel Partners, Felicis Ventures

Ecommerce: Marketplace

Growth in private marketplace investments is coming from two major categories: Traditional retail ecommerce, and internationally-based P2P or loan platforms to consumers and SMEs. While the wave of P2P and online lending hit its peak with investments and IPOs at LendingClub, OnDeck, and others, venture trends would suggest that there remains some traction in the U.S. (i.e. SoFi) while international players are now also beginning to see traction. On the retail side, a growing number of store closures (see Global Internet: Raising global eCommerce forecasts on fast growing countries & categories) in the U.S. and the varying stages of secular online shift occurring across geographies is driving growing in funding, particularly internationally. TTM M&A exits are +83% yoy to 115; however, unlike Artificial Intelligence where we see a large number of acquisitions by tech incumbents, traditional retailers are generally remaining on the sidelines in eCommerce marketplace deals.

- **Top Investors by deal count:** Y Combinator, 500 Startups, BPI France, Global Founders Capital, Index Ventures

Exhibit 20: Artificial Intelligence – TTM largest deals
$ millions

Company	Company Description	Round	Date	Amount	Total Funding
Bytedance	News reading app using AI technologies	Series D	Apr-17	$1,000.0	$1,105.0
NIO	Manufacturer of vehicles (smart/autonomous)	Series D	Mar-17	$600.0	$1,200.0
SenseTime	Computer vision, intelligence	Series B - III	Jul-17	$230.0	$410.0
Mobvoi	Smartwatch company	Series D	Apr-17	$180.0	$253.7
WuXi NextCODE	Global platform for genomic data	Series B - II	Sep-17	$165.0	$255.0
NAUTO	Vehicle network & security	Series B	Jul-17	$159.0	$182.6
Indigo Agriculture	Microbial solutions (agricultural production)	Series D	Sep-17	$156.0	$319.5
Zymergen	Unlocking power of biology	Series B	Oct-16	$130.0	$174.0
SenseTime	Computer vision, intelligence	Series B	Dec-16	$120.0	$410.0
Element AI	Launches/incubates AI solutions	Series A	Jun-17	$102.0	$102.0

Source: CB Insights, Goldman Sachs Global Investment Research.

Exhibit 21: Ecommerce: marketplace – TTM largest deals
$ millions

Company	Company Description	Round	Date	Amount	Total Funding
Tokopedia	Indonesian online-mall marketplace	Series F	Aug-17	$1,100.0	$1,347.7
SoFi	Lending & wealth management	Series F	Feb-17	$500.0	$2,194.1
Tuandaiwang	P2P online lending	Series D	May-17	$292.0	$347.4
Paytm Mall	Indian online retailer	Series A	Feb-17	$200.0	$200.0
Dashu Finance	Unsecured loans to SMEs	Series C	Jul-17	$117.6	$210.6
Funding Circle	Direct lending platform (business loans)	Series F	Jan-17	$100.0	$373.2
iqianbang.com	P2P lending platform	Series B	Jul-17	$74.1	$74.1
ManoMano	Online European marketplace (DIY, niche)	Series C	Sep-17	$72.0	$89.7
Rover	Dog care providers/owners marketplace	Series F	Jul-17	$65.0	$155.9
Patreon	Enabling engagement between artists/fans	Series C	Sep-17	$60.0	$107.1

Source: CB Insights, Goldman Sachs Global Investment Research.

Stage IV: Declining growth vs. a larger capital base

Consumer Hardware

While high-level themes pertinent to early-stage consumer hardware companies such as product appeal, consumer demand, and capital allocation make this a uniquely difficult category from initial investment to successful product launch, we believe that the manifestation of competitive advantages by incumbents has made it even more difficult for startups in the space in the last year. Just one example is tech incumbents Amazon, Google, Apple and Microsoft taking lead in voice and related consumer hardware (i.e. Amazon Echo, Google Home, Apple iPhone), a category where the incumbency advantage (i.e. capital availability, tech stack) creates a difficult environment for disruptors. Given that consumer hardware categories proliferating this incumbency advantage are generating the fastest growth in consumer spending; with Phone hardware, video/audio hardware, and internet access the fastest indexed spending growth of any categories since 2009 (BEA), we believe disrupters in this space may continue to face headwinds.

- **Top Investors by deal count:** Felicis Ventures, Foundry Group, Innovation Works, Kleiner Perkins Caufield & Byers, New Enterprise Associates

Internet of things (IoT)

While TTM VC investment has actually come up 5% yoy, the number of rounds in 3Q17 fell nearly 50% yoy. This was not a case of losing the largest dollar investments; with TrackR, Leap Motion, Cubic Telecom, Log trust, and Airobotics receiving investment dollars (>$30mn rounds) from the likes of Amazon Alexa Fund, Andreesen Horowitz, and others in 3Q. As the space has crowded with competitors and in light of the growth in funding we saw in ‘14/’15, the density of mid-stage rounds (i.e. $5mn-$20mn) has fallen dramatically and the average size of deals doubled to $13.7mn vs. 3Q15. With the hyper-growth we have seen in AI and other fast growing categories, it is possible that we are seeing some rotation of funds out of early-mid stage IoT even as a small number of companies continue to have large, often later-stage investment rounds.

- **Top Investors by deal count:** HAX, GE Ventures, Intel Capital, Lux Capital, Y Combinator, Amazon Alexa Fund, Kleiner Perkins Caufield & Byers

Exhibit 22: Consumer Hardware – TTM largest deals
$ millions

Company	Company Description	Round	Date	Amount	Total Funding
Essential Products	Consumer technology products	Series B	Jun-17	$300.0	$330.0
Haier U-home	Smart home brand	Series B	May-17	$138.3	$138.3
Desktop Metal	Metal 3D printing	Series D	Jul-17	$115.0	$212.0
Ring	Home automation	Series D	Jan-17	$109.0	$203.7
Devialet	High-performance speakers	Series C	Nov-16	$106.2	$149.8
Antenna79	Reduces radiation exposure from cellular	Series D	Nov-16	$94.9	$119.4
Baofeng TV	TV manufaturer	Series B	Sep-17	$60.7	$90.7
Seven Dreamers Labs	Robotics and healthcare devices.	Series B	Nov-16	$60.0	$95.0
Lytro	Computational photography platform	Series D	Feb-17	$60.0	$200.0
Osterhout Design Group	Wearable technologies	Series A	Dec-16	$58.0	$58.0

Source: CB Insights, Goldman Sachs Global Investment Research.

Exhibit 23: Internet of Things (IoT) – TTM largest deals
$ millions

Company	Company Description	Round	Date	Amount	Total Funding
SigFox	Cellular connectivity	Series E	Nov-16	$160.0	$311.0
Desktop Metal	Metal 3D printing	Series D	Jul-17	$115.0	$212.0
Ring	Home automation	Series D	Jan-17	$109.0	$203.7
CloudMinds	Cloud-based smart robotics	Series A	Feb-17	$100.0	$130.0
View	On-demand, energy efficient glass	Series G	Feb-17	$100.0	$815.5
View	On-demand, energy efficient glass	Series G - II	Jun-17	$100.0	$815.5
TTTech Computertechnik	Networked controlled computer systems	Unatt. VC - II	Sep-17	$89.1	$144.0
Actility	IoT enablement platform	Series D	Apr-17	$75.0	$113.0
SentinelOne	Device protection from malware/attacks	Series C	Jan-17	$70.0	$109.5
Peloton Technology	Vehicle technology company	Series B	Feb-17	$60.0	$84.4

