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PitchBook

Private Market PlayBook

The trillion-dollar question:

What does record dry powder mean for PE & VC fund managers?

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A letter from the Editor

Dry powder, the amount of capital available for investment funds to call down, has reached an all-time high. This isn't necessarily a good or a bad thing, but it certainly impacts the players involved in the private market ecosystem (and beyond). On one hand, that's a lot of uninvested capital that can make institutional investors in private equity (PE) and venture capital (VC) funds anxious, since they have timelines for getting returns and are paying relatively hefty fees for that money to sit around. On the other hand, investors are showing patience, staying increasingly selective to avoid overpaying in an era of high deal multiples and valuations.

As limited partners (LPs) continue to funnel distributions back into PE and VC funds, deal volume continues to decline. What this has generally meant is that investors are writing larger checks for fewer investments, experiencing greater pressure to make the right bets. If anything, today's level of dry powder affects the PE and VC fund managers that are having to figure out how to deploy that capital when opportunities are fewer, and competition is higher than ever. In the feature of this edition, we explore this topic, and trace the macroeconomic factors that led to the rise in popularity of alternative assets.

It's important to clarify how we define dry powder, as criteria can vary greatly. Our dry powder figure is calculated using the most recently available fund cashflow data—in this case June 30, 2017—and includes only capital that is held in closed PE and VC funds. For PE, these include buyout, co-investment, mezzanine and growth funds, among others, but exclude evergreen funds. For VC, included are funds raised by traditional venture firms, as well as those raised by any institution with the primary intent of investing in the equity of startups.

I'd also like to outline the new structure of the magazine. You'll notice there are four core sections: Perspectives, The Feature, Market Trends and Analyst Insights. The Perspectives section includes contributions from our financial writers, who are responsible for producing our newsletter, The Daily Pitch, and the content on our News & Analysis website. The feature, as touched on above, will dive into the core of each edition's theme and will often include a spread that helps visualize the data and trends impacting it. The Market Trends section includes our latest macro data and analysis on VC, PE and M&A activity, including deal flow, exits and fundraising. Finally, the Analyst Insights section includes contributions from our research analysts, who are dedicated to providing rigorous, thematic research on key areas driving the private markets.

George Gaprindashvili
Editorial Director

Perspectives

Meet three tech titans helping lead PE's fundraising boom

By Kevin Dowd

The final years of the 1990s were a heady time in the world of software and tech. One dot-com startup after another was founded and quickly rocketed to a lofty valuation—and several private equity firms were formed to capitalize on the bonanza.

The first wave of dot-com darlings soon came crashing back to Earth. But the PE shops created to fund them have proven more resilient. And now, they're raising money like never before.

The primary examples are Silver Lake, Vista Equity Partners and Thoma Bravo. All founded in either 1998, 1999 or 2000, the three tech-focused buyout shops have followed different paths over the past two decades. Yet they've arrived at the same destination: the pinnacle of private equity. All three investors closed new flagship funds within the past 18 months, combining to collect $33.6 billion in new capital.

A new industry emerges

The firm that's now known as Thoma Bravo was created in 1998 by Carl Thoma and Bryan Cressey. Called Thoma Cressey, it was formed as a spin-out from GTCR—where its two founders previously worked—with the intent of raising smaller funds and pursuing smaller deals than GTCR. Ten years later, Orlando Bravo took over Cressey's name partnership, and the scope of the firm's goals began to change: After gathering $822.5 million for its Fund IX in 2009, Thoma Bravo closed its Fund XII in September 2016 on $7.6 billion—representing an 824% step-up in less than a decade. And the firm is now said to be seeking $10 billion for a new vehicle.

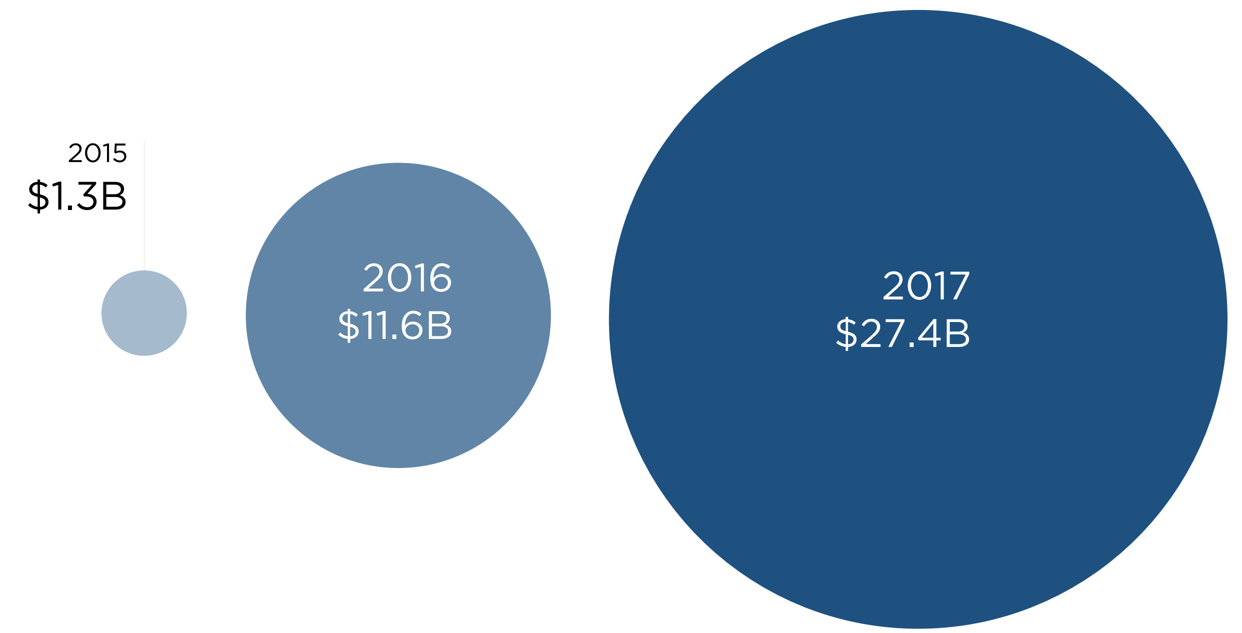
A year after Thoma Bravo was formed, meanwhile, Robert Smith left his position on the tech team at Goldman Sachs to form Vista Equity Partners, a firm focused exclusively on enterprise software companies. The shop has experienced a significant uptick of its own in fund size, going from a $1 billion flagship effort in 2000 to an $11 billion vehicle closed in May 2017. Today, the charismatic Smith is one of the most prominent founders in PE: Away from the office, he's the chairman of the Robert F. Kennedy Human Rights.

It was also in 1999 that veteran tech investors Jim Davidson, Glenn Hutchins, Roger McNamee and Dave Roux formed Silver Lake, creating one of the most-hyped new firms in recent memory: Bill Gates, Michael Dell and Larry Ellison all reportedly contributed to the tech-focused investor's debut. At the time, the idea of large-scale tech LBOs was a new one; now, thanks largely to Silver Lake's successes, it's commonplace. The firm has played a role in some of the biggest transactions ever, including Dell's $67 billion add-on of EMC. Last April, it closed its newest fund on $15 billion.

Combined, the three firms have completed 527 private equity investments since the start of 2008, according to the PitchBook Platform. About 79% of Thoma Bravo's deals have been in the IT sector, compared to 69% for Vista and 63% for Silver Lake.

How different is that from the PE field as a whole? Over the same span, barely 13% of all private equity investments worldwide involved IT businesses.

Total capital raised by Vista Equity Partners, Thoma Bravo and Silver Lake



Source: PitchBook

But with more and more software companies maturing to the stage where private equity investment makes sense, that number seems to be on an inexorable rise. Deals in IT increased from 11.4% of all worldwide activity in 2008 to 17.8% last year. Amid an overall pullback in activity, IT investment surged in 2017, with the industry overtaking B2C as the second most popular sector for PE firms in the US.

Big money, big results

An emphasis on the fast-growing software sector has created another similarity among Thoma Bravo, Vista and Silver Lake: All three have generated some eyebrow-raising returns with recent funds.

Each of Thoma Bravo's last six flagship buyout funds currently ranks in the top half of its respective peer benchmarks, per PitchBook data. That's highlighted by the firm's Fund IX and Fund X, which boast respective IRRs of 44.7% and 39.6% as of mid-2017. Thoma Bravo Fund IX has logged a 3.70x TVPI, the best of any of the firm's vehicles.

Vista's Fund V, from 2014, has been something of a disappointment in terms of multiples: Its IRR currently sits at 11.2%, toward the bottom of its peer benchmark. Before that, though, the firm's LPs had grown used to higher returns: The $3.5 billion Vista Equity Partners Fund IV has a 19.8% IRR and the $1.3 billion Vista Equity Partners Fund III has recorded a 27.7% figure, both ranking near the top of their benchmarks as of 4Q 2017.

Silver Lake's most recent effort, meanwhile, has been a monster. The firm's fourth namesake buyout fund, which closed on $10.3 billion in 2013, had an IRR of 28.8% as of the end of 4Q, far and away the best of any vehicle in its PitchBook benchmark.

While all three have raised recent mega-funds, the trio of tech-focused firms had varying levels of deal activity in 2017.

Vista completed 43 private equity investments, per PitchBook data, headlined by a $4.8 billion acquisition of fintech provider DH. Thoma Bravo sealed 20 new investments, including takeovers of software provider Kofax and a division of Symantec. Silver Lake, meanwhile, completed just 13 transactions, but it could have a doozy in the works: The firm has been connected to reports of a possible chipmaking mega-merger between Broadcom and Qualcomm.

After the fundraising flurry of 2017, the coffers of all three firms are freshly stocked with new billions. When it comes to tech buyouts, there's little reason to think Silver Lake, Vista Equity Partners or Thoma Bravo will slow down anytime soon.

Data-driven investing: Why 'gut feel' may no longer be good enough

By Anthony Mirhaydari, Kate Clark

Money never sleeps. Stock trading that once took place under a buttonwood tree is now beamed using microwaves and lasers to computer-based algorithmic traders that seek edges counted in milliseconds or less.

But where investors are supposed to live and breathe innovation—funneling money to new and emerging companies—things haven't significantly changed: folks sitting around the table, with decisions based largely on "soft" qualitative factors and the confidence that they can predict which companies, technologies and industries will thrive.

Changing the game

The predominant consideration in a VC deal is the initial appraisal of the management team; first impressions, in other words—a quaint concept in an increasingly quantitative world.

But the old way isn't without justification: Unlike equity or bond investors, who have the benefit of years of well-organized, widely available data, startup investors don't have much to go on. In the vacuum that results, factors like founder personality, team dynamics and personal experience are heavily weighed rather than income statement data or operating metrics like units sold, information that often just doesn't exist.

Cognitive shortcuts try to fill in for the missing data points. Which allows bias to creep in if say an underrepresented founder tries to raise money, since they don't fit the archetypal startup founder image—the Stanford-educated, STEM-degreed, white-male tech bro.

Yet a growing number of investors are innovating with data-driven strategies. Right Side Capital Management, Social Capital, EQT Ventures, Nauta Capital, e.ventures, Hone Capital, GV and Correlation Ventures, to name a few. They are early adopters of a new strategy, using machine learning and data to automate the process of selecting portfolio companies, eliminate implicit bias from the equation and quantify gut feelings.

Right Side Capital

San Francisco-based Right Side Capital is using its quantitative approach to concentrate on geographies outside the Silicon Valley and New York startup ecosystems, an advantage of not having to physically meet with prospective founders and thus allowing them to serve underfunded areas, avoid the competitive Valley scene and, it is hoped, secure better deal terms.

Managing director Dave Lambert explains the firm's harsh assumption, based on historical data, is that the startups they fund are likely to fail. So instead of trying to focus on the right industry vertical, pick winners and beat the odds, RSCM makes small investments of between $100,000 and $500,000 (at valuations of $3 million and under) and diversifies aggressively to offset the high assumed failure rate.

Since 2012, they have invested in over 850 companies based on that philosophy. "It's too difficult to predict the future with too many variables and too many potential pivots in areas where the founders have far more expertise," Lambert told PitchBook. In his mind, if these founders feel confident enough to make the sacrifices to roll the dice and be entrepreneurial, who is he to second guess?

He found irony in the fact one's ego wants to "believe it's an expert in everything" when, in truth, the beginning of knowledge is admitting what you don't know.

Social Capital

Perhaps the most well-known adopter of the Capital as a Service (CaaS) model is Palo Alto-based Social Capital. In October, the firm, led by star VC Chamath Palihapitiya, launched a data-driven operating system for early-stage investing.

Investment partner Ashley Carroll told PitchBook that the experiment resulted in a much higher ratio of underrepresented founders, evidence that the traditional VC process is perpetuating bias. Of the 3,000 companies the firm evaluated, just several dozen received funding. But the startups selected represented 12 countries, 42% were women and the majority were nonwhite.

Proof that the CaaS model works, at least when it comes to funding minorities, according to Carroll

In a Medium post outlining Social Capital's embrace of CaaS, Carroll described it as a no-frills model.

"No hoops, no $7 artisanal coffee chats, no designer pitch decks, no bias, no politics, no bullshit," she wrote. "Just the best teams with the best ideas, the best execution, and the best metrics funded on the merits of their achievements, not the status characteristics of their founders or the exclusivity of their professional networks."

EQT Ventures

EQT Ventures in Stockholm takes data-driven investing to a new extreme. The 3-year-old VC firm, which is part of private equity group EQT, uses an AI-driven data platform called Motherbrain to help it make investment decisions. The firm's €566 million fund backs companies at all stages—except seed—with €3 million to €75 million checks. So far, the firm has invested in 22 startups.

Analytics partner and former VP of analytics at Spotify, Henrik Landgren, said Motherbrain could've identified Spotify and Uber as unicorns in the companies' early days. He believes letting software play a key role in crafting one's portfolio is "the next evolution of VC."

"The better data you have, the better algorithms you have, the better investments you'll make," Landgren said. "It's so easy to get caught up in a feeling and make decisions based on that. That's one of the big reasons we have Motherbrain, we can take bias out of that decision."

With a career in analytics—Landgren built Spotify's analytics team—he's understandably passionate about data-driven investing: "You should of course use your gut-feeling to make great decisions, but you should train your gut using data," he wrote on EQT Ventures' website.

So where does the data come in exactly?

Relying on data anonymizes and standardizes the pitch process. Putting an end to the traditional VC-founder pitch meeting that results in a VC saying, "Hey, I liked them and they have drive." That's all "soft, lovey stuff," Lambert said, which is difficult to quantify.

But it's not impossible. For instance, are they technical founders? Do they have significant domain expertise? Do they have previous startup experience? And have they managed people and budgets before? Assign a score, crunch the numbers and leave the cognitive leaps of faith behind.

Not a panacea

Believe it or not, there are still some things humans are better at than their robotic counterparts: identifying strong team dynamics and building relationships with founders that can, in turn, reveal additional information.

EQT's Landgren said EQT Ventures relies on Motherbrain to handle tasks humans aren't so good at, like identifying strong investments without bias. That way, the humans involved can focus on what they are, in fact, good at.

James Newell at Voyager Capital, an investor in RSCM, strongly believes that traditional VC still has a role to play since a "full data" approach cannot be relied upon because hands-off "robo-investing" removes the ability for investors to add value. And the ability to measure everything from body language to personal stories and unique circumstance—things that are not easily inputted into a decision algorithm.

Moreover, Newell's skeptical that many early-stage data-based decision making "black boxes" are in fact bias-free. How does one determine which factors to weigh? And which qualities to rank higher than others? Giving a higher score to Stanford graduates, for instance.

But Voyager's investment in RSCM is a strong vote of confidence that there is indeed a role for data-driven VC. Newell admits that he is "in the business of innovation and will look at every potential tool to make better decisions" and wants to avoid being a "cautionary tale of funding innovation but not using it." Yet right now, the applications are limited in his view.

The future of VC

As much as the data proponents want to streamline and expedite the unicorn hunt, the structural nature of VC investing makes full quantization unlikely. Founders aren't just tapping investors for capital but also mentorship, access to expert networks and help scaling growth and achieving profitability.

Thus, in our view, the future of VC is going to be a mix of both old-fashioned gut feel and new-tech AI-enabled platforms. A full robo takeover isn't likely nor desirable. Early-stage data isn't robust enough. And many factors (such as founder chemistry, motivation, grit) are hard or impossible to quantify. But the universe of capturable data points is expanding, and VCs are developing a better understanding of their biases and cognitive shortcomings. Gut alone just may not be good enough anymore.

Even when filled with $7 artisanal coffee.

The trillion-dollar question:

What does record dry powder mean for PE & VC fund managers?

Well over $1,000,000,000,000 in committed capital sits in the coffers of private equity and venture capital funds worldwide. To be precise, as of the end of June 2017, nearly $1.107 trillion in commitments were available for drawdown by fund managers—$145.4 billion allotted to VC, $961.5 billion to PE.