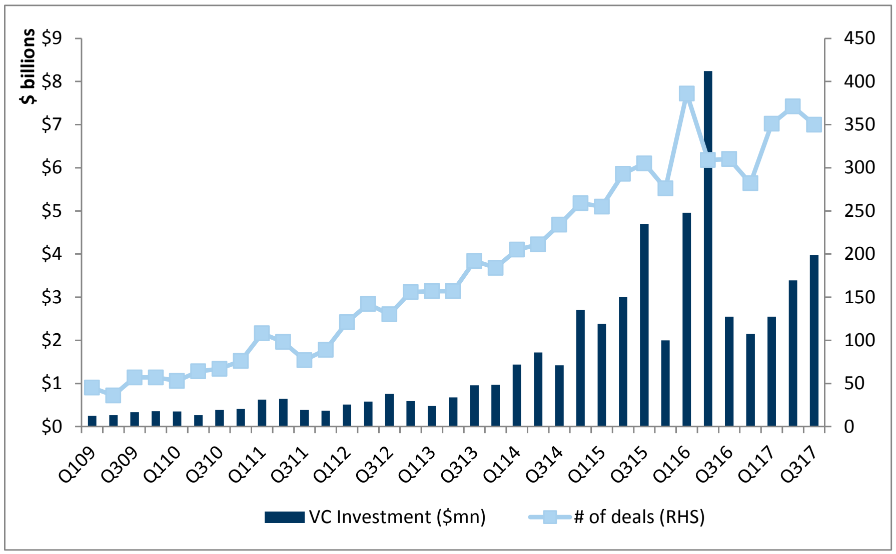
Source: CB Insights, Goldman Sachs Global Investment Research.

5. VC in Financial technology

In previous VCH editions we have focused both on broader trends within the venture capital space (see VCH), and specific verticals (see Consumer Edition: The Sustaining Power of LOHAS and A Healthcare Spotlight & The Coming Age of Regenerative Medicine).

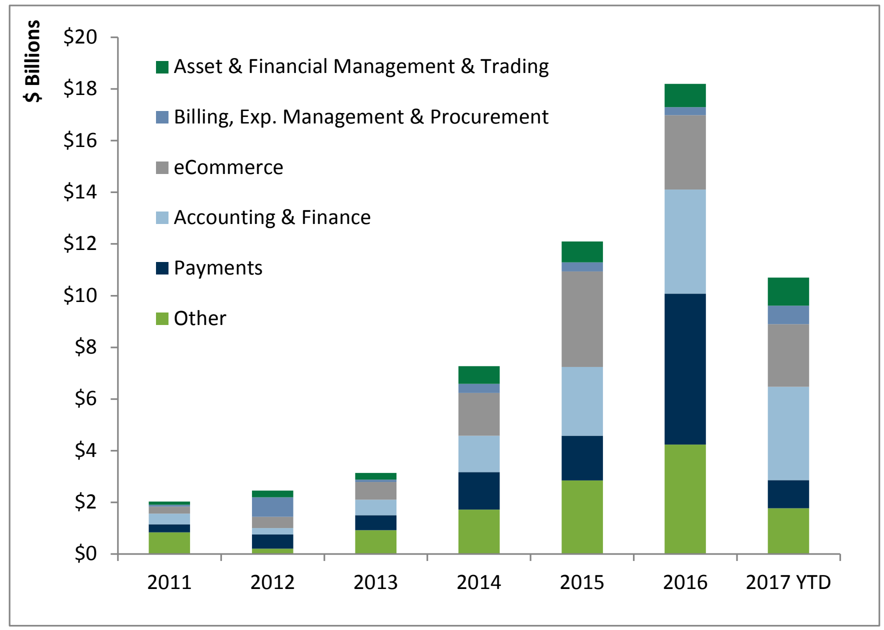
In this edition of VCH we focus on Financial Technology (FinTech) and the various encompassing sub-verticals. On a macro scale, FinTech has seen increasing VC investment over the last 4 years, with number of deals growing at a steady rate and investments beginning to pick up again after reaching a high in 2Q16 (+23% qoq vs. +27% in 2Q). FinTech covers a wide range of categories, sectors and devices / platforms. The largest FinTech sub categories are payments, ecommerce, accounting & finance, and asset & financial management & trading (Exhibit 25).

Exhibit 24: VC investments into FinTech
$ billions



Source: CB Insights, Goldman Sachs Global Investment Research

Exhibit 25: FinTech investments by select categories
$ billions



Last data point as of: 9th Oct 2017

Source: CB Insights, Goldman Sachs Global Investment Research.

Vertical Analysis Framework: FinTech edition

We identify smaller subsets of categories/companies in various growth stages that are driving the FinTech VC narrative and highlight eight sub-verticals within our vertical framework analysis (Exhibit 26). Top deals refer to largest deals by venture capital dollars invested 3Q17 TTM.

Exhibit 26: Select verticals by stage in FinTech
TTM: % change yoy

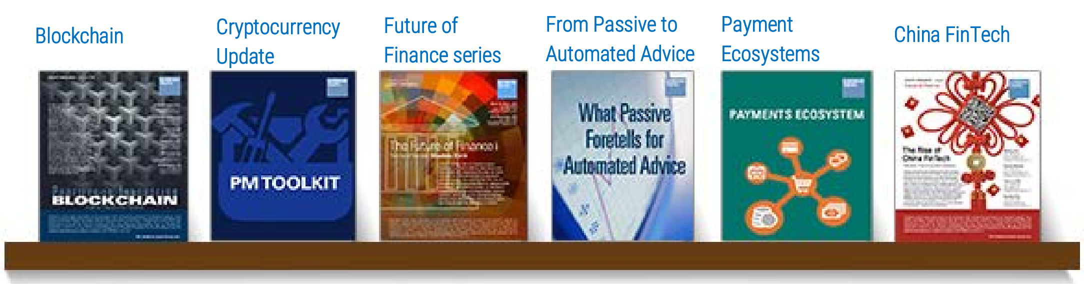
Stage	Verticals	$ millions 3Q17	$ millions 3Q16	$ millions yoy	# of deals 3Q17	# of deals 3Q16	# of deals yoy	Sub-verticals in focus	Top deals
I	Blockchain	$695	$479	45%	93	120	-23%	Trading facilitators (wallets), software	R3, Coinbase
	Billing, Expense Manag., & Procurement	$787	$297	165%	101	67	51%	Bill payments, single platform payments	AvidXchange, ServiceChannel
II	Reg Tech	$1,323	$795	67%	112	101	11%	Information Security, compliance	ForgeRock, Druva
	Wealth Tech	$1,295	$607	113%	89	76	17%	Trading platforms, personal finance	Futu Securities, Addepar, Robinhood
III	Capital Markets Tech	$2,646	$1,486	78%	196	160	23%	Lending enablement, market facilitation	Blend, Cadre, Symphony Communications
	Accounting & Finance: Software & Services	$4,673	$3,571	31%	542	392	38%	Telemedicine consultation, connected healthcare	Kabbage, DianRong
IV	Real Estate Tech	$1,583	$2,466	-36%	237	243	-2%	Home-selling platforms, real estate lending	OpenDoor Labs, Convene
	Startups Attacking Retail Banking	$1,599	$2,460	-35%	41	51	-20%	Banks, P2P platforms	SoFi, DianRong

Source: CB Insights, Goldman Sachs Global Investment Research.

*Note: Some companies overlap between categories.
**Top deals in capital markets tech excl. Futu Securities, Robinhood, Addepar, and crowdfunding

MINDCRAFT

Related reads from the Mindcraft thematic bookshelf



Stage I: Hyper-growth, early stage verticals

Blockchain

Explored in depth in our Profiles in Innovation Deep Dive: Blockchain – Putting Theory into Practice, we view blockchain as a decentralized system that has the potential to disrupt a number of industries from real estate to capital markets and even energy, power, and utilities. While deal count is down 23% yoy to multi-year lows, we think the industry is beginning to see consolidation after the early fragmentation highlighted by a large number of smaller-dollar deals. R3 is a consortium of financial institutions developing a distributed ledger platform, while the duration of Bitcoin's success has led to legitimate players emerging, like Coinbase and Bitmain in consumer facing and back-end mining technology, respectively. With the development of smart contracts and a wide variety of applications on top of blockchain protocols (i.e. Ethereum), we believe this category is still very early stage.