These are unprecedented sums. High levels of dry powder have been a persistent worry for both PE and VC, with old trope of "too much cash chasing too few deals" being replayed every few years. But now, uncharted territory is being entered. For some time now, it has been clear that as fundraising volume stayed strong, records would be set by the hundreds of PE and VC general partners treading the capital-raising trail. But to get to a trillion dollars, many factors had to align concurrently. And with many of those drivers still in play, they will continue to shape how PE and VC firms will deploy their hoards of capital. To explore how this level of dry powder will affect PE and VC fund managers and their strategies, we must start with the origins of today's record tally.

continued >

The visible hand: How central banks' monetary policies encouraged the rise of alternative assets

The ramifications of the global financial crisis are still unspooling. Perhaps the most impactful result of them all was central banks unleashing quantitative easing in an effort to ameliorate the effects of the financial crisis. In tandem with the decades-long trend of lowering interest rates culminating in record lows, the intensity and global scope of quantitative easing finally wrought a truly paradigm-shifting array of consequences.

As fixed-income assets became more and more inflated in price, financial institutions found it necessary to begin adjusting their portfolios, shifting risk levels and allocation to equities in a search for yield. Asset prices began to rise across the board in response to the massive stimulus. And as the rise in prices continued unabated for years, one underappreciated historical driver of increasing allocations to PE and VC came into play: the reverse denominator effect.

The reverse denominator effect

As fortunes wax and wane within public equities, the allocation to private asset classes on the part of large entities also responds in kind, encouraging either an increase or decrease in commitments. In the wake of the financial crisis, PE and VC allocations actually soared higher than official targets as their public equity portfolios shrank while managers were generally slow to mark down portfolio companies in a phenomenon known as the denominator effect. This turned out well for some institutions that held on to their PE holdings as private market returns have rebounded. Many institutions, however, were forced to succumb to the denominator effect and sold their private market holdings on the secondary market at firesale prices in order to rebalance their allocations. Such mathematical shifts are par for the course when it comes to portfolio composition, but shouldn't be forgotten when it comes to encouraging longer-term trends.

The prolonged bull run in public equities has led to a reverse denominator effect, however, whereby institutions need to commit to private market funds at a rapid clip to ensure they maintain their target alternative asset allocations. Accordingly, dry powder levels continued to rise.

It is also worth noting that alternative investments in general can become more popular in some investors' eyes based on their intrinsic merits. Though illiquid and often pricey due to fees, demonstrated historical outperformance and associated long-term stability could justify increasing allocations at least marginally. That said, the more important driver of increased allocations to PE and VC has been the reverse denominator effect.

New-ish kids on the block

Nontraditional fund investors also played a role. High-net-worth individuals by volume, for example, have increased significantly in the past couple decades. And as family offices among other, similar entities targeting wealth preservation, tend to maintain high allocations to alternative investments, PE and VC fund managers benefited once more. Sovereign wealth funds also remained active in their search for high-performing alternative assets, some discussing increasing allocations to established fund managers. This budding population of investors is likely to become increasingly important in the private fund universe.

More for more: Increasing institutionalization and sophistication

It's fitting to conclude our tracing of historical origins with the most recent development within PE and VC. As streams of money kept flowing into the space post-crisis, traditional investment strategies began to evolve out of necessity. Fledgling PE and VC fund managers raised new vehicles targeting more specific segments of the capital stack, or dynamic, fragmented sectors such as healthcare technology. Increased variety of investment strategies entailed a greater array of opportunities for LPs to gain exposure to specific niches, incentivizing institutions to either consider or increase their participation in select PE and VC funds. And those firms that were successful in their initial efforts only kept fundraising, necessarily, raising larger and larger funds. Of course, such success only kept on contributing to the slowly swelling mound of dry powder.

The dry powder is in the details

Let's now analyze the current composition of dry powder in detail, starting with PE. There is a considerable amount of dry powder in PE vintages predating 2014—$139.5 billion or 14.5% of the current total. In short, there is a significant overhang of aging capital that remains to be deployed in the later stages of a typical PE fund's investment cycle.

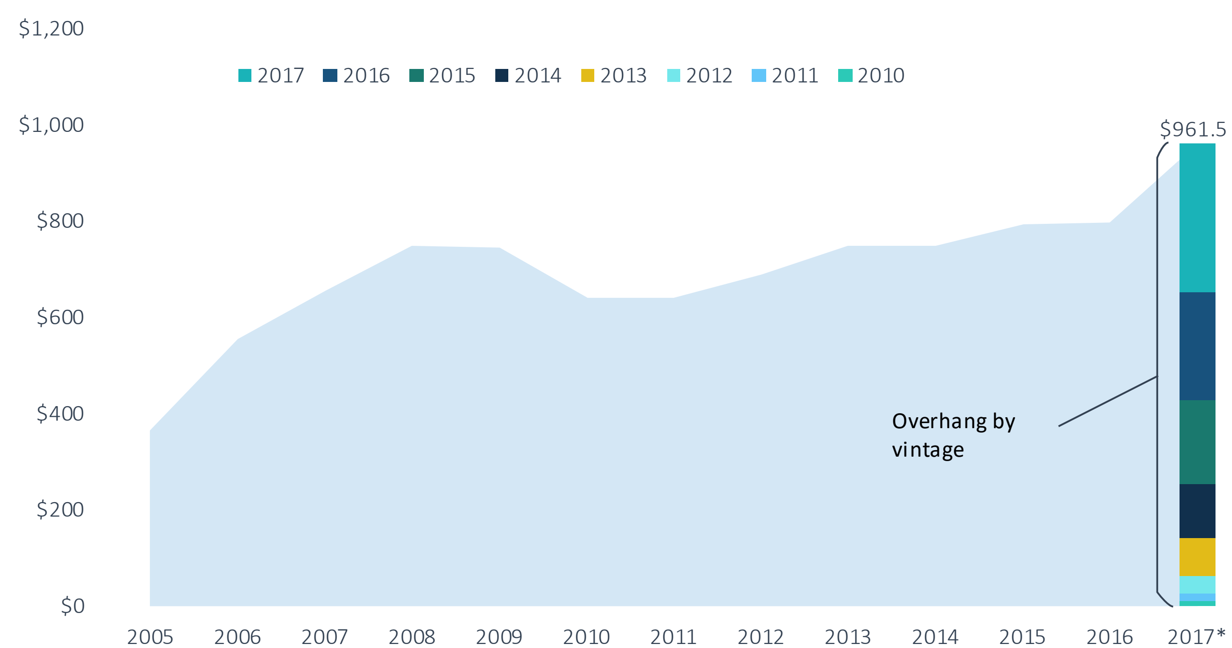
When analyzing PE dry powder by size, additional intriguing trends emerge. Hinting at the growing institutionalization of private markets and PE in particular, the concentration of capital committed to larger vehicles has intensified. 2015 was a clear turning point, with last year in particular standing out due to a resurgence of mega-funds. Apollo Global Management raised a record $24.7 billion for its latest flagship vehicle in 2017, while CVC Capital Partners closed upon €16 billion in commitments the same year for its latest buyout fund, to cite two examples.

Why? Though PE is a relatively youthful field all said and done, tracing its true institutional development to the 1960s, larger funds have consistently represented a disproportionate share of capital raised, on a relative basis. But PE in general is simply becoming more institutionalized and widespread, especially on a geographic basis—the inventory of PE-backed companies is only growing larger and larger, exceeding 12,000 as of the end of 2017. The natural evolution of the field has resulted in multiple large firms being able to successfully raise billion-dollar-plus vehicles, particularly for PE. The market has been traditionally dominated by the earliest succeeding firms within the space—flagship buyout funds such as Blackstone, KKR and Apollo—but slowly, more and more firms were able to emerge throughout the late 1990s and early 2000s to begin carving out their own profitable niches. It's also worth pointing out that as limited partners have only grown larger and larger in size, they have had to commit larger and larger sums to maintain allocations. Consequently, committing to large fund managers has only tended to intensify over time.

Dry powder in the venture industry may be expected to exhibit somewhat similar traits to PE, but it is actually quite different, subject to more

Dry powder spiked in 2016 and 2017 due to a resurgence of mega-funds

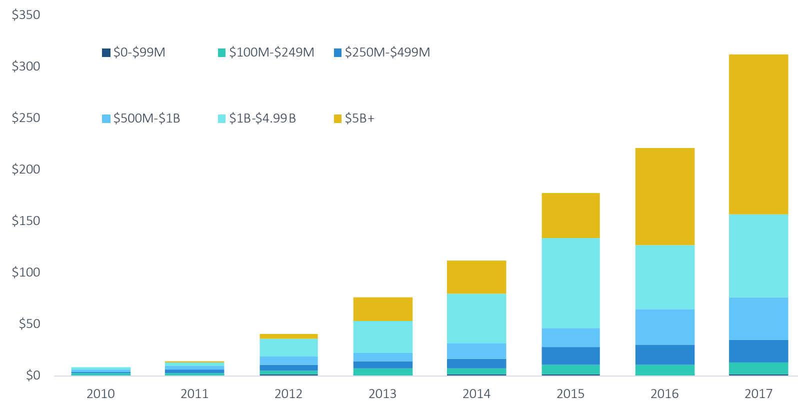
PE dry powder



Source: PitchBook
*As of 6/30/2017

A majority of recent dry powder is concentrated in large funds

PE dry powder ($B) by vintage year and fund size



Source: PitchBook
*As of 6/30/2017

significant skew and quicker changes in composition. First of all, it must be emphasized that VC is still a small proportion of overall private equity allocations, as limited access to top-performing managers and the necessary attributes of the industry persist as constraints. Furthermore, the power distribution of returns in VC resembles a hockey stick much more than in nearly any other asset class. True home runs are often achieved by the earliest-stage investors, yet few can preserve outperformance for long. Those that can raise larger, late-stage funds benefit from the advantages of scale, as such vehicles tend to exhibit more stable performance. What this entails is an environment predisposed to experience outsized concentration. Only a small coterie of venture firms has successfully raised multiple vehicles over many years, with accompanying increases in size, which has led to VC fundraising trending larger and larger in aggregate especially as of late, resulting in a plurality of venture capital overhang being concentrated in relatively youthful fund vintages.

What increasing concentration entails is a necessary diversification of investing strategies across the entire capital stack in VC as firms look to stand out. A bigger fund means bigger checks typically have to be written by late-stage managers, while firms aiming at the early stage have had to more clearly delineate specific focus and advantages. Essentially, with more capital at the disposal of multiple fund managers, competition has been intensifying when it comes to the evolution of strategies, as GPs vie to identify any edge.

How investors are answering the trillion-dollar question

Any given investment firm is necessarily unique, as unique individuals carry out its operations and formulate its investment thesis. However, several clear trends are emerging among evolving strategies as investors seek to deploy a ponderous arsenal of dry powder efficiently. Let's analyze PE first.

Growing exposure to technology companies

PE fund managers have been significantly increasing their activity within the technology sector—about 20% of all 2017 US PE activity was within IT. This is hardly surprising; as technology matures and proliferates into multiple other sectors, blurring traditional industry demarcations, more technology enterprises have come under the investing purviews of PE firms. Especially as early players in the space have begun demonstrating strong returns, tech has become even more alluring.

Doubling down on unification amid fragmented sectors

Perhaps the second-most popular investing thesis, multiple PE firms have continued to engage in add-ons across multiple fragmented sectors, particularly healthcare clinics & outpatient services. Although within PE's typical operational wheelhouse, such an add-on-centric play has rarely accounted for as high a proportion of overall PE buyout activity as ever before, persistently eclipsing 50%.

Increasing utilization of diverse investment approaches

Secondary buyouts continue to account for a growing share of liquidity for PE fund managers, as well as a major source of deal flow. As complex as the implications of sponsor-to-sponsor

How fund managers are adapting strategies

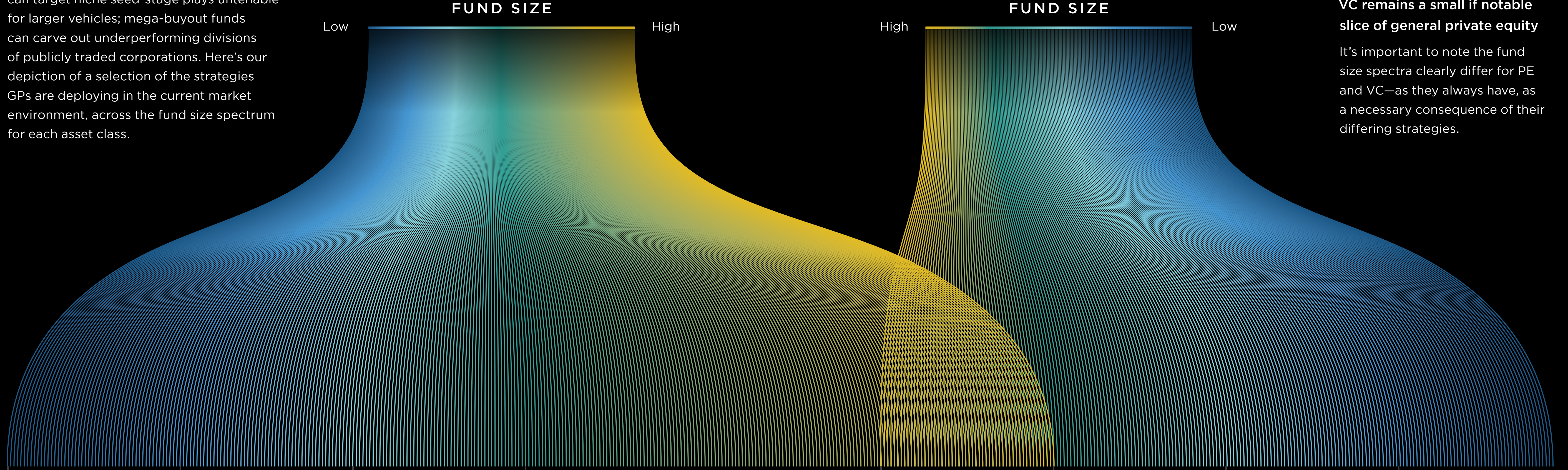
There are no hard-and-fast rules about funds of specific sizes pursuing only select strategies. But typical check sizes do matter in practicality, leading to funds within certain size ranges tending to explore certain opportunities others can't. Micro VC funds can target niche seed-stage plays untenable for larger vehicles; mega-buyout funds can carve out underperforming divisions of publicly traded corporations. Here's our depiction of a selection of the strategies GPs are deploying in the current market environment, across the fund size spectrum for each asset class.

PE

VC

VC remains a small if notable slice of general private equity

It's important to note the fund size spectra clearly differ for PE and VC—as they always have, as a necessary consequence of their differing strategies.



ADD-ONS

Middle-market-focused fund managers are tackling fragmented niches, building out platforms.

TECHNOLOGY

As enterprise software companies adopt SaaS models—entailing steady cashflows—PE firms find them even more to their liking.

SECONDARY BUYOUTS

Larger firms with greater resources or specialist approaches can often take over the portfolio companies of smaller, fellow GPs.

CARVE-OUTS

Divestitures of divisions by public companies looking to boost performance can represent take-private opportunities.

PRIVATE GROWTH

Large, mature tech companies staying private represent growth investment opportunities.

ENTERPRISE

It's not that consumer plays aren't possible, it's that incumbency effects are more potent than ever before, so B2B looks to be a better bet.

GEOGRAPHIC DIVERSIFICATION

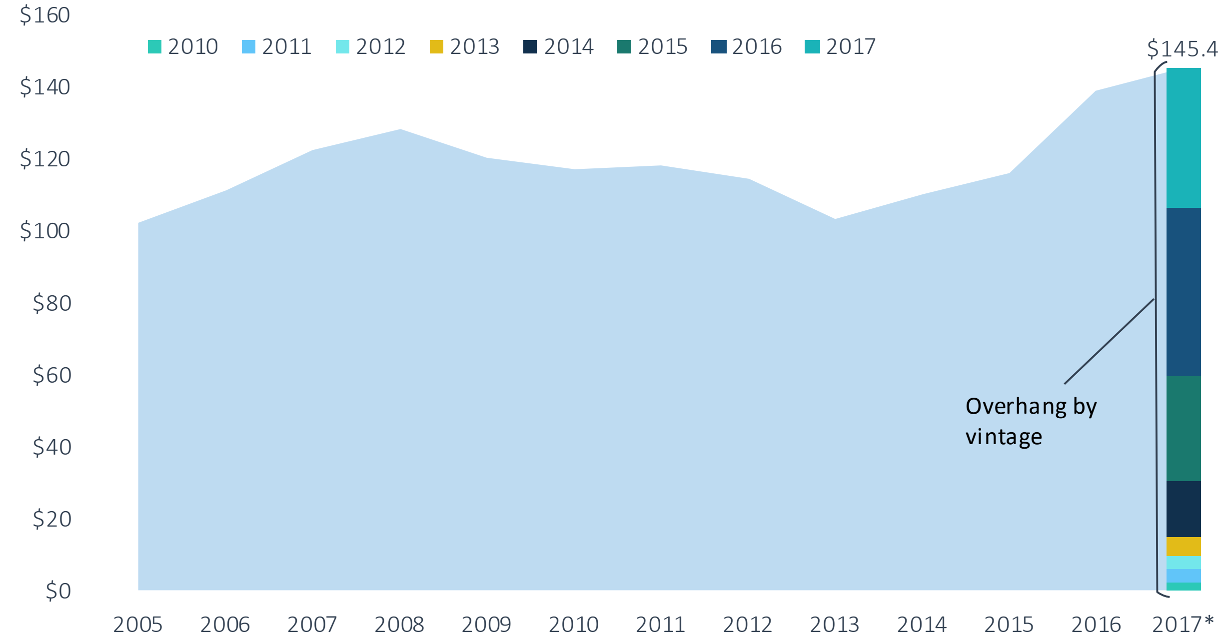
Although there is no major push to invest globally yet, VCs are keenly aware of relative cost and network advantages.

NICHE FUNDS

In a high-priced environment, capable first-time GPs are doubling down on differentiation on sector and capital stack foci.

Recent vintages account for a majority of current dry powder

VC dry powder



Source: PitchBook
*As of 6/30/2017

transactions may be for LPs, their growing incidence testifies to increasing specialization and sophistication on the part of PE buyout shops. More and more, larger firms are picking off assets in the portfolios of fellow yet smaller PE funds that lack the resources to take certain companies to higher expansion rates. Fund managers with dedicated, sole-sector focuses can also make compelling cases for their ability to extract additional value beyond the abilities of more generalist firms.

Although never as predominant as control acquisitions, growth investments have remained more stable amid slowly diminishing PE activity over the past several quarters. Their appeal in a high-priced environment is obvious—what's more difficult is finding truly worthwhile situations in which acquiring a minority stake is justifiable. As of late, such opportunities have often arisen when it comes to rapidly growing, mature technology companies that have opted to stay private for longer than traditional norms. Often venture-backed, these businesses still conduct late-stage capital raises via private means rather than going public, and those PE firms that decide to participate in such financings often find themselves joined by late-stage venture funds. With that, then, it is time to assess how VC firms are navigating an environment characterized by significant amounts of capital.

Playing for high stakes

In 2017, nearly half of all VC invested was concentrated in rounds of $50 million or more. Late-stage venture has become an expensive game indeed. So how are VCs armed with massive funds still dispensing capital efficiently? In short, they are still willing to pay fairly high prices because growth potential of some companies remains remarkable. It's important to remember there are plenty of highly capitalized companies that are likely to achieve good liquidity events.

In addition, late-stage VCs are not solely underwriting these high-priced late-stage rounds themselves. Other deep-pocketed firms are joining in, and, moreover, many of these late-stage VCs are engaging in increasing diversification.

Greater geographic and sector diversification

As lower-hanging fruit in consumer software plays is either gobbled up by incumbent tech giants or faster-moving startups, there is more and more focus on enterprise use cases. For example, agtech posted its most lucrative year yet in 2017, while other sectors that once were overhyped yet now appear to be finally gaining greater steam are becoming more attractive.

Beyond sectors, greater geographic diversification both internationally and across the US is slowly transitioning from mostly talk to at least some action. Firms such as Elsewhere Partners have launched funds dedicated to exploring opportunities explicitly located outside current hotspots. Such specialist strategies have tended to outperform in the past.

Explicit intertwining of sector & size strategies, along with segmentation of the capital stack

Let's illustrate these twin concepts by analyzing the seed stage. Nowadays, to raise a seed-stage fund, you need not only a dedicated check size focus but also a strategy explicitly geared toward a particular niche sector. Operating experience is, of course, an immensely helpful attribute consequently. Although smaller funds are not nearly as consequential in terms of percentages of overall volume as they once were, they are hardly dying out, so there is competition for LP dollars. For smaller fund managers looking to raise, being able to exhibit a highly specific thesis around particular parts of the capital stack, accordingly, can be alluring to LPs and thereby has led to greater segmentation among many smaller fund managers.

The consequences of record capital overhang: How will this transform the PE & VC industries?

Is record dry powder a good or bad thing? Will too much capital chasing relatively the same number of opportunities lead to prices high enough that they engender compression of returns? Worst of all, could that return compression lead to the allure of PE and VC consequently dimming, as they are increasingly unable to demonstrate significant outperformance of other asset classes? Or could private fund managers find new niches to target as well as new models of owning and managing assets that could lead to inroads in new sectors? Won't innovation cycles in key sectors such as automation lead to newer opportunities that could prove prime for not only early-stage-focused firms but also long-term holders such as buyout funds?

It is easy to see how some of those questions could result in fairly bearish takes, ultimately. However, a bearish take would be rather myopic, as it is overly predicated on PE and VC approaches staying static. As we have already seen, fund managers are constantly adapting to an ever-shifting environment—and one of the principal factors of that change has been the driver of an ever-increasing dry powder level.

But increasing dry powder is in and of itself a consequence of global macrofinancial and macroeconomic forces, as well as growing sophistication and institutionalization of private markets. For example, much has been made of the gradually shrinking universe of publicly listed companies. However, much of that decline has occurred amid small-cap companies. In a not-so-coincidental simultaneous shift, during that gradual decrease over the past 20 years, the global inventory of PE-backed companies in particular has been rising. On the venture side, the unicorn phenomenon signifies how mature tech companies that traditionally would have already listed are electing to stay active in private markets, raising capital to continue fueling growth. Private markets evolved into absorbing smaller-cap companies, in short, and they will continue to evolve and demand new approaches by fund managers. Record dry powder is, once again, a result of the evolution of private markets and also an accelerating factor in that evolution.

Neither a problem nor a pure positive, a trillion dollars doesn't get invested swiftly. The consequences of that tally of committed capital will continue to reverberate. One conclusion is clear: The fact that dry powder has exceeded $1 trillion is a testament to how much PE and VC have evolved as asset classes, and how much further they have to go.

Market Trends

Drawn from our flagship industry reports covering private equity, venture capital and M&A, this debut section of the PlayBook contains analysis and datasets summarizing the primary trends shaping each market.

Overview

Midway through last year, we highlighted that 2017 was pacing to come in as the highest year since at least the dot-com era in terms of total capital invested. As we closed out 2017, this certainly played out, with more than $84 billion in capital invested across nearly 8,100 completed financings, reflecting a drop of around 6% in terms of aggregate deals, yet a surge in total deal value of 16% year over year (YoY).

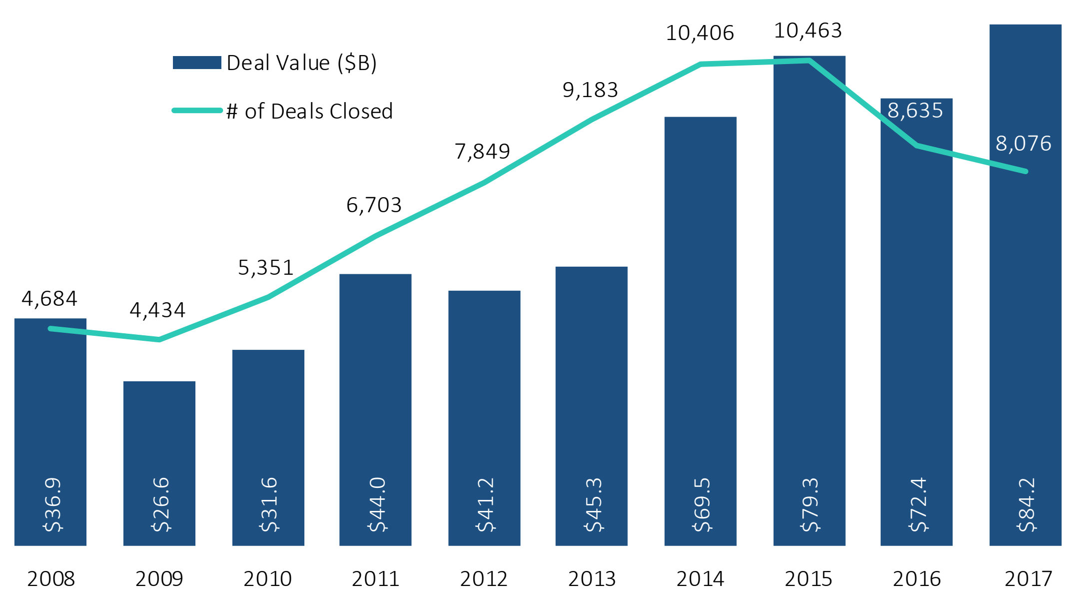
The venture markets today have undergone a shift in the dynamics and parameters that have shaped them. Companies are larger and many are taking on institutional financings later in their lifecycle as evident by the growing median age of companies raising v rounds. This trend is particularly notable the earlier in the investment cycle you look. Since 2013, the median age of companies raising institutional angel & seed rounds has grown a staggering 38% to 2.42 years, with companies at the Series A round coming in at just over 3.5 years of age, and Series B companies typically raising those rounds at around year five, on a median basis.

We've also continued to witness liquidity cycles stretch to unprecedented levels, driven by record amounts of dry powder ready to be deployed to the outperforming businesses that have proven their going concerns in today's marketplace. This notion is compounded by a founder and management mentality that has embraced the continued use of private capital to fuel growth, rather than move through an IPO or M&A exit. Just as recently as a few years ago, this wasn't simply a matter of choice, but also an implicit need to garner the typically large amount of capital needed to drive growth at a later-stage company. That is not the case today.

To illustrate, venture financings of at least $50 million have grown at a compounded annual growth rate of some 13% since 2007, more than double the pace at which rounds completed between $25 million and $50 million (6% CAGR) have grown, and at nearly 4x the rate at which rounds between $5 million and $25 million have increased (2.5%-3% CAGR). Further, VC financings of $50 million+ accounted for nearly half of all VC invested in 2017, a staggering figure in and of itself that is even more remarkable when compared to the fact that such rounds represented less than 20% of all VC invested in 2007.

$84B+ invested for first time since dot-com era

US VC activity



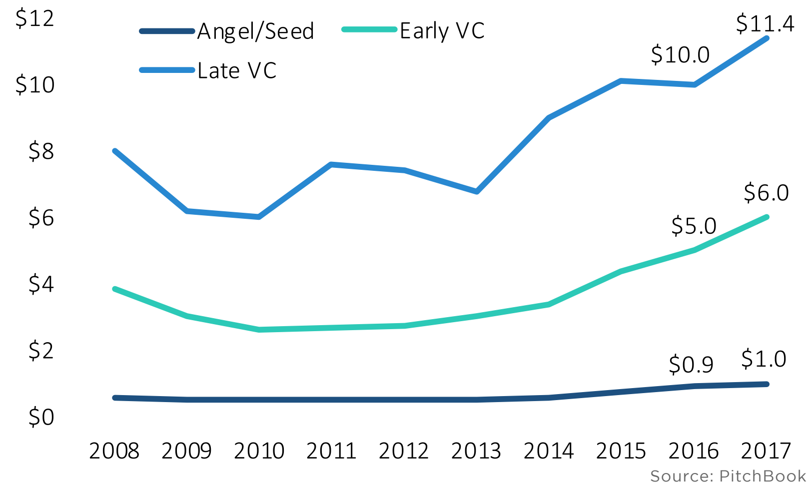
Source: PitchBook

Round sizes have also continued to increase and have shown no sign of slowing down, growing at a rapid pace across the entire venture lifecycle. At $6 million, early-stage rounds came in roughly 20% higher than what we saw in 2016, with late-stage rounds growing 14% to $11.4 million. This, coupled with the rounds completed by aging companies that continue to push off full liquidity events, has resulted in a profound rise in private company valuations, particularly at the late stage where we saw median Series D+ valuations jump to $250 million last year, a hike of over 85% relative to the already large $135 million figure we saw in 2016.

In many ways, 2017 can be characterized by the record amount of activity we saw involving unicorns. More than $19 billion was invested into such companies across 73 completed fundings, reflecting a YoY increase of over 10% and nearly 49%, respectively. Further, investments in companies valued over $1 billion amounted to more than a fifth of all VC invested last year, yet less than 1% of total deal flow. We've also begun to see winners and losers emerge amongst some of the various tech platforms we saw rise over the last half decade or so in areas such as fintech, Big Data, virtual reality and the sharing economy, among others. For example, companies such as Airbnb, Lyft, WeWork, Magic Leap, Unity, SoFi, Wish and Coinbase have all built relatively successful businesses over the last few years, able to continue raising private capital at hefty valuations and contributing to the continued rise of unicorn financings.

Early-stage rounds grow in size by roughly 20%

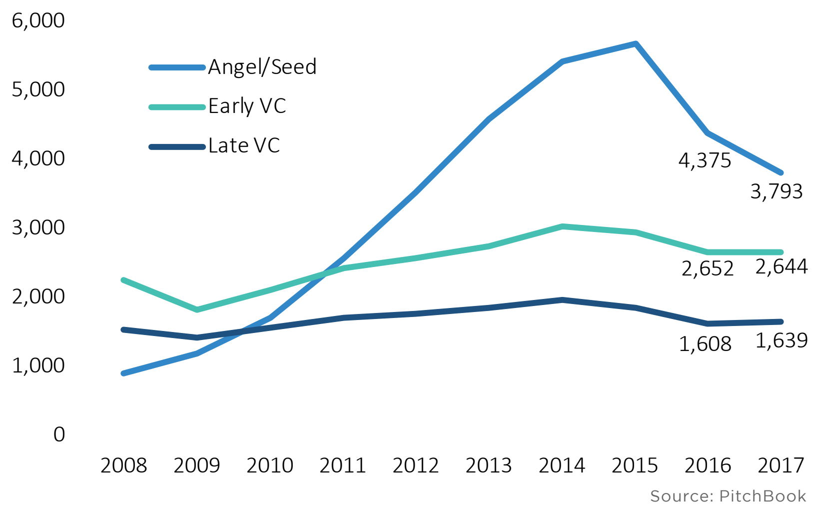
Median deal size ($M) by stage



Source: PitchBook

Angel/seed deals account for most of decline

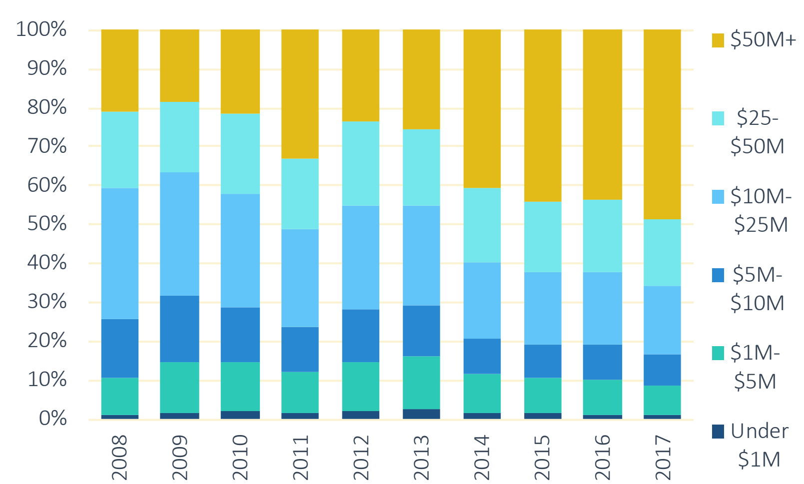
US VC activity (#) by stage



Source: PitchBook

Near 50% of value from deals of $50M+

US VC activity ($) by size

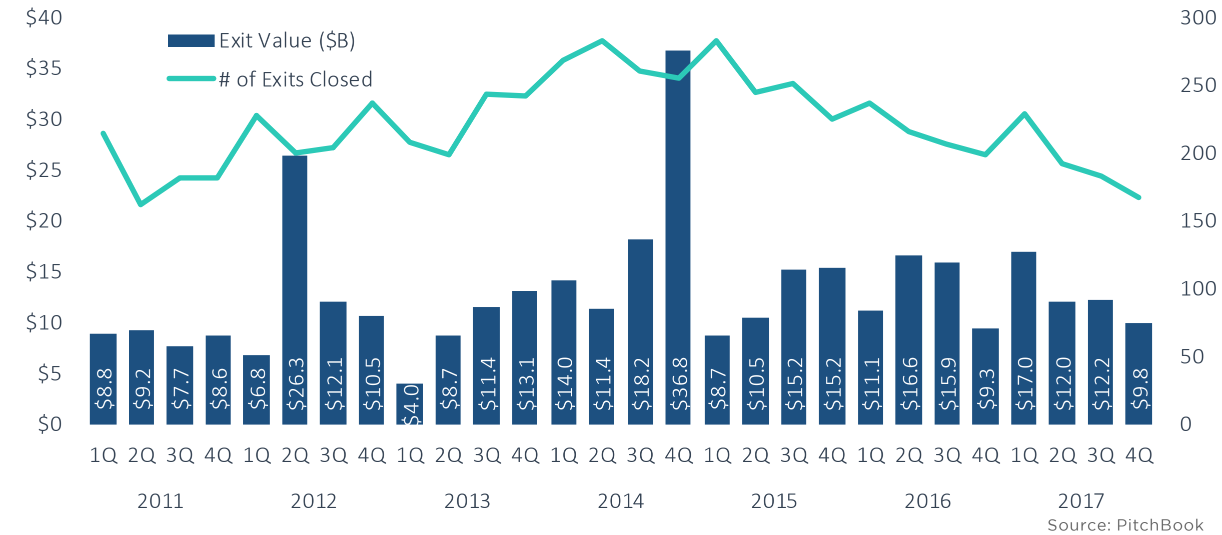


Source: PitchBook

Exits

Exits continue to slide, leaving industry in crunch

US VC-backed exit activity



Source: PitchBook

We've continued to see exit counts trend lower following a surge in VC-backed company sales and liquidity events between 2009 and 2014. However, sales have been significantly larger and aggregate exit value has remained heightened. 2017 saw more than $51 billion exited across 769 liquidity events, equating to a marginal YoY decline of 3.6% in terms of aggregate exit value, yet a drop of over 10% in terms of volume. Buoyed by SNAP's massive IPO ($3.4B) and a host of backlogged exits that came to market early in the year, 1Q showed signs of a rebounding exit market with nearly $17 billion exited across 228 sales. However, each subsequent quarter saw exit activity in terms of both value and volume decline. In fact, the 167 exits completed in 4Q registers as the lowest figure we've seen since 2011.