- **Top Investors by deal count:** Digital Currency Group, Boost VC, Fenbushi Capital, Draper Associates, Blockchain Capital

Billing, Expense Management, & Procurement (Internet)

This vertical has seen rapid growth in the last couple of quarters; with Q317 TTM deal growth of 51% and 165% growth in investment dollars. While businesses cope with the cost of human capital in financial operations and try to keep up with technology-adopting competitors, the ability of companies such as AvidXchange, ServiceChannel, and Billtrust to facilitate these processes and drive time/cost efficiencies has driven a surge of VC dollars to the space in recent quarters. M&A exits are up 44% yoy with Nexonia, an expense & time reporting company, as the most active acquirer.

- **Top Investors by deal count:** Y Combinator, New Enterprise Associates, 500 Accelerator, 500 Startups

Exhibit 27: Blockchain – TTM largest deals
$ millions

Company	Description	Round	Date	Amount	Total Fund.
R3	Financial institution consortium devloping blockchain applications	Series A	May-17	$107.0	$107.0
Coinbase	Bitcoin wallet and platform	Series D	Aug-17	$100.0	$217.4
Bitmain Technologies	Develops and sells bitcoin miners	Unatt. VC	Sep-17	$50.0	$50.0
Canaan	Blockchain servers & ASIC microprocesser solutions	Series A	May-17	$43.0	$47.5
Blockchain	Software platform for digital assets, bicoin wallet	Series B	Jun-17	$40.0	$70.5
Brave Software	Using blockchain to create privacy focused browser	Crowdfunding	Jun-17	$35.0	$42.0
BitFury	Software and hardware blockchain technology solutions	Series C	Jan-17	$30.0	$90.0
Devign Lab	Web-based home trading system facilitating ethereum/bitcoin trades	Series A	Jul-17	$27.0	$27.2
Veem	Next generation payment service provider	Series B	Mar-17	$24.0	$36.6
Axoni	Blockchain software for capital markets	Series A	Dec-16	$18.0	$23.2

Source: CB Insights, Goldman Sachs Global Investment Research.

Exhibit 28: Billing, Expense Management, and Procurement – TTM deals
$ millions

Company	Description	Round	Date	Amount	Total Fund.
AvidXchange	Automating invoice/payment processes	Series F	Jun-17	$300.0	$571.7
ServiceChannel	Payment platform for facilities managers	Unatt. VC	May-17	$54.0	$67.6
Billtrust	Automating invoice/payment processes	Series D	May-17	$50.0	$104.5
Freshbooks	Small Business accounting (cloud-based)	Series B	Jul-17	$43.0	$73.0
Power2SME	Information/tools for SMEs	Series E - II	Sep-17	$36.0	$81.1
TravelBank	Business expense app	Series B	Aug-17	$25.0	$35.0
AvidXchange	Automating invoice/payment processes	Series E	Nov-16	$18.0	$571.7
Aria Systems	Cloud based billing and monetization platform	Series F	Sep-17	$18.0	$142.0
Karmic Labs	Combining payments and business applications	Series B	Jul-17	$17.2	$37.1
Scout RFP	Automated sourcing/auction platform (cloud-based)	Series B	Jun-17	$15.5	$27.3

Source: CB Insights, Goldman Sachs Global Investment Research.

Stage II: Fast growing verticals on a larger capital base

Regulatory technology

RegTech as an industry encompasses a growing set of companies that facilitate the implementation of regulatory requirements, often times by providing enterprise security, data analytics, and other control mechanisms. With a flurry of regulatory questions surrounding both emerging FinTech (e.g. online lending marketplaces, cryptocurrencies) and traditional financial institutions, one of the biggest issues for early-stage companies according to industry stakeholders is the lack of a proactive compliance plan that addresses the evolving regulatory environment.

Whether it be the example of Digital Reasoning, a company that reduces compliance risk for large companies (including financial institutions), or LogRhythm, which utilizes security intelligence to respond to cyber threats, stakeholders continuously highlight RegTech's use case in helping protect company brands and IP from one-off internal and external events, which are issues that only continue to grow in 2017. Risk assessment and analytics firm Verisk Analytics has been the most active acquirer in the last 2 years.

- **Top Investors by deal count:** New Enterprise Associates, Accel Partners, Salesforce Ventures

Wealth Tech

From robo-advisors to mobile-friendly broker platforms, there continues to be a growth in deal count and dollars (+17% and +113% yoy on a TTM basis, respectively) in wealth tech as companies attempt to match demand by retail investors and advisors. While many wealth tech companies like Robinhood, Betterment, and Wealthsimple have been able gain traction with consumers as independent companies with unique business models, incumbents have also shown interest in the space. Financial services companies E*trade, TD Ameritrade, TIAA, and Accenture have all acquired a Wealth Tech company in the last 2 years. The 39 M&A exits in the last three years is well above the 12 that the category saw in the prior 5 years.

- **Top Investors by deal count:** Commerce Ventures, Startupbootcamp FinTech, CreditEase FinTech Investments

Exhibit 29: Reg Tech – TTM largest deals
$ millions

Company	Description	Round	Date	Amount	Total Fund.
ForgeRock	Open source vendor (I3 products)	Series D	Sep-17	$88.0	$140.2
Druva	Control of business information	Series F	Aug-17	$80.0	$198.0
Sumo Logic	Data analytics platform	Series F	Jun-17	$75.0	$235.5
Prevalent Networks	Third-party risk management platform	Series C	Nov-16	$60.0	$72.0
DataRobot	Predictive analytics, enterprise machine learning platform	Series C	Mar-16	$54.0	$124.6
Netwrix	Governance platform for hybrid cloud security	Series A	Feb-17	$51.0	$51.0
Collibra	Cross-organizational data governance platform	Series C	Jan-17	$50.0	$75.4
Pondera Solutions	Security software	Series A	Jun-17	$46.7	$46.7
Kyriba	Cloud-based proactive treasury management	Series E	Sep-17	$45.0	$144.2
HyTrust	Automated enterprise security	Series E	Jul-17	$36.0	$103.5

Source: CB Insights, Goldman Sachs Global Investment Research.

Exhibit 30: Wealth Tech – TTM largest deals
$ millions

Company	Description	Round	Date	Amount	Total Fund.
Futu Securities	Online stock-trading services	Series C	Jun-17	$145.5	$215.5
Addepar	Financial operating system for data-driven investing	Series D	Jun-17	$140.0	$205.8
Robinhood	Online trading platform	Series C	Apr-17	$110.0	$176.0
Betterment	Personalized finance	Series E - II	Jul-17	$70.0	$275.0
Wacai	Personal finance app developer	Series C	May-17	$42.0	$228.6
Personal Capital	Next generation financial advisor	Series E - III	Aug-17	$40.0	$247.0
Just2Trade	Online broker platform	Unatt. VC	Nov-16	$40.0	$40.0
Stash Invest	Investment mobile app	Series C	Jul-17	$40.0	$78.8
Nutmeg	Alternative investment platform	Series C	Nov-16	$37.5	$89.6
Wealthsimple	Technology-driven investment manager	Series B	Jan-17	$37.0	$62.0

Source: CB Insights, Goldman Sachs Global Investment Research.