Today's industry dynamic, which can be summarized by a few items such as larger round and exit sizes, fewer sales and older companies raising capital, has certainly manifested itself on the back end of the VC cycle with the median exit size across all exit types soaring to new levels. At $85 million last year, the median exit size jumped close to 17% YoY. This figure not only comes in as the largest median exit size we've recorded in at least a decade, but also the largest YoY percentage increase in that metric. This trend also holds true when looking at strategic and financial acquisitions, which paid a median of $87 million to acquire venture-backed businesses last year— also the highest figure we've seen on record in at least a decade. With sales processes continuing to push out, the median time to exit in the venture market has reached a record 5.6 years. Undoubtedly driven by the ability of many companies to raise larger sums of late-stage private capital, companies are coming to market as larger entities and as a result, exit sizes and valuations have hit uncharted territory.

Despite exit volume declining, we've noticed a shift in the makeup of exit types being utilized. Strategic acquisitions typically represent the bulk of sales, yet as M&A activity across the board has lightened up, VC-backed sales to strategics last year declined roughly 20% YoY. That said, we've continued to see PE play a larger role in the venture market. Nearly $7 billion worth of VC-backed buyouts were completed last year in 146 sales, reflecting YoY growth of over 200% in terms of exit value, and a jump of 33% in terms of completed sales to PE. With the proliferation of both tech-focused PE funds, as well as a lending ecosystem that has grown to better understand how to stack debt against recurring revenue software businesses, we expect this outlet to remain in place for venture-backed management teams. Last, the IPO markets rebounded as well last year, with close to $10 billion raised across 58 completed listings, reflecting significant increases of 236% and 41%, respectively.

Fundraising

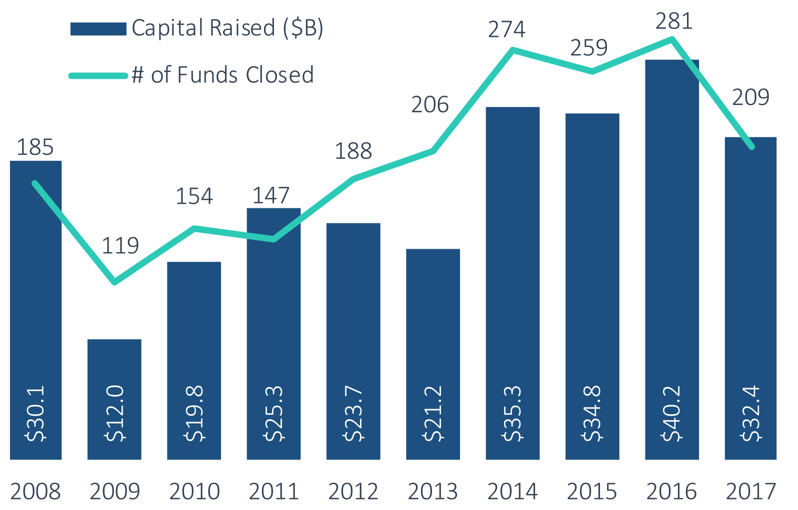
While coming in lower than the total amount of capital raised in 2016, on a historical basis, managers were still able to garner considerable success on the fundraising trail last year. More than $32 billion was raised across 209 completed closes, equating to a YoY drop of close to 20% in terms of total capital raised and 26% in terms of the number of vehicles closed. Interestingly, barring activity between 2014 and 2016, more vehicles closed last year than in any year in the last decade, with more capital raised than in any year during that same timeframe.

Buoyed by a mix of outsized fundraises by the likes of NEA ($3.3 billion) and Mithril Capital Management ($850 million), along with a steady pace of fund closings, 2017 was poised to match the record amount of capital ($40 billion) raised in 2016. However, as we transitioned to the back half of the year, fund sizes remained heightened on a median basis, but total closings dropped off dramatically, with both 3Q and 4Q seeing 36 and 45 total vehicles closed, respectively. This compares to the 64 funds we saw close in each of the first two quarters of last year. Given the massive uptick in vehicles we've continued to see come to market in recent years, along with ample dry powder yet to be deployed, seeing commitments slow to a certain extent is likely a positive to the overall industry, as capital availability certainly isn't an issue for the market today.

Despite the drop in fund counts in 2H, some of the largest vehicles to close in 2017 came then, such as TPG's Rise Fund, which closed on $2 billion in 4Q, and Institutional

$143B raised since 2014

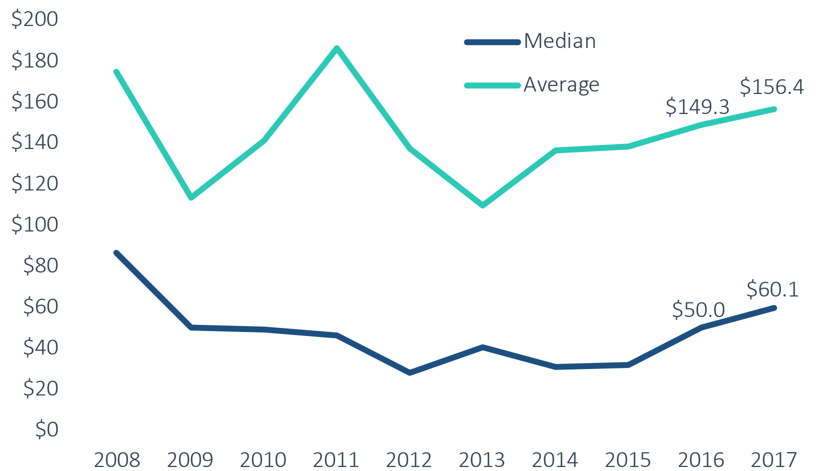
US VC fundraising activity



Source: PitchBook

Median fund size jumps past $60M

Median & average VC fund size ($M)



Source: PitchBook

Venture Partners' IVP XVI, which closed on $1.5 billion in September of last year. To that point, median fund sizes have continued to rise, coming in at $60 million last year, relative to $50 million in 2016 and just $32 million in 2015.

As we've noticed across the PE market as well, first-time fund managers have continued to garner interest from LPs across all stages.

More than $3.3 billion was raised by such managers last year across 35 vehicles, a growth of 47% and 40%, respectively. Further, first-time managers raising sub $50 million vehicles have also had considerable success, raising close to $380 million last year across 15 funds, equating to a jump of some 23% in terms of total capital raised across the same number of vehicles that closed in the bucket in 2016.

Overview

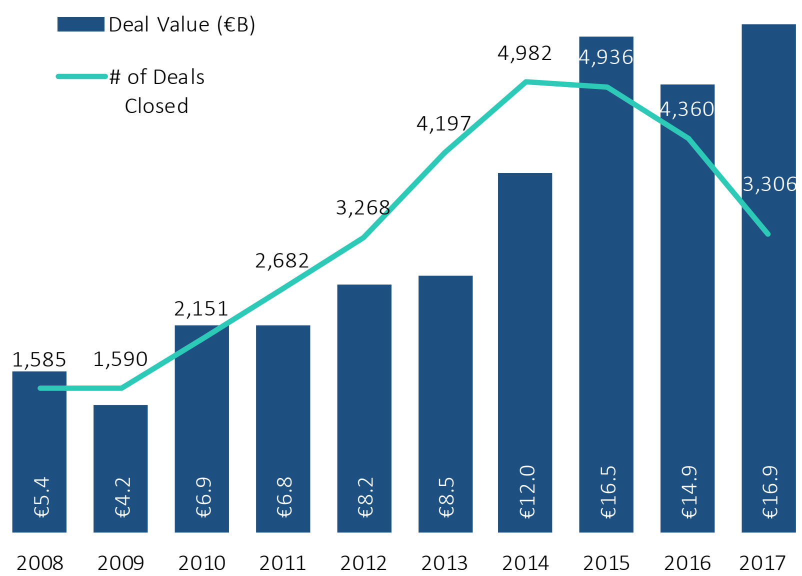
2017 was a record year for Europe's venture ecosystem, with €16.9 billion in capital invested—the highest number PitchBook has recorded. Deal count, however, trended downward for the third consecutive year. The final number of closed deals came in at just 3,306, a 24% decrease from 2016 and the lowest number of financings since 2012.

Angel & seed deals see sharp decline

2017's low deal count was due in part to a significant decline in the number of angel & seed rounds, which saw a 39% decrease from 2016. One explanation for this trend is that investors are increasingly investing in more developed companies. Another contributing factor could be the increasing prevalence of angel deal syndication resulting from networks and governmental support, which may be pushing what would traditionally be angel & seed rounds into larger echelons where they are considered early stage deals instead. The European Business Angel Network (EBAN), for example, reports growing membership and assists angels in deal syndication and cross-border deal making. Additionally, the European Investment Fund (EIF) recently established the European Angel Fund (EAF), which provides matching equity investments and facilitates networking and co-investment amongst angels. Whereas individual angels might complete more financings separately, syndicates enable angels to pool resources to participate in larger deals and share risk.

VC deal value reaches decade high in Europe

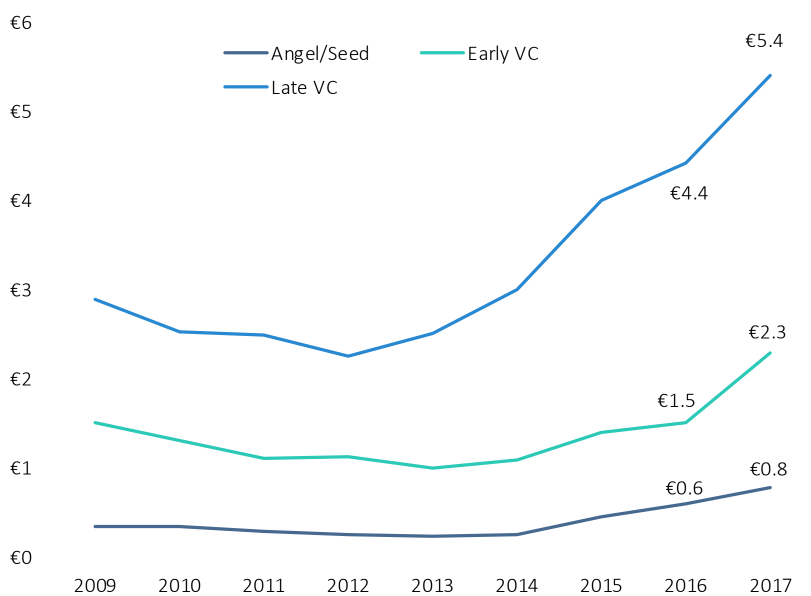
European VC activity



Source: PitchBook

Median deal size reaches decade high at all stages

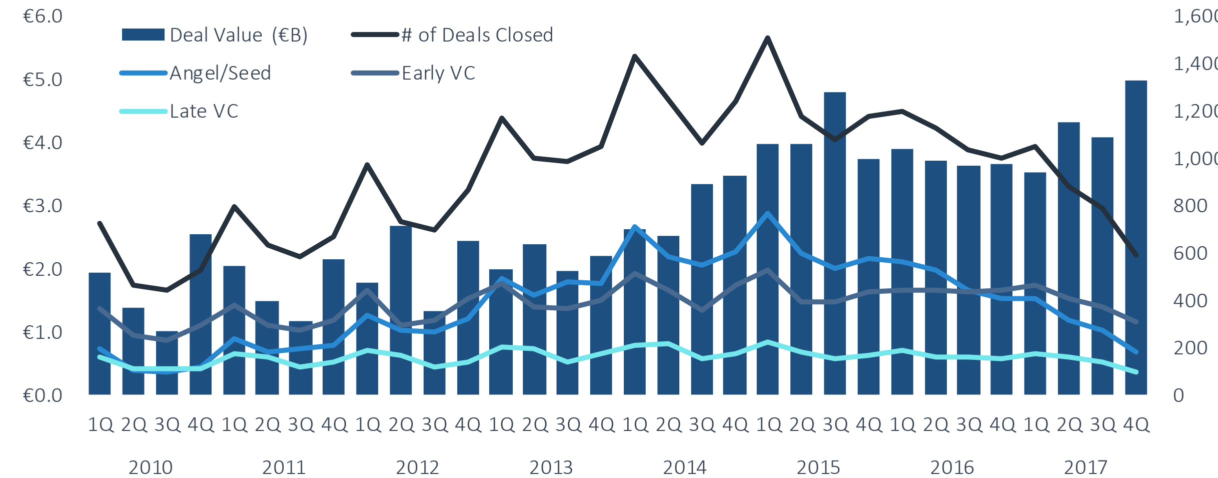
Median European VC deal size (€M) by stage



Source: PitchBook

4Q deal count falters to lowest level since 2011

European VC activity



Source: PitchBook

Deal sizes continue to grow

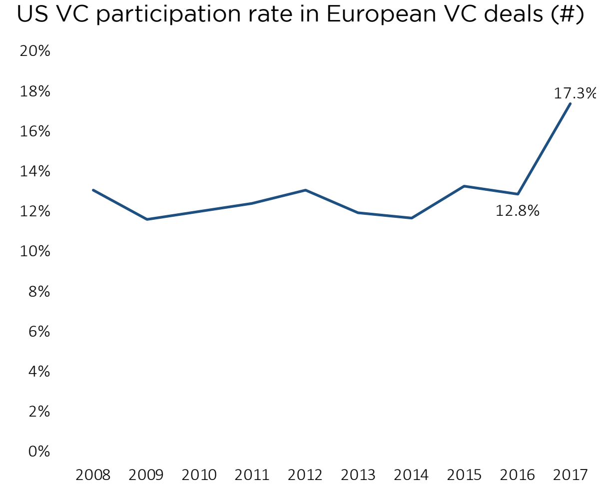
Though early and late stage deal counts have also declined, capital invested remained relatively stable in 2017, thanks in part to the proliferation of larger deals. Improbable's €458 million SoftBank-led Series B financing and Deliveroo's €417 million Series F round are both examples of the large deals which, though outliers, are part of the class of increasingly common large deals from recent years. More than half the capital invested in 2017 was in deals greater than €25 million, a segment that saw a 35% YoY deal count growth in 2017. Correspondingly, median early and late stage deal sizes reached heights of €2.3 million and €5.4 million, respectively.

Though domestic late-stage capital has historically been difficult to access, the proportion of VC funds in the €100 million-€250 million bucket increased from 15% of total funds in 2014 to 35% in 2016. This was likely helpful to startups aiming for larger financings in 2017.

Larger deals have also been facilitated by the participation of deep-pocketed foreign investors, including US VCs, who participated in over 17% of European deals in 2017. Seven out of 10 of the year's largest deals had participation from a US VC, and the median size of deals with US investor participation was €5.5 million. European startups may continue to look to US VCs for late stage financing because they have ample dry powder and can provide mentorship in scaling abroad.

US VCs increase participation in Europe

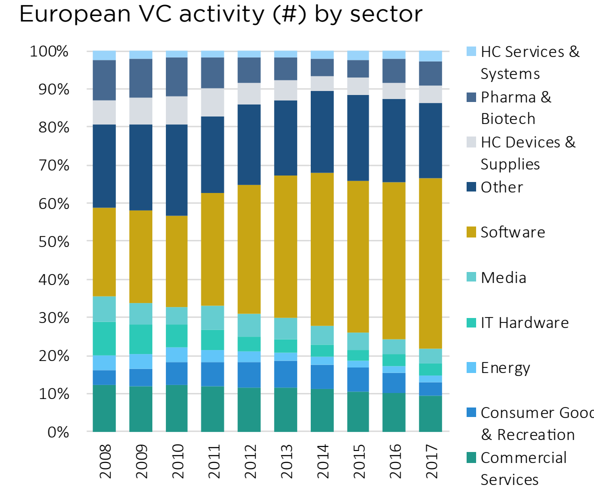
US VC participation rate in European VC deals (#)



Source: PitchBook

Software continues to dominate

European VC activity (#) by sector



Source: PitchBook

Exits

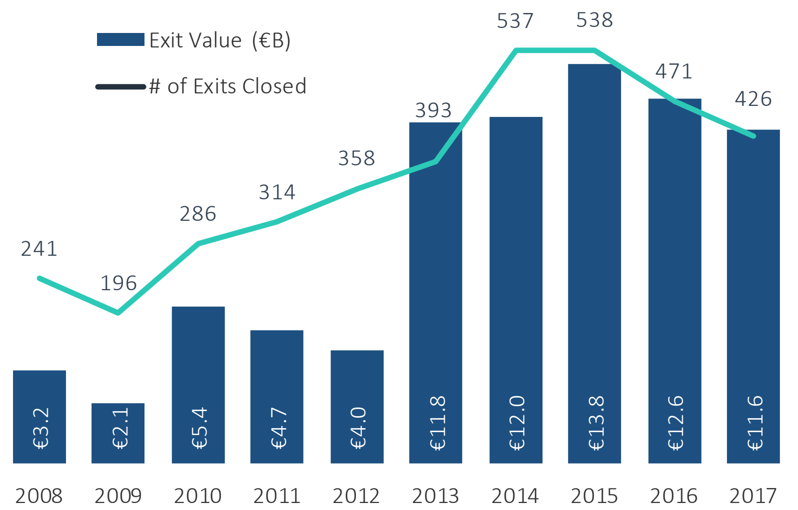
2017 saw exit counts and value in line with those of the past five years, as €11.6 billion was exited across 426 transactions. While this represents a two-year slide in exit activity from the peak in 2015, 2017 marks the fifth consecutive year of over €11.5 billion exited. Worth noting is the strength of the exit market despite the absence of any billion-euro exits closing in 2017. Robust exit value despite lower volume and mega-deals seems to indicate a stabilization of the market around a new standard of exit value.