Stage III: Modest growth within larger investment verticals

Capital Markets Tech

Companies revolutionizing capital markets include software/technology companies that are providing services to investment banks, hedge funds, and portfolio managers, as well as business intelligence/data platforms and back-office administrative functions. Given the broad definition of these companies, the category is amongst the largest in FinTech and continues to grow rapidly in deal count and investment dollars. Whether it be Orbital Insight, a company that is disrupting competitive advantages in business intelligence, to DataRobot, a machine learning company changing the way predictive algorithms affect market dynamics, and Blend, a company trying to facilitate the lengthy mortgage approval and closing process, a number of companies are attacking the status quo in capital markets.

FactSet and NASDAQ are the two largest acquirers of capital markets technology companies in the last two years, with 3 acquisitions each. Incumbents have not turned a blind eye to these disruptions either, as J.P. Morgan, and Barclays were within the top 25 VC investors by deal count.

- **Top Investors by deal count:** Startupbootcamp FinTech, Andreessen Horowitz

Accounting & Finance Software/Services

With the legacy systems that exist in traditional financial institutions, there are cost burdens flowing through to consumers across traditional financial products and services. The keys to disruption highlighted by top VC funded companies including Kabbage, DianRong, and others, is providing a service and the associated underlying tech stack that fulfills one of two value propositions: 1) Reducing high legacy cost pass-through to consumers (e.g. credit card APRs) and 2) improving or adding to the functionality and efficiency of existing infrastructure and services.

Given high consumer costs associated with many financial transactions today, companies across the industry we've spoken with have felt confident in their ability to gain market share. With TTM M&A exits up 131% to 95, London-based Fair FX has been the largest acquirer with corporates Credit Karma and LendingTree also participating in the M&A environment.

- **Top Investors by deal count:** 500 Accelerator, Y Combinator, Startupbootcamp FinTech, Barclays Accelerator, Ribbit Capital

Exhibit 31: Capital Markets Tech. – TTM largest deals
$ millions

Company	Description	Round	Date	Amount	Total Fund.
Blend	Mortgage Lending	Series D	Aug-17	$100.0	$142.5
Cadre	Tech-enabled investment platform (real estate)	Series C	Jun-17	$65.0	$383.3
Symphony Comms.	Secure connection of markets, organizations and individuals	Series C	May-17	$63.0	$229.0
Collibra	Cross-organizational data governance platform	Series C	Jan-17	$50.0	$75.4
Confluent	Harnessing real-time data streams	Series C	Mar-17	$50.0	$80.9
Kyriba	Cloud-based proactive treasury management	Series E	Sep-17	$45.0	$144.2
Juvo	Access to mobile financial services	Series B	Aug-17	$40.0	$59.3
Ellevest	Digital investment platform for women	Series C	Aug-17	$34.6	$55.6
Scabale Capital	Online wealth manager	Series B	Jun-17	$33.4	$45.6
Iguazio	Data analytics platform	Series B	Jul-17	$33.0	$48.0

Source: CB Insights, Goldman Sachs Global Investment Research.

Exhibit 32: Accounting & Finance Software/Services – TTM largest deals
$ millions

Company	Description	Round	Date	Amount	Total Fund.
Kabbage	Automated funding to small businesses	Series F	Aug-17	$250.0	$2,249.0
DianRong	P2P loan and financial services platform for SMEs	Series D	Aug-17	$220.0	$439.0
Jubaohui	Online financial services company	Series A	Nov-16	$200.0	$200.0
Suishou Tech Co.	Mobile finance software	Series C	Sep-17	$200.0	$230.0
Neyber	Enabling employers to offer access to affordable loans	Series C - II	Sep-17	$152.8	$198.3
Bread	Facilitated purchase financing	Series B	Aug-17	$126.0	$144.6
Atom Bank	Mobile-only bank	Series C	Mar-17	$102.0	$307.1
Blend	Food delivery service operating in Tokyo	Series D	Aug-17	$100.0	$142.5
51Xinyongka	Credit card/online financial service app	Series C - II	Oct-16	$84.0	$459.0
WeCash	Big data credit assessment	Series C	Apr-17	$80.0	$106.6

Source: CB Insights, Goldman Sachs Global Investment Research.

Stage IV: Declining growth vs. a larger capital base

Real Estate Tech

We highlighted in our inaugural venture capital report the rise of Internet-based real estate companies in 2016, as home-selling platforms such as OpenDoor, Knock and Offerpad, as well as platforms such as Compass and Homelink looking to disrupt the real estate industry, received investments that drove the category to +45% yoy growth in the year. With the category becoming increasingly crowded and a small number of incumbents such as Zillow, Redfin, and Move dominating traffic market share in their respective sub-verticals (Zillow in advertising, Redfin in online brokerage), TTM deal value has come down significantly accompanied by a lack of larger dollar investments. Given the start-up costs associated for real estate brokerage companies, as well as the national brand competition from the likes of Zillow, who currently holds ~70% of unique visitor market share in the U.S., this is a category that has become increasingly difficult to compete amidst a growing number of competitors.

- **Top Investors by deal count:** Y Combinator, 500 Startups, Khosla Ventures, General Catalyst, Lightspeed Venture Partners, Menlo Ventures

Startups Attacking Retail Banking

While there is some overlap in companies disrupting retail banking and other categories, we believe the driving force behind the decline in retail banking-related start-ups has been the incumbent response to P2P lenders and mobile/online bank startups, as well as the growing cost of control for businesses in a space where incumbents are more well-positioned from a capital perspective to adapt. From a traffic and competition perspective, the evolution of incumbent efforts on mobile banking apps and technology-driven lending initiatives has made it more difficult for startups. In addition, and if the growth in RegTech investment is any indication, the cost of compliance may be making it more difficult for P2P lenders and online bank startups to compete.

- **Top Investors by deal count:** QED Investors, Anthemis Group, Portag3 Ventures, Ribbit Capital, Northzone Ventures

Exhibit 33: Real Estate Tech – TTM largest deals
$ millions

Company	Description	Round	Date	Amount	Total Fund.
OpenDoor Labs	Home-selling platform	Series D	Nov-16	$210.0	$320.0
Convene	Workplace-as-a-service platform	Series C	May-17	$68.0	$113.5
City Home	Residential leasing platform	Series A	Jul-17	$50.0	$50.0
Placester	Premium listing services, deep analytics	Series D	Mar-17	$50.0	$100.9
HomeLight	Agent matching/recommendation service	Series B	Aug-17	$40.0	$55.5
Breather	On-demand network for private rooms	Series C	Dec-16	$40.0	$67.5
YOPA	Home-selling platform	Series C	Sep-17	$35.8	$78.4
Knock	Home-selling platform	Series A	Jan-17	$32.5	$32.5
HouseCanary	Data & predictive analytics for RE transactions	Series B	Sep-17	$31.0	$64.0
Offerpad	Home-selling platform	Series A	Jan-17	$30.0	$260.0

Source: CB Insights, Goldman Sachs Global Investment Research.

Exhibit 34: Startups Attacking Retail Banking – TTM largest deals
$ millions

Company	Description	Round	Date	Amount	Total Fund.
SoFi	Lending & wealth management	Series F	Feb-17	$500.0	$2,194.1
DianRong	P2P loan and financial services platform for SMEs	Series D	Aug-17	$220.0	$439.0
Robinhood	Online trading platform	Series C	Apr-17	$110.0	$176.0
Atom Bank	Mobile-only bank	Series C	Mar-17	$102.0	$307.1
Nubank	Brazil-based financial services startup	Series D	Dec-16	$80.0	$379.0
Betterment	Personalized finance	Series E - II	Jul-17	$70.0	$275.0
Younited Credit	P2P Lending platform	Series E - II	Sep-17	$47.8	$95.7
Wacai	Personal finance app developer	Series C	May-17	$42.0	$228.6
Zopa	P2P Loans	Series F	Jun-17	$41.2	$84.1
Upstart	Student loan funding platform	Series D	Mar-17	$32.5	$584.7

Source: CB Insights, Goldman Sachs Global Investment Research.

6. Initial Coin Offerings: $2bn+ raised in the last six months

In nearly every interaction we have had with venture capitalists in recent months, initial coin offerings (ICOs) have been a major topic of discussion. ICOs represent a potentially important trend for venture capital as they can serve as an alternative to a traditional VC backed funding round, a way for existing venture backed companies to fund a specific project, as well as a way for a company to build awareness among target customers.

Decrypting the ICO

Initial coin offerings (ICOs) come in a variety of forms but with largely the same purpose: To raise capital. Rather than raising capital through distributing equity or bonds in the private or public markets, companies raise cryptocurrencies (generally bitcoin or Ethereum) that are meant to help avoid some of the pain points associated with traditional means of raising capital; including financing costs associated with equity and debt offerings or the challenges of acquiring dollars in private venture rounds. In exchange for the liquid cryptocoins, investors receive a newly generated digital currency or "tokens"; which they hope will rise in value upon the successful completion of a project, often outlined by an ICO whitepaper.

Investor dollars are moving into ICOs rapidly; with the overall size of the ICO fundraising market reaching more than $2bn in fundraising in the last 6 months, vs. less than $100mn in the prior six months. **In each of the last four months, cryptocurrency offerings generated more investment dollars than angel & seed funding going to Internet companies (Exhibit 35).**

What is the appeal for investors?

- **White paper.** When investors decide to allocate capital to an ICO, they are generally underwriting what developers call a "white paper;" an explanation of the use of liquid cryptocurrency or, in the case of a token sale, what value the tokens will have in the context of a project. A currency ICO occurs when a whole new cryptocurrency is generated through a white paper. Whitepapers have ranged from Ethereum, which created a new blockchain platform, to Kin, an in-app social media currency which the company Kik hopes to build a marketplace around. White papers also generally describe the mission statement, use of proceeds, goal for the project, and the technical aspects of a currency's supply/demand over time, trading dynamics, and "proof" mechanism within the blockchain. The general value proposition for investing in these forms of ICOs is return on investment through the appreciation of a cryptocurrency's value when it hits an exchange.

- **Pricing Dynamics.** The price post-ICO is determined by supply and demand, utility of the currency, and liquidity, among other factors. As the perception of the whitepaper's usefulness or adoption changes, currencies also often change in value fairly rapidly. Ethereum, for instance, has seen rapid appreciation in the blockchain ecosystem, allowing for usage of Smart Contracts on top of the platform that apply to a flexible number of use-cases. Given the utility that Ether currency demonstrated post-ICO, being tied to the Ethereum blockchain, the cryptocurrency's value is nearly 1000X what it priced during the ICO (per ICOStats). It also helps that the supply/demand dynamics have made Ethereum highly liquid, to the point where new cryptocurrency ventures often accept Ethereum as an alternative to liquid currency. While there is certainly risk of a venture failing (and the value of the cryptocurrency depreciating rapidly), the investor focus on reward potential has led many investors to underwrite future blockchain projects.

Use-cases: $2bn in early-stage potential

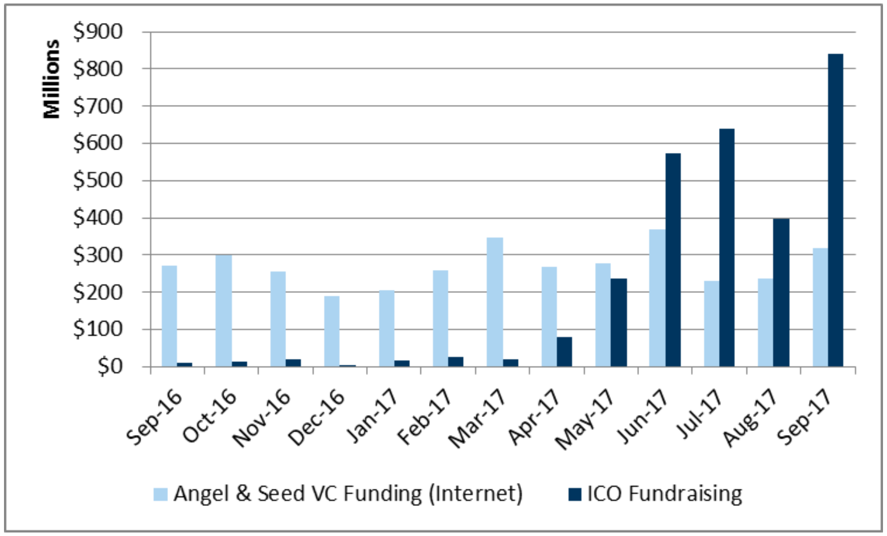
The underpinning technology of cryptocurrencies and tokens is the Blockchain, or decentralized ledger of transactions, that verify the transfer of funds and control creation of monetary units (see: Profiles in Innovation: Blockchain)The decentralization of transaction verification creates an added security layer that reduces fraud potential, and is continuously refined and modified through new blockchain projects. One important distinction to be made is that potential use cases of newly generated cryptocoins go beyond merely using a decentralized ledger as a means of transaction.

- **Protocols.** Protocols are the process by which the next "block" in the blockchain sequence is validated and added; the incentive system for effective, decentralized control. Bitcoin is well known for its "proof of work" consensus algorithm, where large amounts of computational energy are rewarded with newly generated bitcoins. This is not the only way by which a blockchain ecosystem operates, and there are a large number of companies that have raised money in ICOs for the purpose of evolving blockchain protocols as barriers to entry on "proof of work" protocols become more difficult to match. The Tezos protocol raised $232mn in July on the premise of further decentralizing protocol governance through "proof of stake" and delegated validators; however some press reports have indicated questions arising regarding Tezos' legal structure, driving the value of the currency down recently (Fortune, 10/19/2017). EOS is another protocol-oriented blockchain company that raised over $150mn in July through its ICO.
  - **Why does it matter?** That many of the largest ICOs are protocol-oriented provides evidence that investors are willing to underwrite the future of specific blockchain applications on top of these protocols. Ethereum is just one example of a protocol that has attracted a variety of digital assets that make use of the blockchain for smart contracts; an asset light and high speed ecosystem that facilitates and validates a wide variety of transactions. The introduction of new protocols may provide flexible optionality for companies looking to create their own currency on top of an existing blockchain, potentially driving increased adoption of application specific use-cases.
- **Application specific.** Becoming increasingly widespread over the last few months have been ICOs/token sales that in practice create new forms of digital currency for a variety of use-cases. Social media is just one example of companies hoping to utilize existing blockchain protocols to facilitate transactions. Kik Interactive raised nearly $100mn in exchange for "Kin" cryptocurrency in September, with the hope of revolutionizing digital service offerings to platform users through its Rewards Engine and earnable currency model. In the long run, the company's goal to create a "Kik economy" marketplace highlights the potential for liquid decentralized currency as a transactional backbone for created content or brand offers in an online ecosystem. Brave is taking a similar approach in advertising, hoping to use a cryptocurrency incentive system to increase anonymity/privacy for users, improve targeting for advertisers, and reward publishers for user attention.
  - **Why does it matter?** Applied use-cases have the potential to provide a number of competitive benefits for companies relative to legacy systems; including speed, security, accuracy, and removal of intermediaries. Amidst a digital environment where economies of scale and network effects provide outsized, compounding benefits for incumbents in a number of monetizable fields, introducing themes of anonymity and decentralized decision-making may serve to differentiate value propositions for participants on both the supply and demand side of digital transactions. The introduction of varying protocols further gives developers flexibility in adopting decentralized systems.