Contrary to earlier indications, 2017 proved to be a rebound year for VC-backed IPOs, raising over €3 billion across 53 offerings. Assisted by larger offerings from Delivery Hero and Rovio, this year was the strongest showing since 2014, which retains decade-highs values for both IPO value and count.

Looking forward in 2018, one of the most anticipated exits is Spotify's pursuit of a direct listing. This unconventional transaction will not raise any new capital and will be completed without formal underwriting support from investment banks. We believe this approach has potential disruptive power on the traditional IPO process, since Spotify is going through this process with only a handful of advisors and paying them a fraction of the normal IPO fee. Because of Spotify's size and unique a-la-carte attitude toward investment banking services, its IPO will be closely watched by many of the other large late-stage companies that have postponed IPOs over the last couple years.

Exit value remains historically high

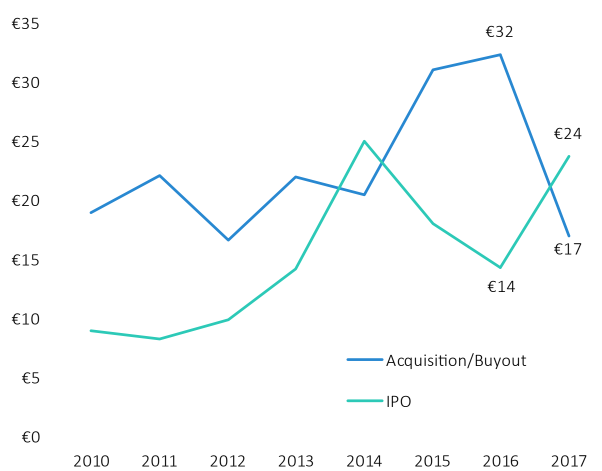
European VC-backed exits



Source: PitchBook

Median acquisition/buyout exit size declined to decade low

European VC-backed exits



Source: PitchBook

IPOs and buyouts show relative strength

European VC-backed exits (#) by type

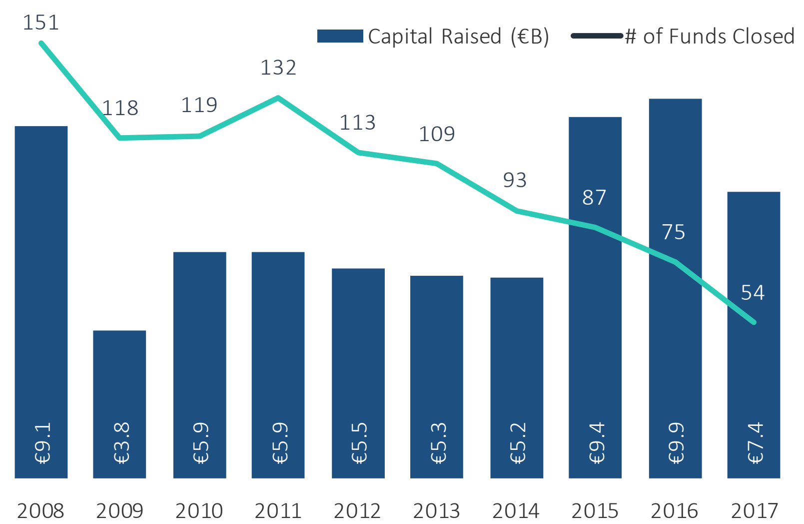
Source: PitchBook

Fundraising

Fundraising saw a 25% decrease in volume in 2017, with €7.4 billion raised across only 54 vehicles. Although 2017 is the third consecutive year to see more than €7 billion in capital raised by European VCs, fund count continued a six-year slide leading to the lowest level in 10 years. Reflecting recent venture market dynamics, the presence of seed and early-stage funds has diminished significantly, with only 10 micro-funds (less than €50 million) raised in 2017. The data suggest that early-stage investors may be targeting larger funds sizes, as 2017 saw an uptick of funds raised in the €50 million–€100 million range.

Fundraising totals decline despite uptick in fund size

European VC fundraising activity



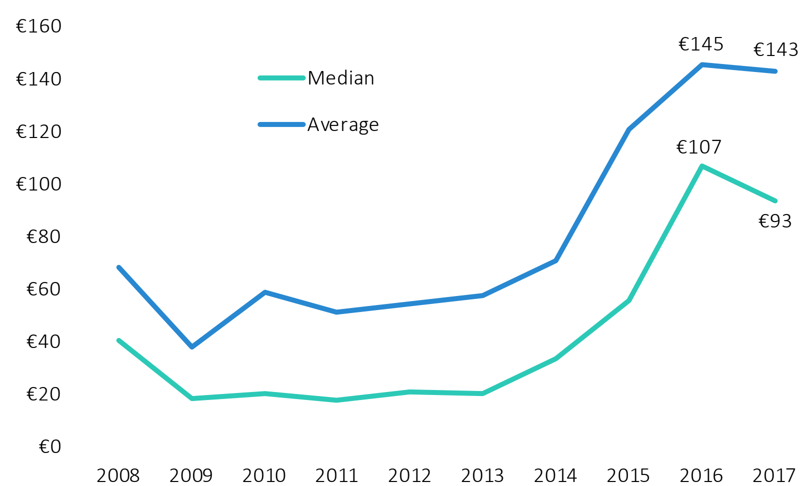
Source: PitchBook

Fund count dwindles as VCs raise larger funds

Three years ago, micro-funds made up 49% of funds raised in Europe. In 2017, however, the proportion of micro-funds has shrunk to 19% of the total, while 62% of funds raised were in the €50 million–€250 million range. Perhaps in response to the more than doubling of early-stage deal sizes over the past three years, it appears VCs are raising larger funds to meet the growing prices of venture deals and maintain sufficient follow-on reserves. In 2017, more than half of funds in €50 million–€100 million range were at least twice the size of their previous fund.

Average European VC fund size has plateaued

Median and average European VC fund size (€M)



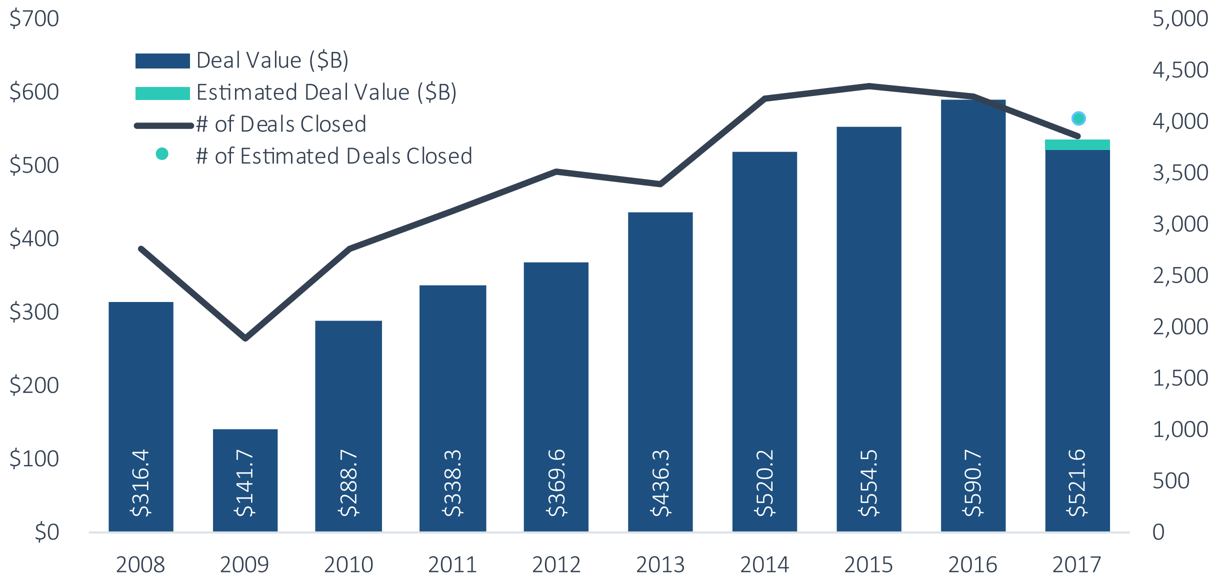
Source: PitchBook

2017's low fund count may also be a result of LPs committing larger sums to fewer managers. Established fund managers may have an easier time raising larger funds as LPs look to commit more capital to fewer, historically high-performing managers. LPs frequently cite two reasons for writing larger checks and consolidating to proven managers. First, cementing relationships with GPs that can deliver consistent returns is valuable, as there are considerable opportunity costs to allocating to an unsuccessful manager. Fewer manager relationships also makes portfolio management easier for LPs, some of which have limited staff to manage alternative investments.

Overview

2017 PE activity concluded on par with 2016

US PE deal flow by year

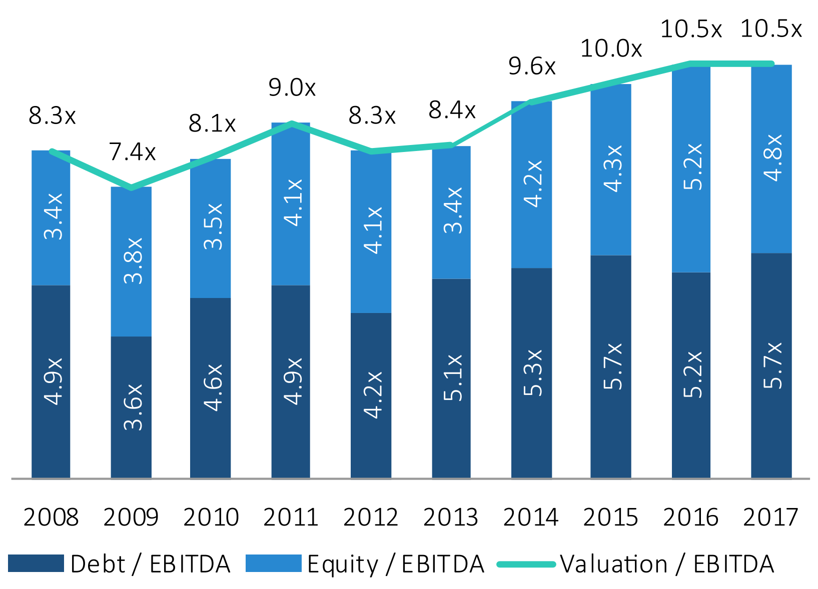


Source: PitchBook

PE deal activity during 2017 was roughly on par with 2016, as dealmakers put $538.2 billion to work across 4,053 deals. After spiking in 3Q, deal activity decelerated in 4Q, which accounted for 24.6% of 2017 deal volume with 999 deals completed to close out the year. The flat activity year-to-year is surprising, as dry powder has continued to build as a result of the record-breaking fundraising environment we've seen over the last few years. Somewhat counterintuitively, this excess availability of capital may be hindering dealmaking. Our recent 2018 Crystal Ball Survey report found that the two biggest concerns for dealmakers were the high-priced environment and the lack of quality targets—two

Multiples persist at elevated levels

US M&A (including PE buyouts) multiples



Source: PitchBook

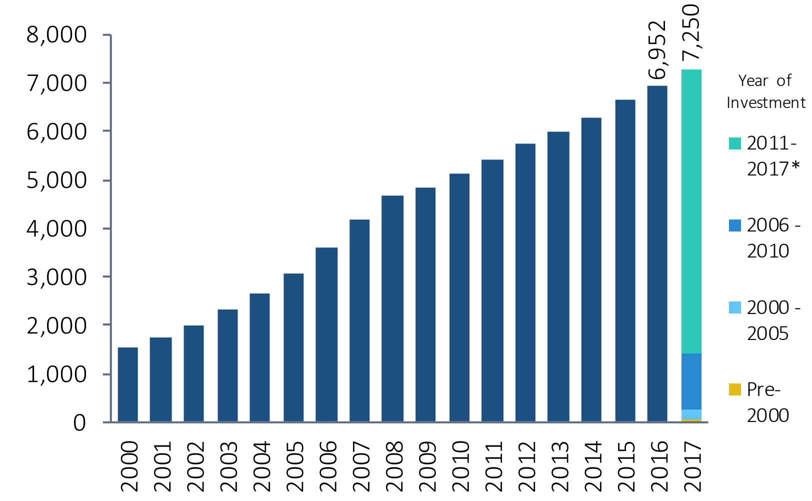
factors influenced by competition. The ever-growing amount of dry-powder is certainly contributing to these concerns, as PE fund managers struggle to place a greater amount of capital to work.

These competitive pressures do not appear to be abating anytime soon. While no year has surpassed the amount of capital raised in 2007, recent annual US fundraising has consistently approached record levels, with at least $200 billion raised every year since 2014. Furthermore, a total of $648.4 billion was raised from 2015 through 2017, which is the most raised over any three-year period in our sample. Moreover, anecdotes from various LPs suggest that the fundraising trail is unlikely to lose steam in the near term. Given the broad-based strength in fundraising, the median fund size climbed from $225.0 million in 2016 to $292.5 million in 2017—another record high in the database.

Despite growing fund sizes, the proportion of deals in various size buckets remains relatively unchanged, with 89% of deal volume in the sub-$500 million deal range. However, the competitive nature of the private markets kept acquisition multiples elevated, with a median EV/EBITDA multiple of 10.5x. While median acquisition multiples remained unchanged from 2016, dealmakers used higher levels of leverage, with the median debt percentage in overall M&A climbing from 50% to 54.3%. These higher proportions of debt usage are not unprecedented, however, as debt usage in 2017 is in line with the 10-year average debt percentage of 55%. That said, the median debt/EBITDA multiple climbed from 5.2x to 5.7x, which is the highest debt/EBITDA multiple recorded in the dataset.

As inventory ages, does it portend more exits?

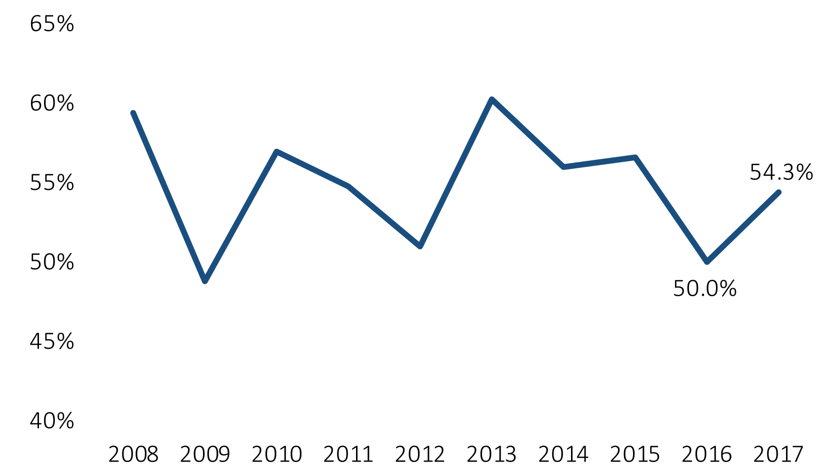
US PE-backed company inventory



Source: PitchBook

Debt percentages climb, but remain within historical bounds

Median debt percentages in US PE buyouts



Source: PitchBook

Elevated valuations have done little to deter PE acquisitions; the number of US PE-backed companies continued to climb in 2017, reaching a total of 7,250. Not only is the company inventory (PE-sponsored companies excluding add-ons) growing, but the companies that comprise it are getting older. As of 2017, 34% of PE-sponsored companies were acquired more than five years ago.

We continue to find it surprising that more long-held portfolio companies have not been exited given favorable market conditions, but this seems likely to change. A previous build-up in aging inventory, which peaked in 2013, was followed by a boom in exit activity that coincided with the record-setting M&A years between 2014 and 2015.

Exits

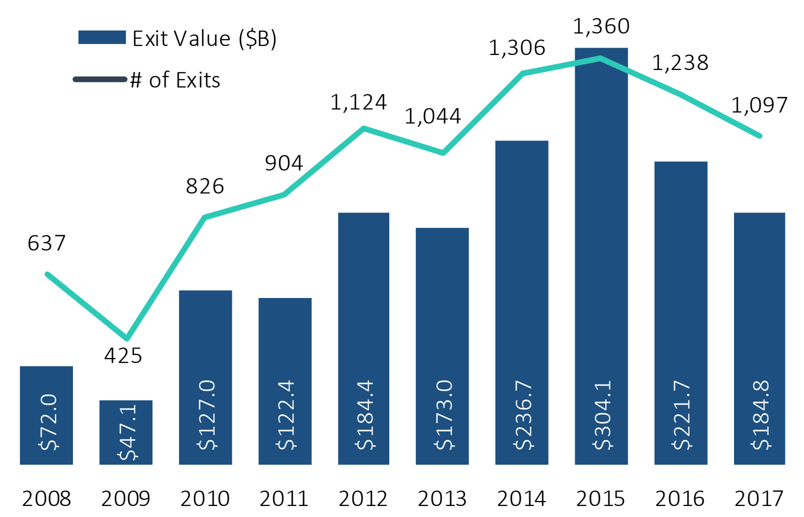
PE firms saw an 11% YoY decrease in exit volume, with exit value and volume falling below both five-year averages for the first time since at least 2010. A total of $184.8 billion in value was realized over 1,097 exits during 2017. The technology sector saw a 2% increase in exit volume and is the only sector that did not seen a decline in exit volume, with all other sectors trailing their five-year average in exit activity.