Regulatory considerations

There have been varying responses to cryptocurrency exchanges and ICOs across geographies. In the United States, the SEC suggested that token sales may be subject to the Securities Exchange Act of 1934, and that investors participating in such offerings should be aware of the risks. In Japan, the FSA (its financial regulator) approved the registration of 11 cryptocurrency exchanges in September. Alternatively, some press reports indicate that China banned the practice of raising money through ICOs in September (Bloomberg, CNBC, 9/4/2017).

Exhibit 35: ICO fundraising has exceeded Internet Angel & Seed VC funding in Internet over each of the last 4 months
$mn, angel & seed funding excludes crowdfunding



Source: CoinSchedule, CB Insights, Goldman Sachs Global Investment Research.

Exhibit 36: Top ICOs of 2017
$mn

Project	Description	Market cap	Capital Raised
Filecoin	Blockchain-based storage network	N/A	$257.0
Tezos	Self-governing blockchain	N/A	$232.3
EOS Stage 1	Decentralized application infrastructure	$233mn	$185.0
Bancor	Smart contracts protocol	$94mn	$153.0
Kin	In-app cryptoeconomic ecosystem	$63mn	$97.0
Status	Open source messaging platform	$82mn	$90.0
TenX	Cryptocurrency wallet	$193mn	$64.0
MobileGO	Crypto-centric mobile gaming platform	$54mn	$53.1
Sonm	Decentralized, universal supercomputer	$49mn	$42.0
Aeternity	Smart contract innovation	$91mn	$37.0

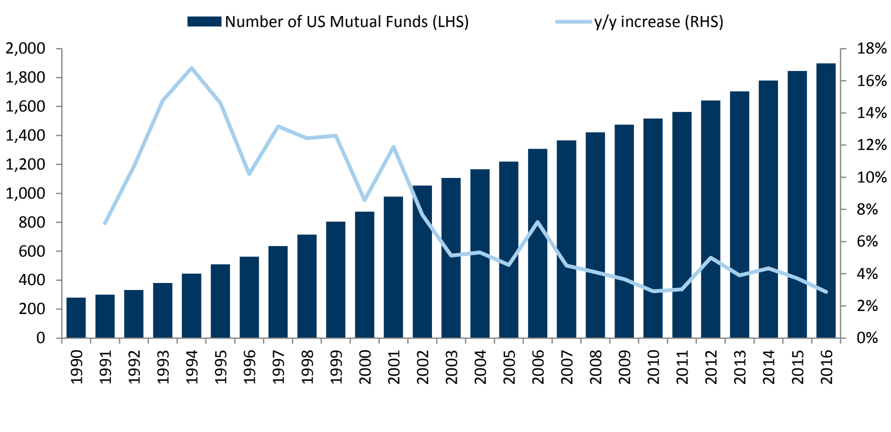
Source: CoinSchedule, CoinMarketCap as of 10/2/2017

7. Wrangling big data as a source of alpha and implications for asset managers

How does big data impact asset managers?

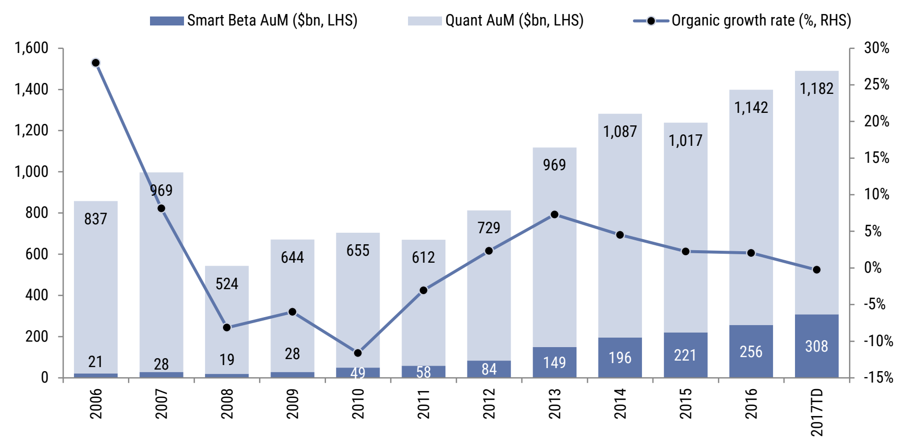
The asset management industry continues to evolve. Limited alpha generation, particularly in the more mature asset classes such as US large cap equities, and fee concerns have driven investors into more passive products – a trend that continues to unfold. In an environment where traditional managers have underperformed benchmarks for several years, and hedge fund returns have not kept pace with the rise in SPX, managers are looking for alternative ways to outperform. More funds are turning to heavy computing power, big data and machine learning in the hope of finding insights that can lead to alpha. AUM in quant and smart beta oriented products is approaching $1.5tn (and an average organic growth rate of 3.7% from 2012-16 vs the US active equity mutual fund at 0%) in the US (not including many of quant oriented alternative products) and fundamental managers are increasingly looking at ways to incorporate differentiated data sources into their investment mosaic. We believe that data proliferation, greater computing power and ease of access are all supporting greater use of "big data" in both investment processes (front office) and client marketing, onboarding and support functions (back office), beyond the typical wide ranging use-cases in other industries.

Exhibit 37: US active equities has become oversaturated with funds
Number of US active mutual funds investing in US equity; y/y growth



Source: Morningstar, Goldman Sachs Global Investment Research

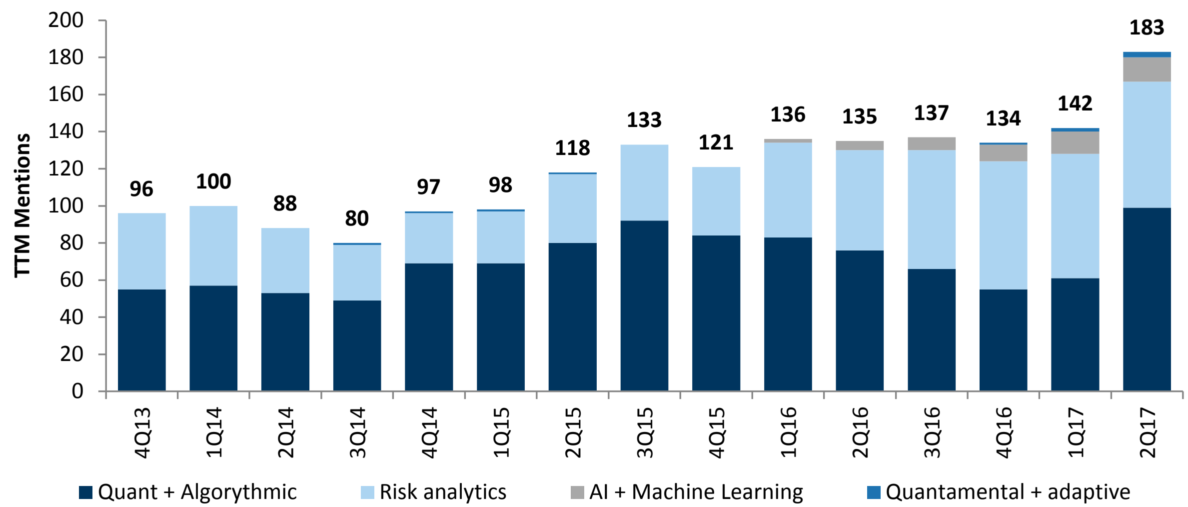
Exhibit 38: Demand for computer-driven investments styles has increased
Smart beta and quant AUM; organic growth rate



Source: Simfund, Evestment, Goldman Sachs Global Investment Research]

Over the past 2 years, publically traded asset managers have cited terms such as "big data, machine learning, and artificial intelligence" with increasing frequency, while investment in the space (both capex from asset managers, and venture funding) is increasing. The reason for the increased focus is clear as (1) managers are looking for innovative and more efficient sources of alpha and (2) increasing use-cases for back office optimization. In all of this, however, having a proprietary nature to a dataset and a unique way to utilize it remains critical as greater industry-wide alpha opportunities disappear. Below we highlight several use cases.