The downward trend in exits is largely driven by a strong pullback in strategic activity, with $95.45 billion in exit value across 505 strategic acquisitions of US-based portfolio companies in 2017. While exit value via strategic acquisition remains above pre-crisis levels, it fell below both the five- and 10-year averages in 2017, which saw the lowest amount of strategic activity since 2011. Despite several corporate mega-deals, which represented much of the industry commentary in 2017, it was secondary buyouts (SBOs) that drove the median exit size to a new all-time high of $221.5 million.

As discussed last quarter, SBOs, in which a PE-backed company is sold to another PE fund, are becoming the go-to exit option for PE firms in the middle-market. PE firms exited $77.6 billion of value through 548 SBOs in 2017, with a median exit size of $400 million. As the saturation of PE-sponsorship grows in the US, it is likely PE-to-PE transactions will become more of an industry norm as firms look for both liquidity and deal flow in the current market environment.

Exits decline below long-term trends

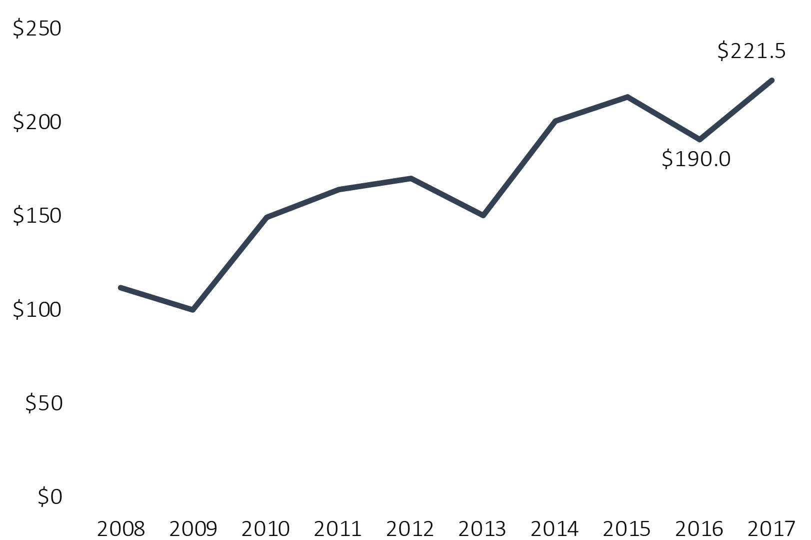
US PE-backed exits



Source: PitchBook

A new all-time high

Median US PE-backed exit size

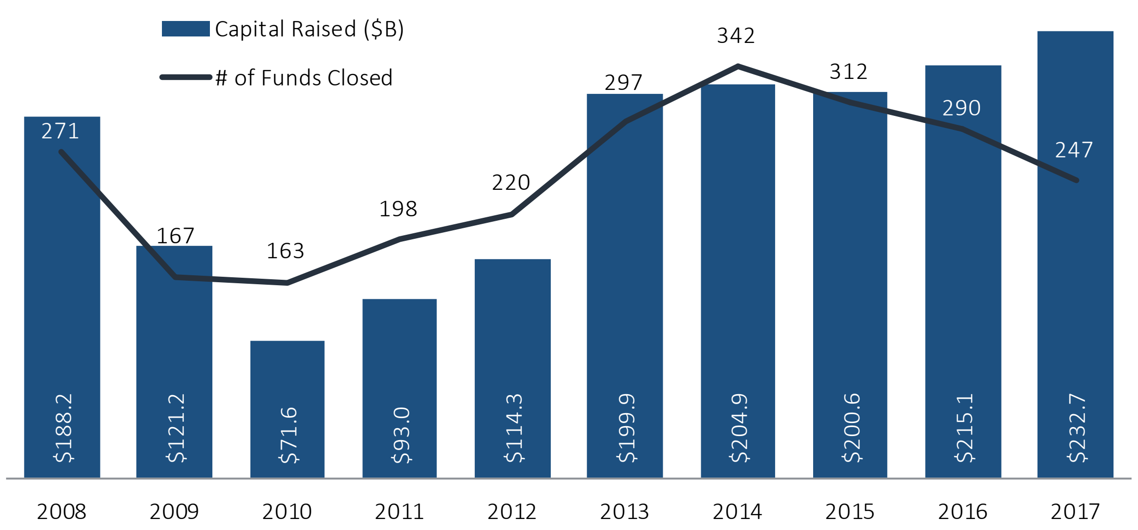


Source: PitchBook

Fundraising

2017 was robust in terms of capital raised

US PE fundraising



Source: PitchBook

PE firms closed on $232.7 billion in capital commitments across 247 funds during 2017. Capital continues to accrue to fewer yet larger funds, evident in the 8% year-over-year (YoY) increase in committed capital despite a 15% decrease in the number of funds over the same period. The proportion of funds under $100 million in committed capital fell to 25%, which is well below both the 5- and 10-year averages of 33%. This is in line with industry commentary surrounding some LPs' desire to consolidate around fewer and more-established GPs in order to negotiate a better fee structure, gain access to co-investment opportunities, and reduce the due diligence costs of managing a large number of fund managers.

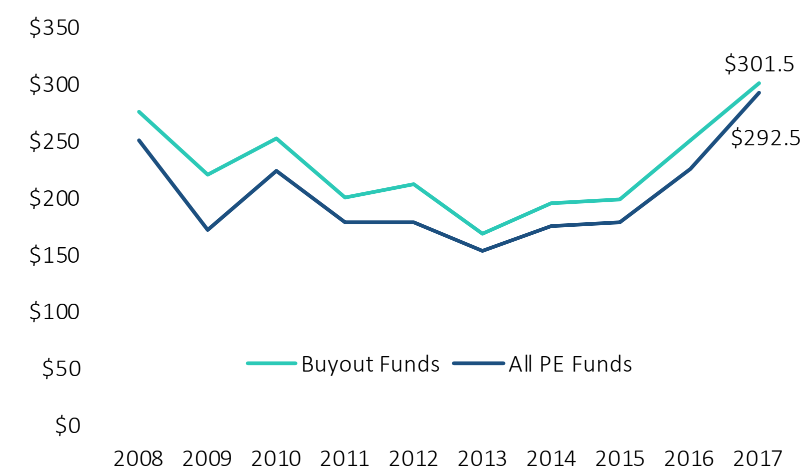
The unfortunate second-order effect of saving money by consolidating to fewer, larger funds is that these larger vehicles are less likely to deliver top-quartile returns. In previous research, we found that sub-$100 million funds outperformed all other fund-size buckets by a wide margin, with a median IRR of 32.3%.

Of course, the dispersion of returns for smaller funds are certainly higher as well, driven by a variety of factors at the operational level.

While the ability to effectively allocate relatively small sums of capital will vary depending on the LPs' unique situation, LPs who consolidate their commitments generally should expect lower returns relative to historical performance, albeit with less variance.

Capital accrued increases 8% YoY even as volume drops 15%

US PE fundraising



Source: PitchBook

Overview

European PE grows larger

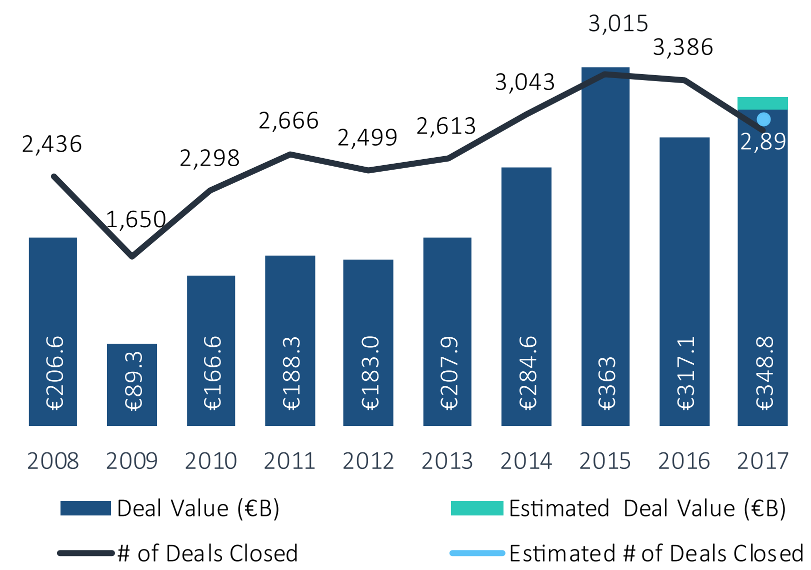
2017 was another strong year for European PE. Deal flow on the continent totaled €363.0 billion across 3,015 transactions— a 14% increase and 11% decrease, respectively, from the prior year. Activity mirrored trends across private markets, with investors completing fewer but larger deals in 2017. The median deal size for European PE transactions increased by 67% in 2017, to €38.5 million—the highest since 2006. Larger deal sizes are driven by a confluence of factors, one being the need to write larger equity checks to effectively allocate the larger funds raised in recent years, evidenced by the €125 billion in dry powder in European funds (as of June 30, 2017). An improving economy has also provided tailwinds to PE dealmaking. In 2017, European GDP is expected to have grown at 2.2%, its fastest rate in a decade.

Increasing debt boosts multiples

European M&A multiples continued to creep higher in 2017. The median valuation (including buyouts and strategic acquisitions) reached 7.6x EBITDA by year-end, nearly three turns higher than the recent low of 4.8x recorded in 2010. Prices continue to receive upward pressure from an increase in debt usage, which reached a median of 4.0x EBITDA in 2017—the highest in three years. Historically, European dealmakers have relied heavily on banks for

Median deal size spikes upward

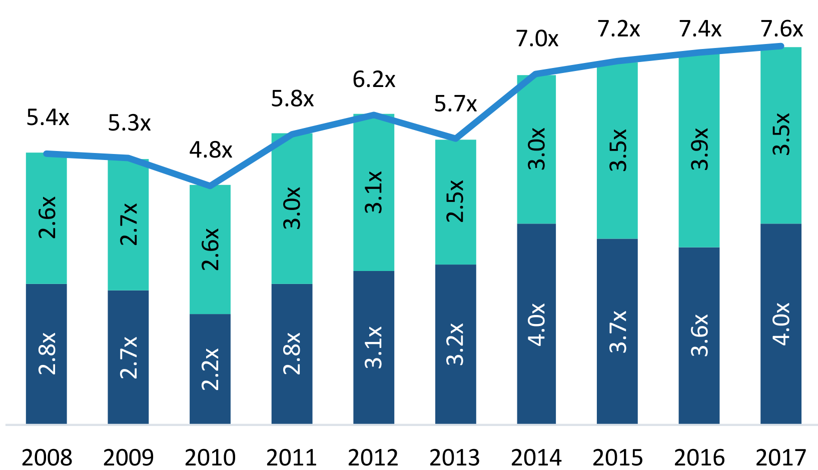
European PE deal activity



Source: PitchBook

Multiples see continued expansion

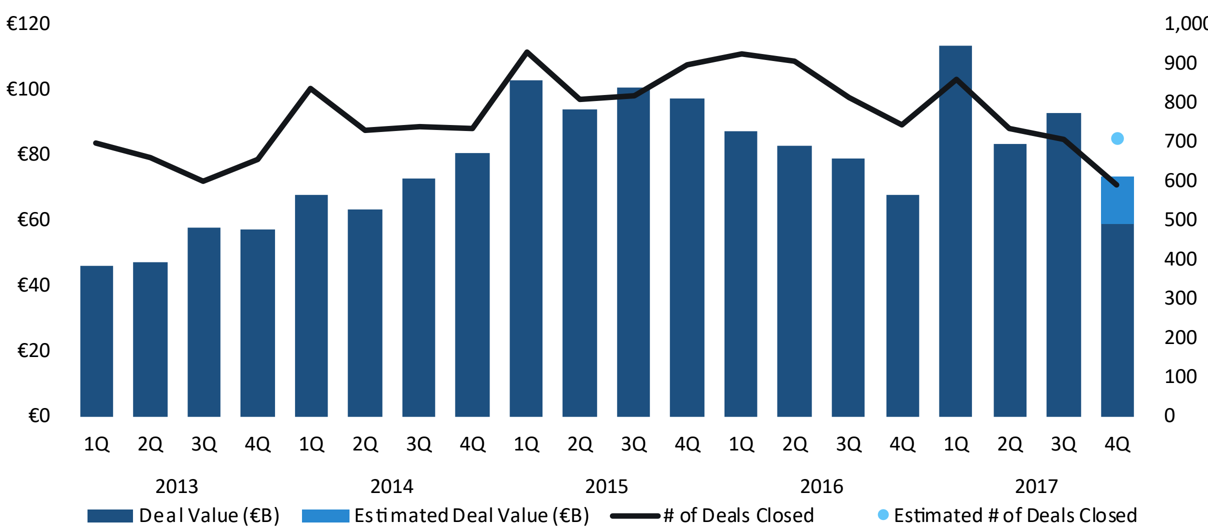
European M&A (including buyouts) multiples by year



Source: PitchBook

Quarterly figures indicate tapering in deal count

European PE activity



Source: PitchBook

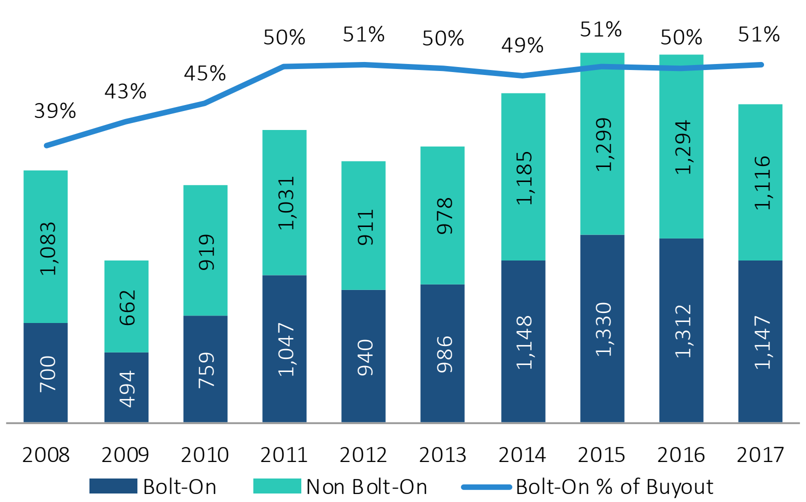
buyout financing, but that trend has begun to change. Private debt funds now provide an alternative source of capital for buyout transactions. However, these funds should not be mistaken as the primary driver of the recent uptick in private debt usage. Debt/EBITDA levels have reached these levels prior to the advent of these funds.

Bolt-on plateau continues

After growing from 29% of all buyouts in 2006, to 50% of activity in 2011, the proportion of bolt-on transactions has plateaued in recent years. As buyout firms expanded their portfolios over the last decade, they increasingly engaged in buy-and-build strategies to enhance the operations of their portfolio companies, blurring the traditional demarcation between strategic acquirer and financial sponsor. However, buy-and-build strategies hit a high watermark in Europe far before they did in US.

One-half of European buyouts are bolt-on transactions

European bolt-on activity



Source: PitchBook

Bolt-ons still account for one of every two buyouts in Europe, compared to two of every three in the US. The reasons for the difference are clear, with perhaps the primary factor being the relative ease of doing business across state borders rather than national ones. Despite the single market of the European Union, cross-border bolt-on transactions within the continent still carry more tax and legal implications, as well as cultural barriers, relative to deals between US states.

Exits

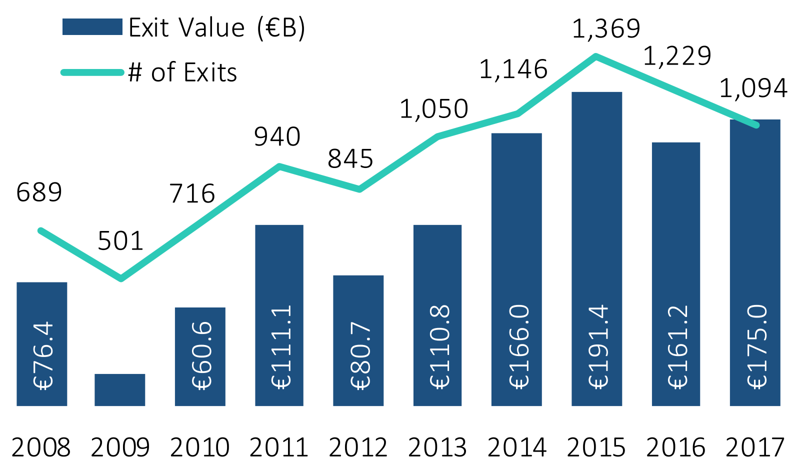
Secondary buyouts buoy exit activity

In 2017, PE firms enjoyed another strong year of exit activity. PE-backed exit activity totaled €175.0 billion in value across 1,094 portfolio companies—the fourth consecutive year of at least €160 billion. Strong liquidity was aided by the buying power of other PE firms eager to deploy the sums of dry powder raised in recent years. Secondary buyouts (SBOs) accounted for one half of all exit activity in 2017, both in terms of number and value of transaction. PE firms invested €88.1 billion on transactions in which another PE firm was the seller—higher than any other year on record. Meanwhile, strategic acquisitions accounted for just 44% of exit activity, the lowest in the last decade. Corporate acquirers slowed their pace of acquisition last year, as they worked to incorporate recent purchases into existing operations.