Exhibit 39: Public company interest in quant analysis, machine learning and artificial intelligence is increasing
TTM Number of mentions on asset managers earnings calls



Source: GS Data Works

Front office: Ultimately, we view big data and machine learning as a supplement to active management rather than a replacement. The rise of quantamental investing (fundamental analysis with heavy use of big data and machine learning techniques) is evidence of this. The majority of quantamental managers will use a combination of industry experience and big data to gain insights. These tools can increase productivity by performing complex analysis faster and finding insights that otherwise may have been overlooked – ultimately this may reduce the headcount of junior investment professionals, but will likely be offset by data engineers who can procure, parse and distil data into insights.

Additionally, big data is being used to monitor investment risks by a) scrapping information on positions across the web, including social media, and b) creating a quantum view of potential outcomes and resulting stock moves. Beyond the infrastructure and data acquisition expenses, asset managers need a culture open to the use of big data, technical skill sets, trust of technology and willingness to accept a more statistics-driven investment process.

> **Use cases:** Tracking containers onboard cargo ships across the globe, monitoring energy produced by solar panels in Nevada, breaking down underlying income demographics of location specific MBS, monitoring patent applications for Virtual Reality technology, scraping ticket prices from travel websites, YouTube preview views ahead of blockbuster video game releases.

Back office: Less exciting, and likely less appreciated, is the ability for big data and machine learning to optimize back-office operations, reduce expenses, and increase client-insight. We see two key areas where big data and machine learning can be beneficial to asset managers: 1) By combing several public data sets (credit reports, income, spending habits, collateral), asset managers can improve their KYC requirements; 2) Improved client profile segmentation (risk characteristics, product interest, investment requirements) can assist with marketing specific products as and when they are required and enhance relationships with clients as salespeople are delivered useful information more quickly.

Who are the big data companies and how are they disrupting the ecosystem?

We see three categories of firms trying to break into the asset management space with big data/AI capabilities: 1) Providers of content (data sources, signal discovery), 2) providers of infrastructure and technology, 3) those that tend to do both (see our profile of Enigma on page 30).

1. **Content Providers:** Firms that procure alternative data sets, either specifically for asset managers or third parties in general, either through a recurring feed or a one off sale. The firms with the most sustainable moats (and which can likely charge the highest prices) collect data that is more challenging to aggregate. We expect some managers will establish exclusivity contracts to secure the longevity of the insight. In some cases these firms may take the additional step of trying to find the "signal through the noise" through machine learning. This data is either a) highly commoditized if firms are willing to sell the data in volume, or b) expensive as the data firm would monopolize the insight and sell it to the highest bidder. The challenge is that asset managers will not know the quality of the insight until they purchase the data. During our conversations with asset managers, the more widely sold a data set is, the less likely they are to purchase it. Heavily sold data is almost viewed as a contrarian indicator, though there is perhaps a baseline need for data that the bulk of the market has access to. Conversely, there are also firms that are willing to run "solo-missions" using drones or satellites to collect specific data.

2. **Infrastructure and Technology Providers:** Firms that provide infrastructure and data management expertise can quickly accelerate an asset manager's use of big data in both "front" and "back" offices. These firms can: improve data gathering capabilities, data storage for easier analysis, combine multiple databases to drive better insights, improve analysis of unstructured data, add additional public data sources and improve overall usability. These firms can also add machine learning to assist the asset manager in developing their own proprietary insights. For the front office, we believe this service is more likely to be used by asset managers relative to purchasing content, as it reduces the likelihood of using data that is already commoditized and can be customized for individual managers' fundamental views. Back office improvements are likely less appreciated as improved infrastructure and aggregation of data can improve understanding of client needs and potentially create red-flags earlier if issues (such as potential money laundering) arise.

What are the key challenges…

…For newcomers: Asset managers are facing numerous revenue and expense headwinds, making it difficult to take on greater costs of "big data" for alpha generation. Moreover, we believe proof of sustainability of data-driven alpha remains heavily debated, potentially holding asset managers back from making the initial investment. Further, in order to be valuable for the asset managers, data providers have to offer unique insights that cannot be competed away over time by others (or become widely enough used by asset managers that will make alpha sources obsolete overtime). Lastly, we believe cultural differences within asset management industry and inability to adapt to change quickly enough could present a challenge.

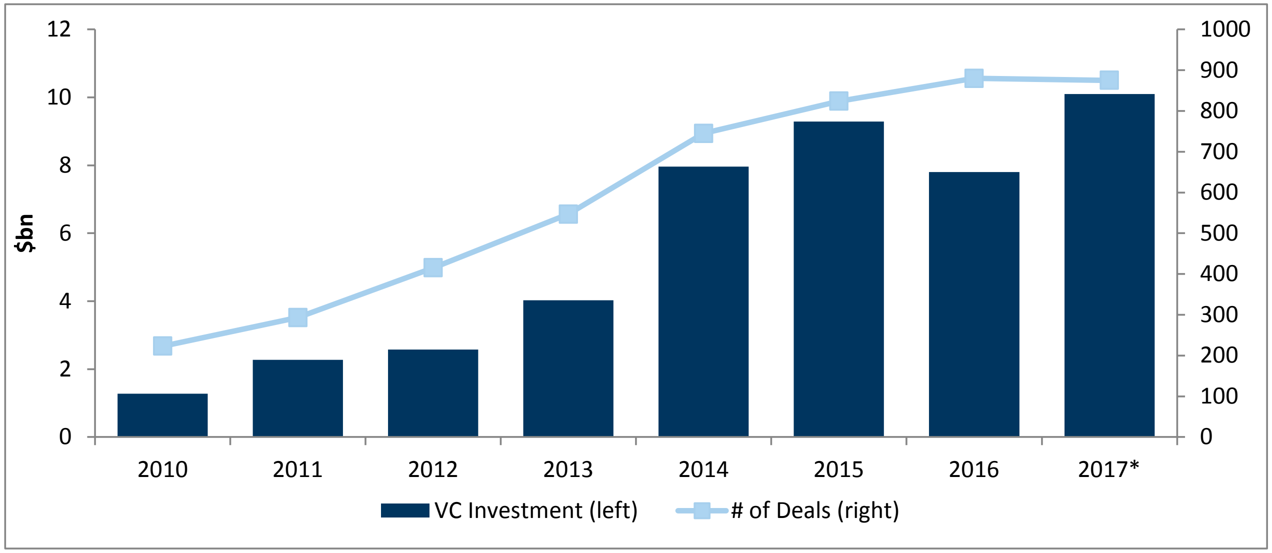
…For incumbents: Maintaining an edge using big data is a constant challenge for incumbents as more managers adopt similar methods and competing managers attempt to find the more useful datasets or insights. Additionally there is constant need to invest in and source new and insightful datasets while considering the tradeoff between cost to acquire the data and alpha before decay (others come to the same answer) of a signal. Additionally, models for data need to be heavily back-tested as there can often be a lag between event, data acquisition and fundamental event.

VC interest in big data and machine learning

Given the high level of interest in big data and machine learning across various industries, venture funding remains high in the space. Corporates such as GOOGL, AAPL, AMZN as well as VC firms are seeing greater use-cases with need to invest quickly as any individual firm's "edge" can be quickly commoditized if distributed too broadly. Given this environment, we see a greater likelihood that asset managers will look to use data infrastructure services rather than acquiring a data services firm to jump start (or build on) quant strategies.