Though the broader European IPO market bounced back in 2017, PE-backed IPOs were essentially on par with the prior year. PE-backed companies raised $14.5 billion across 63 listings in 2017, a 7% decrease and 5% increase, respectively, from 2016. New listings were still well below 2014 and 2015, which saw record levels of PE-backed IPOs.

European PE exit activity has slowed, though exit value remains high

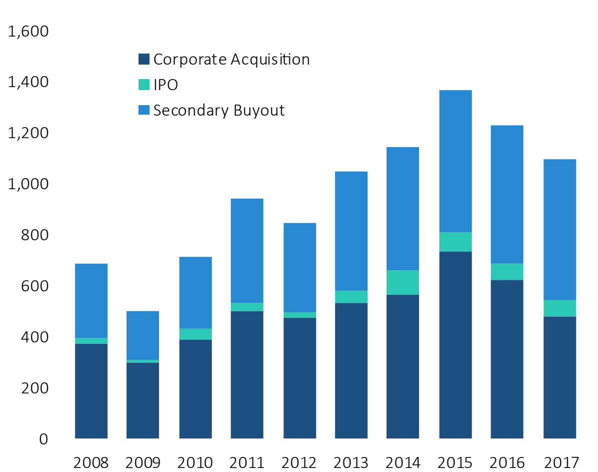
European PE-backed exit activity



Source: PitchBook

Acquisitions account for fewer PE exits than in any year since 2012

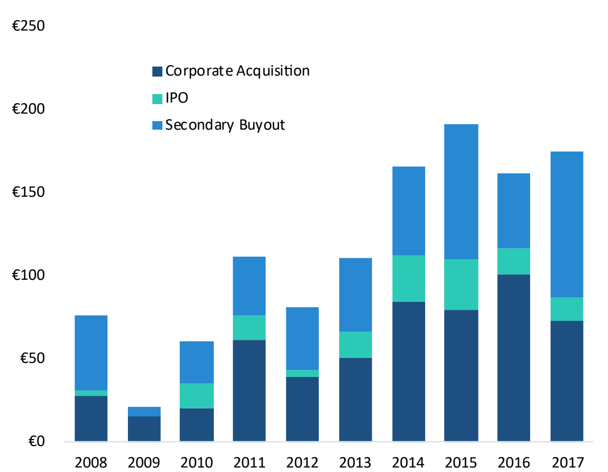
European PE exits (#) by type by year



Source: PitchBook

SBOs account for one half of exit value

European PE exits (€B) by type



Source: PitchBook

Fundraising

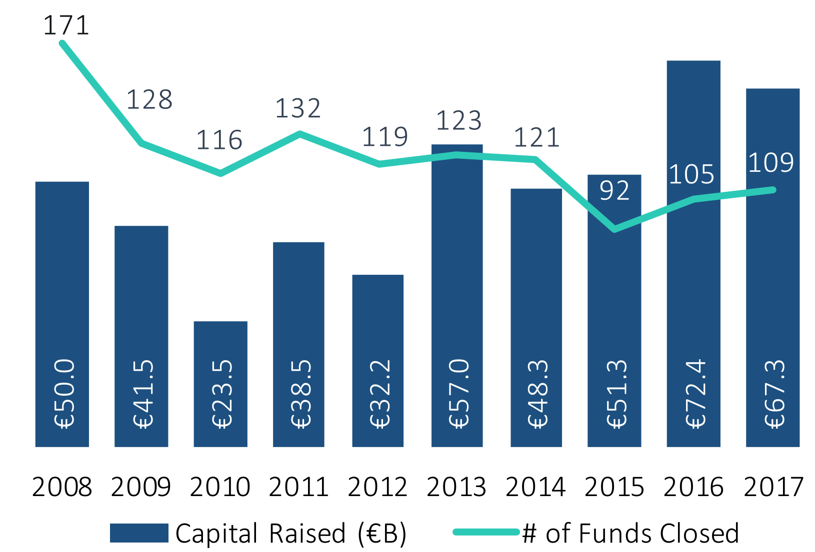
Mid-market funds increasingly popular

European PE firms raised €67.3 billion across 109 vehicles in 2017, a 7% decrease from the prior year in terms of value, but still the second highest capital total since the financial crisis. Institutional investors who are starved for yield in more traditional asset classes continue to propel allocations to alternatives, including private equity and private debt. €5.3 billion was committed to energy funds in 2017, the highest of any year on record. Growth funds, too, saw €4.9 billion in capital commitments, higher than any year since 2013.

After growing every year from 2012 to 2016, the median fund sizes dipped slightly in 2017 to €310.0 million—below the €326.4 million recorded in 2016, but still comfortably above pre-crisis levels. The decrease in fund sizes is indicative of a growing interest in middle-market-focused funds (those with between €100 million and €1 billion in commitments), which accounted for 77% of total closes on the year—the highest in at least a decade. Interest in the middle market, however, has not stopped the largest firms from raising mega-funds. In June, CVC Capital Partners raised the largest European buyout fund in history, totaling €16.0 billion for its seventh flagship fund.

Capital commitments total second highest since financial crisis

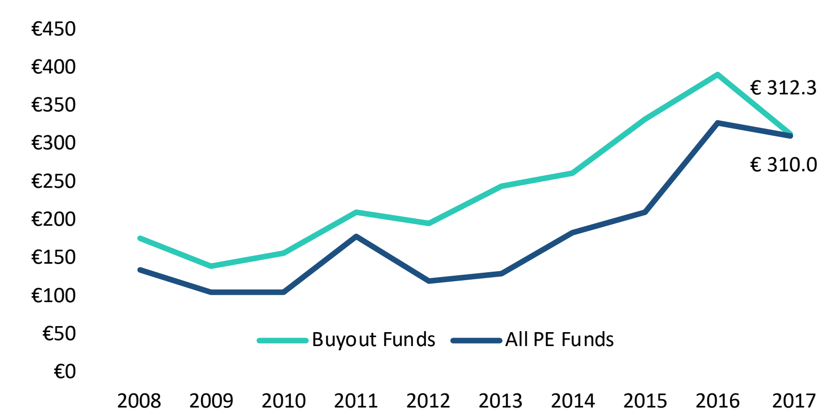
European PE fundraising



Source: PitchBook

Fund sizes dip amid increasing interest in mid-market funds

Median European PE fund size (€M)

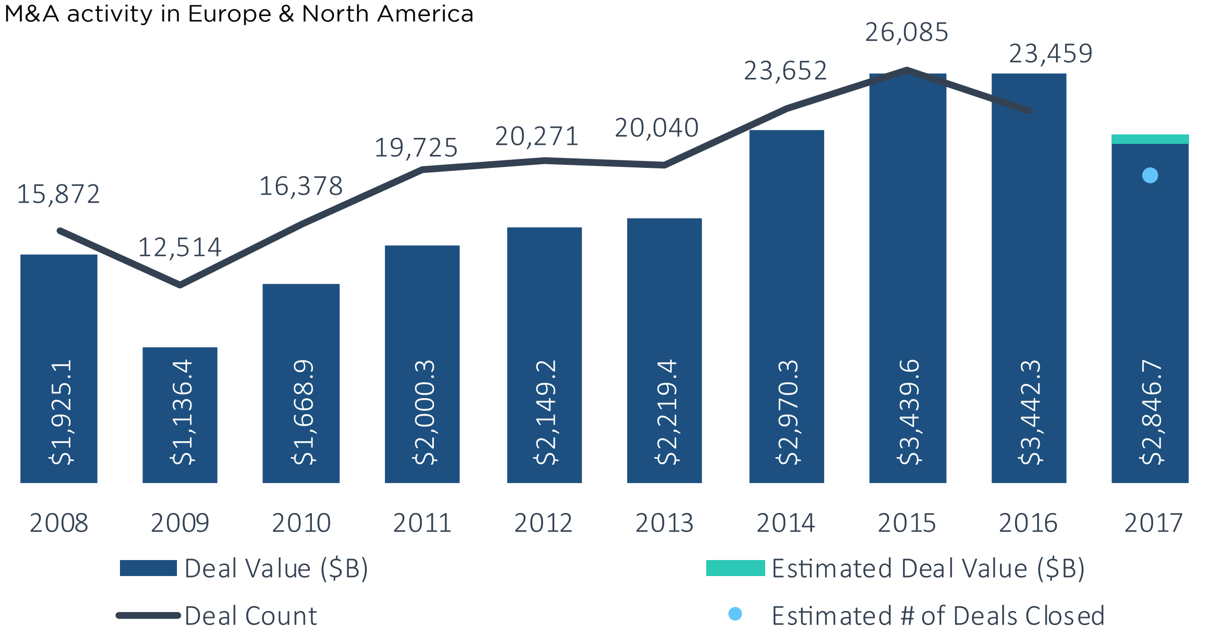


Source: PitchBook

Overview

Buyers are tapping the brakes as they incorporate recent acquisitions into existing operations

M&A activity in Europe & North America

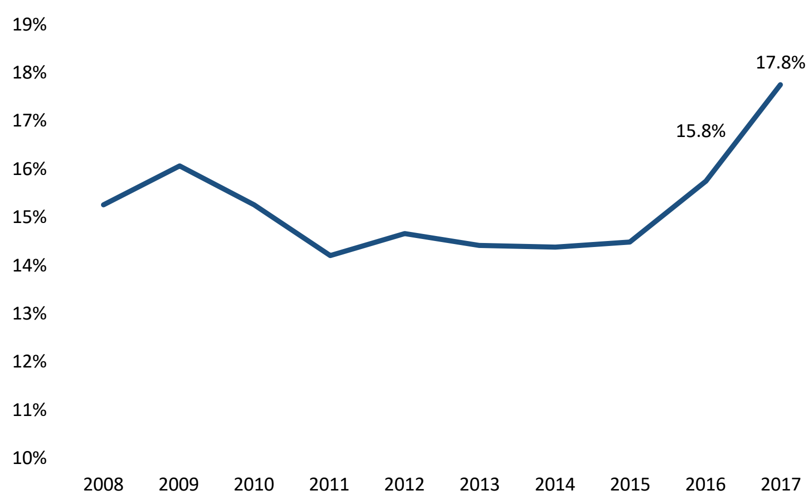


Source: PitchBook

M&A activity in North America and Europe totaled $2.93 trillion across 19,510 deals in 2017—the fourth consecutive year of at least $2.9 trillion in value. While M&A activity has remained strong on a historical basis, the number of completed transactions decreased by 16.8% year-over-year. Continually high cash on corporate balance sheets and ballooning PE fund sizes, combined with relatively easy access to affordable financing, has allowed buyers of all types to pursue larger deals, with the median deal size climbing by a third to $40 million in 2017. Increasing competition, especially from PE buyers, has driven valuations upward.

Multiple factors are driving IT's relative popularity

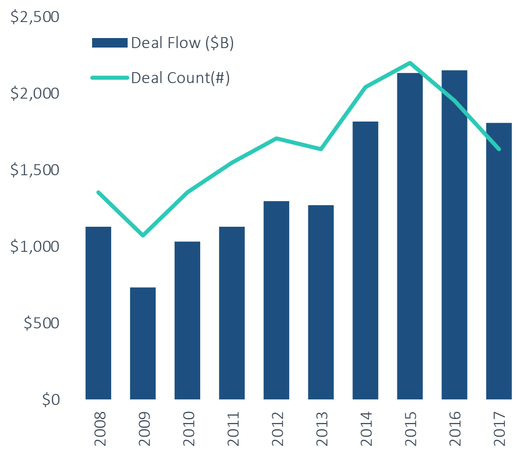
IT% of M&A volume by count



Source: PitchBook

M&A declines 16% YoY

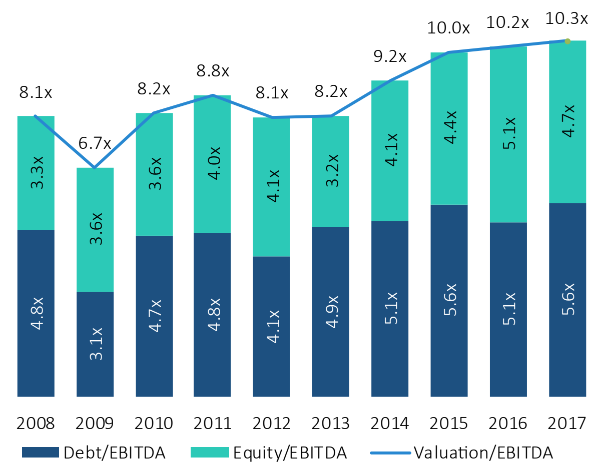
North America M&A activity



Source: PitchBook

M&A multiples crept above 2016's tally

North American M&A multiples



Source: PitchBook

Meanwhile, prolonged QE in Europe combined with only moderate tightening by the Fed in the US should keep financing costs low and allow dealmakers to continue enjoying issuer-friendly terms on new debt issuances for some time.

While investors maintain a sanguine global economic outlook, the pace of growth remains sluggish compared to other recoveries. With organic growth difficult to come by, acquisitions are still seen as an easier way to boost revenue and earnings, especially given the easy access to financing in today's market. But some buyers, especially strategics, are tapping the brakes as they incorporate recent acquisitions into existing operations.

M&A activity in North America totaled $1.8 trillion across 10,465 deals in 2017—trailing 2016 by 16.0% and 16.1%, respectively. The slowdown comes despite sound economic indicators in the US, including sustained growth in manufacturing, strong corporate earnings growth and record-high CEO sentiment. While corporations in general are already operating from a position of strength, recent tax legislation and repatriation of foreign earnings are expected to further bolster balance sheets and give a boost to M&A in 2018. US firms are expected to bring back $300 to $400 billion in cash, according to GBH Insights, which is expected to be used on a combination of dividends, stock buybacks, capital expenditures and acquisitions.

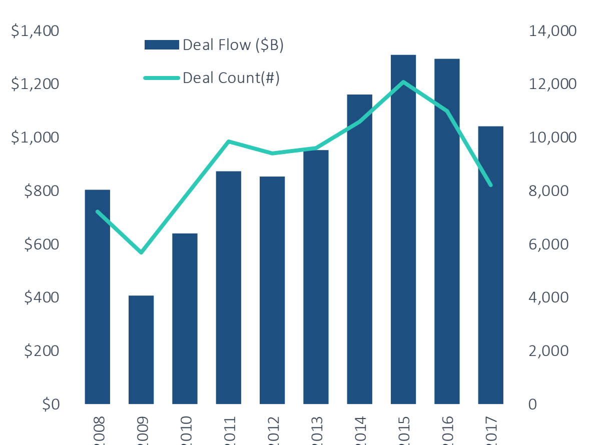
An increase in M&A activity will likely put further upward pressure on price multiples, which have already risen to all-time highs due to ample PE dry powder reserves and readily available debt financing. The median valuation/EBITDA multiple for North American M&A transactions reached 10.3x in 2017, up slightly from the 10.2x recorded in 2016.

M&A activity in Europe totaled $1.04 trillion across 8,188 deals in 2017—19.4% and 25.4% decreases from the prior year, respectively. Activity slid further than it did across the Atlantic, despite an improving economic outlook in Europe. In 2017, European GDP is expected to have grown at its fastest rate in a decade, according to the European Commission. What's more, the ECB has been reluctant to tighten monetary policy, resulting in financing that should continue to be cheap for some time. The France/Benelux region saw a particularly steep fall in both deal value and deal count, by 30.8% and 37.2%, respectively; however, we expect activity to rebound in the region as the dust settles from contentious elections held in France and the Netherlands in early 2017.

European valuation multiples also increased to their highest level on record—7.5x EBITDA in 2017. The expansion was driven by an increase in debt usage, which reached a median of 4.0x EBITDA in 2017—the highest in three years. European dealmaking relies more heavily on traditional money centers for financing than their U.S. counterparts, but the growth of private debt funds in the region has provided another source of capital, helping fuel the expansion in recent years.