Exhibit 40: VC investments in big data and machine learning has increased with corporate interest generated beyond the asset management community

USD value of VC investments ($bn) and number of deals



Source: CB Insights.

Profile: Enigma

Discussion with Hicham Oudghiri, Co-Founder and CEO; and Adam Gibbs, Communications and Public Relations

Enigma, a firm that specializes in providing data infrastructure and consulting on data management operations, as well as machine learning, has received $34mn in funding, including from Two Sigma Ventures, TriplePoint Capital, New York Times American Express Ventures and Comcast Ventures. Enigma works with companies across various industries to optimize the usage of firms' existing internal data sources, set up infrastructure to have databases sync effectively to generate better insight, provide the largest database of public data and assist with machine learning and artificial intelligence to help firms find solutions to complex problems. For asset managers specifically, this is using alternative data to find unique alpha opportunities and cross-referencing ideas across multiple sources. Some of the tasks Enigma has assisted with include underwriting (historical context, valuation metrics, key words/sentiment in transcripts), adverse event management (generate a series of most likely outcomes allowing a variety of counteractions to be planned), and pharmacology, among others.

> **What Enigma does differently:** One of Enigma's key differentiating factors is linking multiple datasets together to create a proprietary edge. Enigma will fit multiple databases together and then use machine learning to draw conclusions across data that may not appear to have a relationship at first glance to a human user. This data (and subsequent insight) inherently becomes more valuable because of the increased complexity in obtaining something valuable and increased challenges in replicating it, therefore protecting the edge.

Enigma's thoughts on the asset management space:

- **Thinking two steps ahead leads to success in the big data race:** The asset managers most successful in using big data and machine learning are those: where the cultural landscape encourages use of innovative techniques to solve problems; have a higher degree of statistical thinking; think about data holistically; where boundaries are pushed on applying statistical analysis into multiple areas of the business; that combine multiple databases to drive insight. These types of firms primarily use Enigma for developing infrastructure, consulting on new ways to use data and utilizing Enigma's public data sources.
- **Some managers are not quite ready for what's required:** Conversely there are asset managers that ask Enigma directly for signals, or ways to trade alpha. These firms typically are not equipped to set up elaborate big data systems, likely have less staff who would be capable of using the systems and would potentially be less likely to use big data in decision making processes. For these firms education is key, where Enigma will work with them to avoid pitfalls, explain what is necessary from a cultural standpoint and the types of personnel needed to utilize the software.
- **Consistent alpha from multiple datasets:** Based on experience with asset managers, Enigma believes that consistent alpha generation is done best by employing multiple datasets in order to draw conclusions as a) more data leads to a greater understanding of the world and b) allows investors to cross check conclusions presented in one data set with others, increasing the chances on finding an alpha edge and decreasing the chances of being led astray.
- **Quantamental:** The most successful Quantamental managers have built elaborate and powerful monitoring engines that test thesis that portfolio managers and analysts have arrived at fundamentally. They will use machine learning to test patterns they have observed and will use the data to back up their thesis rather than as the lynch pin of the strategy. The most successful of these shops are nimble and can run multiple tests in parallel.
- **Bringing the back office to front-of-mind:** Some managers who have been successful with front office uses of big data and machine learning have adopted similar techniques to improve their back office tasks, including: technology compliance, onboarding of clients, due diligence process, operations, and marketing. Within marketing, certain managers are analyzing previous responses to email times, RFP requests in various market scenarios, requirements from the clients, ultimate negotiated fee rates and a myriad of other unstructured data in order to better understand what their clients want and to offer it to them before they ask someone else.
- **Pace of investment is increasing for the asset management community:** Across both front office and back office uses. Many managers have been focused on cataloging, and integrating various datasets as a starting point.

Profile: Numerai

Discussion with Matt Boyd, Chief Operating Officer; and Geoffrey Bradway VP of Engineering

Numerai is among the more unique and innovative hedge funds in the quantitative space using a combination of crowdsourcing, and cutting-edge technologies such as liquid cryptocurrencies (bitcoin/Ethereum) including the firm's own cryptocurrency (Numeraire), big data, quantitative models and machine learning. Numerai's hedge fund model is built using an amalgamated model from a combination of the most competitive and effective crowdsourced models.

In order to source quantitative models, Numerai hosts two "tournaments" where data scientists (or the general public) can prove the value of their model and receive 1) recognition for their skills and 2) the opportunity to earn USD equivalent prizes in the form of bitcoin or ether.

The first tournament, the "general tournament" allows data scientists to "train" their machine learning models against statistical problems set by Numerai. These problems include 500K rows of stock-specific market data that has been scrubbed by Numerai and encoded so the data scientists do not know which security their model is solving for. There are numerous data scientists that can program their machine learning model to arrive at the same answer, increasing the variations of models seen by Numerai. The goal of the "general tournament" is to earn Numeraire, a cryptocurrency that Numerai distributes to data scientists.

Numeraire is an entry mechanism to the second tournament, or the "stake tournament," where data scientists bet their Numeraire tokens on their models being able to generate alpha in live scenarios with the reward of USD equivalent prizes in the form of bitcoin or ether. From here, Numerai will take the most successful models and combine them in their meta model. The combination of multiple models, what is known as an ensemble model, which includes many different outputs is more reliable and durable than a single algorithm. Numeraire then uses their meta model, which includes internally built algorithmic models, to trade long-short global equities.

What is Numerai's edge: Numerai's edge is in the sourcing, and scrubbing of the data sets that it provides to tournament participants and in their ability to create statistical problems that appear like a game for data scientists. This has driven increased interest and usage of Numerai's platform. Users are unaware of the security they are looking at and because the data has been scrubbed by Numerai, this reduces data scientists' ability to use "track records" to get fulltime positions at hedge funds as the track record is not built on a real world environment.

Points on Numeraire: While the initial distribution of Numeraire was not an effort to raise funds in the form of an ICO, the currency now trades on the secondary market given its value on the Numerai platform. Including the exchange value of Numeraire, the company pays out approximately $120-$130K per month to data scientists and prizes. The value of Numeraire also gives data scientists an incentive to support the overall platform, competition, number of users and quality of models, as growth/success in the platform is tied to the value of Numeraire. Numerai decided to switch from Bitcoin payouts to Ether payouts (to data scientists who had staked their Numeraire on their live models) because of their belief in the growth outlook for the Ethereum.

Methodology

- We define **VC funding** as seed, angel, Series A, Series B, Series C, Series D, Series E+, unattributed VC, corporate VC, or "other VC" as defined by CB Insights
- **Total Funding** includes the above VC funding types, as well as all other funding types captured by CB Insights, including:
  - Convertible notes
  - Private equity
  - Growth equity
  - Debt
  - Grants
  - M&A
  - IPO
  - Other
- **Top investors** are ranked according to deal activity or number of deals participated in over the last two years, irrespective of the amount invested
- Some companies may overlap between categories when looking at analysis of verticals
- Unless otherwise indicated, data updated as of 10/1/2017

Rating and pricing information

Electronic Arts Inc. (B/A, $113.62), Priceline.com Inc. (N/A, $1,942.11) and TripAdvisor Inc. (S/A, $40.30)

Disclosure Appendix

Reg AC

I, Heath P. Terry, CFA, hereby certify that all of the views expressed in this report accurately reflect my personal views about the subject company or companies and its or their securities. I also certify that no part of my compensation was, is or will be, directly or indirectly, related to the specific recommendations or views expressed in this report.

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Financial Returns and Multiple use the Goldman Sachs analyst forecasts at the fiscal year-end at least three quarters in the future. Growth uses inputs for the fiscal year at least seven quarters in the future compared with the year at least three quarters in the future (on a per-share basis for all metrics).

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