2017 M&A value fell by 19%

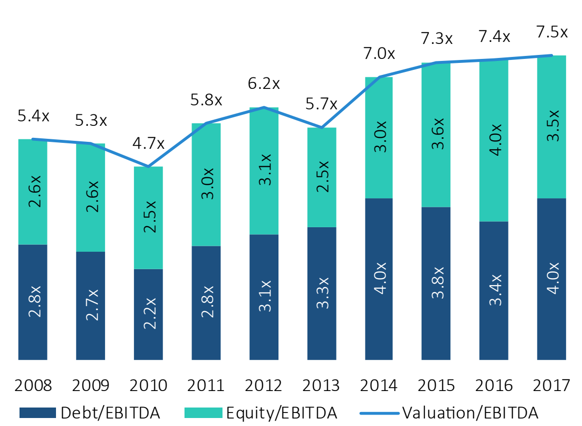
Europe M&A activity



Source: PitchBook

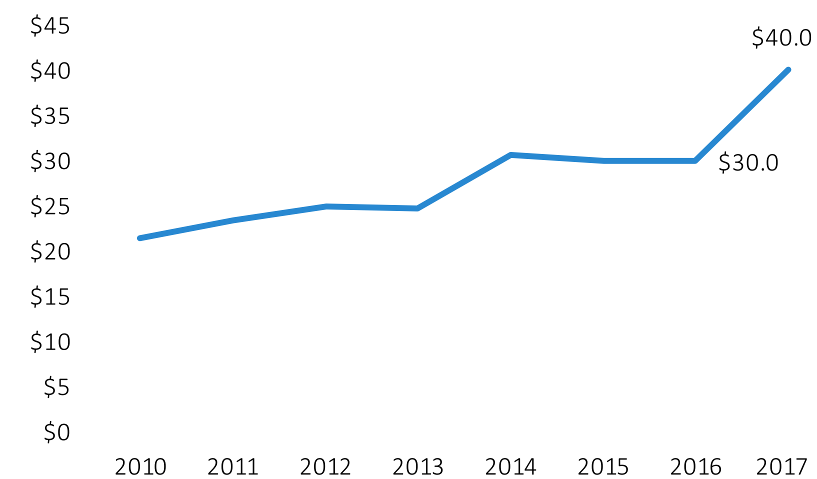
2017 multiples expansion driven by debt usage

Europe M&A activity



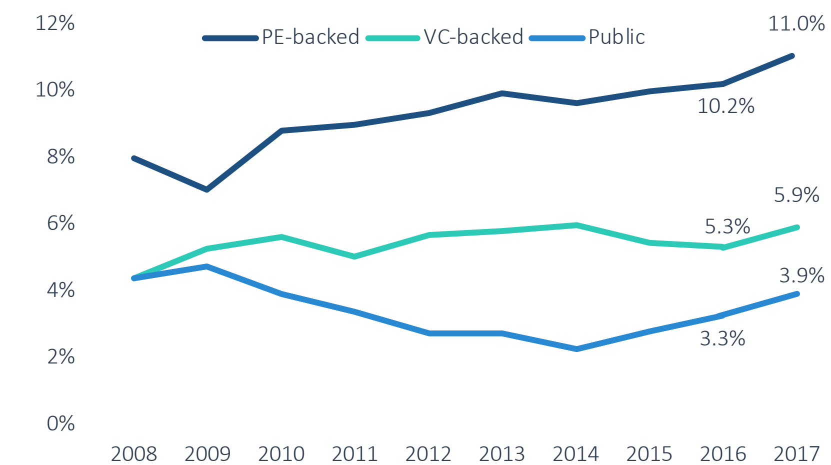
Source: PitchBook

Median M&A deal size ($M)



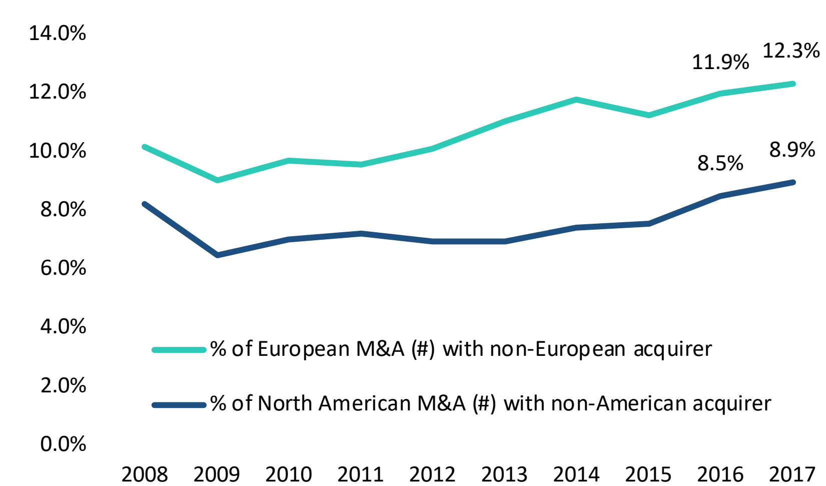
Source: PitchBook

Percentage of acquisition targets with institutional backing



Source: PitchBook

Cross-border activity (#) by foreign participation

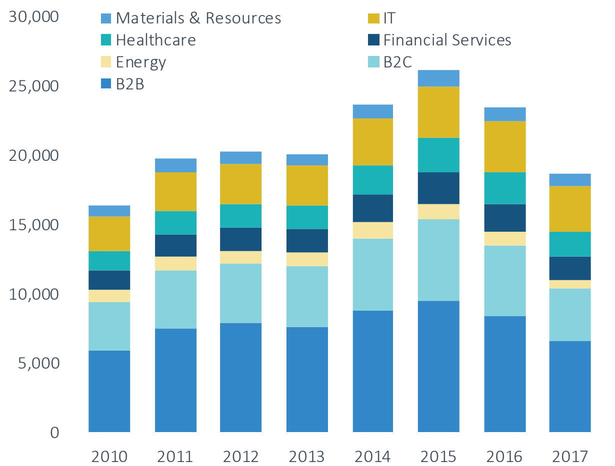


Source: PitchBook

By sector and size

IT has bolstered overall volume

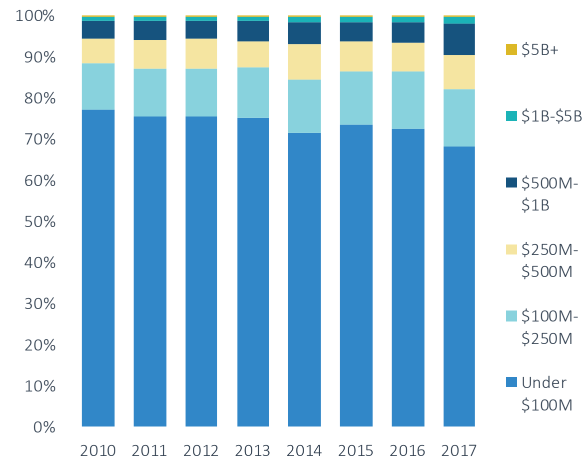
M&A (#) by sector



Source: PitchBook

Deal size inflation is more evident

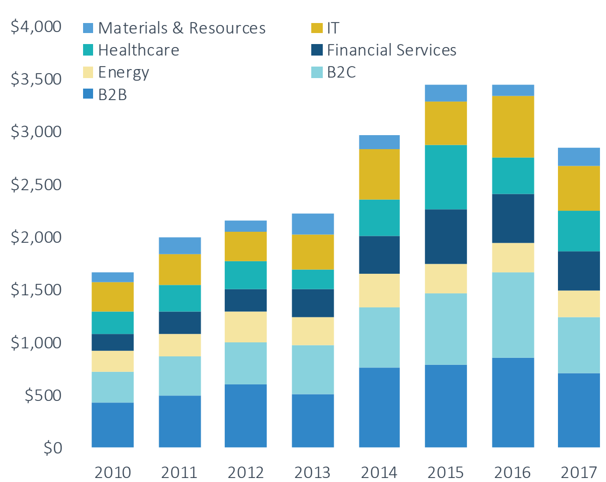
M&A (#) by size



Source: PitchBook

B2B still predominates deal value

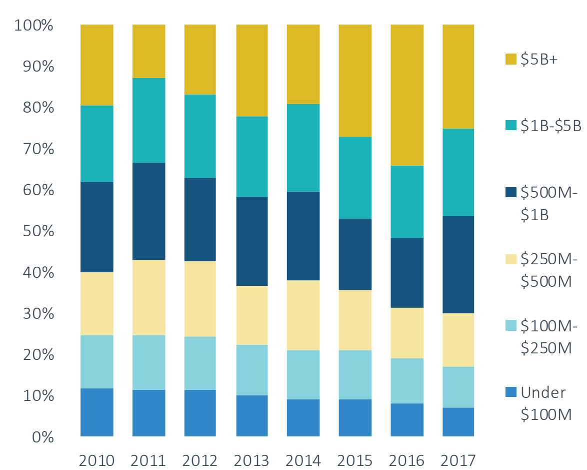
M&A ($B) by sector



Source: PitchBook

Lower middle market accounts for smaller portion of deal value

M&A ($) by sector



Source: PitchBook

Analyst Insights

A foundational framework for analyzing crypto assets: utility tokens

By Nico Cordeiro

Important Disclosure

The primary analyst responsible for this note has a financial interest in the sector and is an investor in Ethereum (Ticker: ETH) through his/her personal trading account. The analyst's investment has been made as a long-term buy and hold strategy.

2017 was a breakout year for the crypto asset class, with retail and institutional investors alike trying to take part in the potentially transformative technology. With the stampede of investors entering the space and massive price swings, virtually everyone is trying to be the short-to-medium term price guru, but few people are delivering deep, long-term value research.

Given the predominant narrative that bitcoin and crypto assets in general are the "greatest bubble of all time," with many going as far as to call them Ponzi schemes, it may seem odd to look for long-term value opportunities; however, we do see value in the underlying technology and believe that, if developed and implemented successfully, it can dramatically reduce transaction costs, create transparency, enhance security, and remove costly intermediaries across an array of industries.

Furthermore, crypto assets and blockchain technology will impact the traditional venture capital ecosystem, with many VCs already altering their limited partnership agreements (LPAs) to allow for investments in crypto assets. Due to this wide-ranging potential, we began to explore a framework to assess the long-term value of a blockchain protocol and its impact on the investment ecosystem.

The first thing we noticed is that many market participants assess crypto assets as if they were traditional stocks, ETFs, or commodities due to the ability to trade on open markets; however, the underlying business models are early-stage projects barely out of the proof-of-concept phase, and the uncertainty associated with products in that stage of development inherently results in extreme price volatility.

To that end, we view the risk profile as most like early-stage venture investments and, as such, we will analyze these investments in a similar manner. Much like the venture return distribution, the return distribution for cryptos will likely be extremely fat-tailed and skewed to the right. It is this asymmetric return distribution that creates the potential for outsized returns. To better understand the potential development of the blockchain ecosystem and how it can impact the landscape in which venture and PE investors operate today we created a five-point framework for analyzing individual protocols that evaluates the incentive structure, token distribution schedule, market opportunity, founding development team, and network strength.

Incentive Structure

The analysis begins with an understanding of how an individual protocol incentivizes participants to interact with the network. Due to the lack of support by real-world assets or authorities, the protocol must be designed with an inherent incentive structure that promotes positive contribution to the network by thousands and possibly millions of unknown participants. Due to this nature, we view the incentive structures as the most important factor underlying a protocol.

Token Distribution

Crypto assets lack the regulatory oversight of traditional asset classes. Even as governments introduce new laws and regulations, crypto assets' global nature makes it difficult for regulators to reign in bad actors, especially as decentralized exchanges hit mainstream adoption. Due to this lack of oversight, many forms of trading activity that are illegal in traditional assets frequently occur in the crypto asset class, which makes understanding a protocol's token release schedule important to avoiding pump-and-dumps, cornered markets, insider trading, and other activity that could compromise an otherwise promising project.

Market Opportunity

While many blockchain protocols are decentralized and lack the typical corporate structure, they still offer a product or service in some form. Evaluating and understanding the value proposition along with the total addressable market allows for a greater understanding of how the protocol fits in with the current business environment. This includes identifying and quantifying the total addressable market, competitive advantages over both centralized and decentralized competitors, and establishing a valuation model.

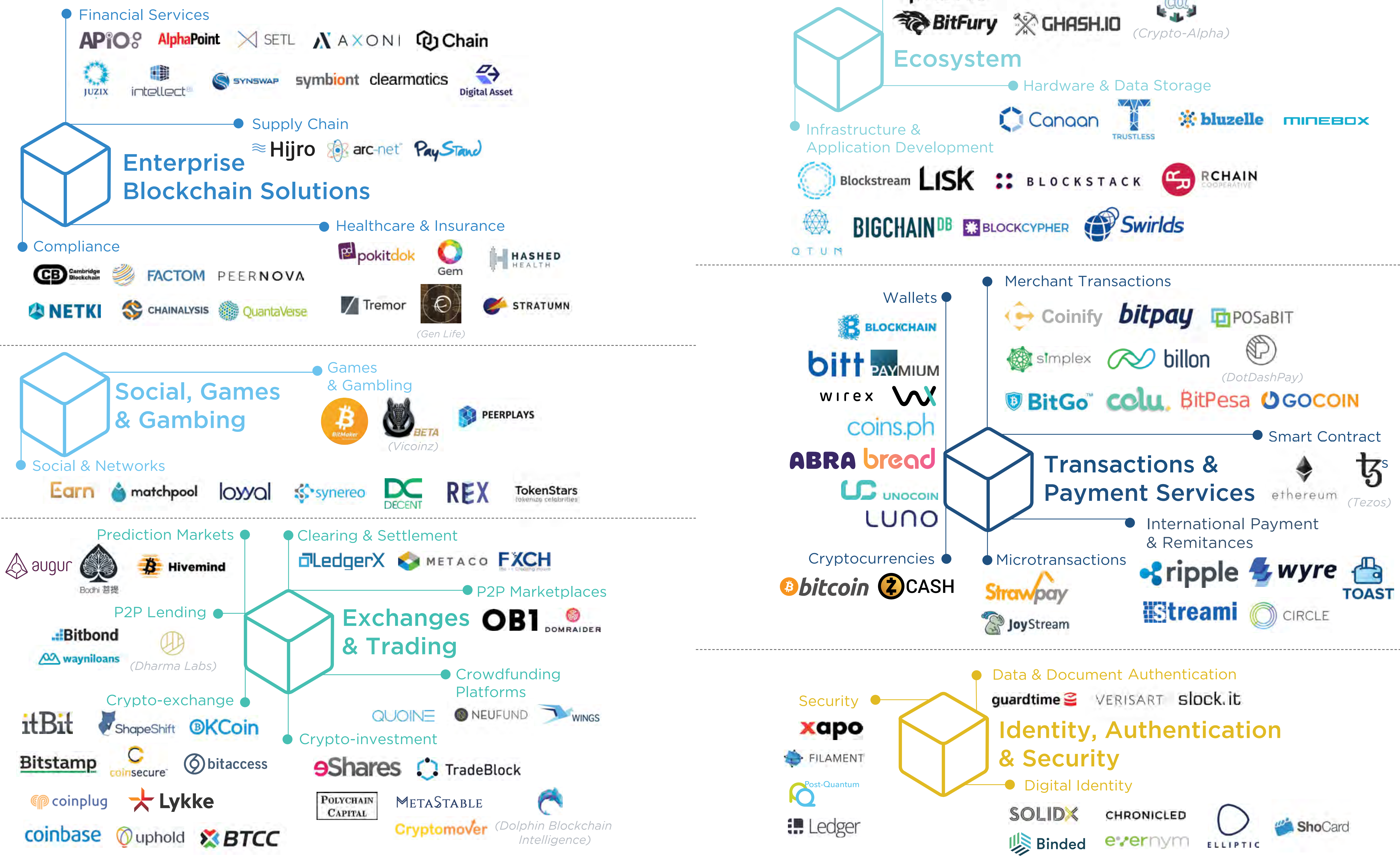
Founding Development Team

Blockchain protocols are in very early-stage development, and much like investing in traditional startups, understanding the strengths and weaknesses of the development team leading a project is vitally important to delivering on a project's vision. As increasing amounts of capital are thrown at blockchain projects, development teams must outshine not just their fellow decentralized competitors but also traditional incumbents in the current market. Fortunately, there are a variety of avenues that allow for thorough analysis of most founders, such as social media, criminal background checks and primary outreach.

Network Strength (If Applicable)

If a protocol is running a live network, it is important to analyze the strength of the network, which we define as the ability to survive through various regulatory regimes and prevent collusion among nodes. Unfortunately, the infrastructure and lack of common metrics and standards can make this analysis difficult but the trajectory of three groups (developers, nodes/miners, and end-users) over time provide some insights into the ability of a protocol to achieve the stated goals and reach a certain level of adoption.

Blockchain Market Map



Blockchain market map methodology

By Joelle Sostheim

The understanding of blockchain technology and its utility is nascent and ripe for exploration. While the technological breakthrough of decentralized networks is exciting, it's difficult to predict how it will be harnessed years from now. Some have compared the blockchain ecosystem's current state to the early days of the internet, with entrepreneurs and investors grappling with how to best leverage the arcane technology. By segmenting use cases and end-users of blockchain startups, we can gain a better understanding of the possibilities this technology holds.

This market map is an overview of startups utilizing blockchain technology that have received venture capital funding. Market segments were determined by similarities in use cases, then further specified into sub-categories of those uses. While we recognize some startups could belong in multiple segments or sub-categories, they are categorized based on our understanding of their primary use case. The map consists of 130 blockchain startups that have received the greatest amount venture funding, per the PitchBook platform.

Most blockchain startups here have use cases in financial services, though our research highlights an emerging and highly viable segment of enterprise-level blockchain solutions for sectors beyond finance, including healthcare, insurance, and supply chain systems.

Examining the variety of ways startups are harnessing this technology illustrates its vast potential, though the blockchain ecosystem still requires significant development before the technology can be viably implemented in the mainstream.

SECTOR DESCRIPTIONS

Transactions & Payment Services
This category contains startups whose primary use cases involve buying, selling, or storing cryptocurrencies without a financial intermediary. The term cryptocurrency refers to a digital asset which functions as a medium of exchange on a distributed ledger. Smart contracts are programmable, transparent transaction contracts which self-execute upon the fulfillment of its terms of agreement. Wallets are software programs which interact with various blockchains to let users store, send, and receive crypto-assets and monitor their holdings. Some wallets extend services internationally and specialize in low-fee cross-border remittances. Merchant services enable vendors or organizations to participate in crypto-transactions. Finally, micropayment startups offer payments for metered content in small denominations.

Cryptocurrency Exchanges & Trading

Crypto-exchanges are platforms for exchanging cryptocurrencies into other cryptocurrencies, fiat currencies, or vice versa. Peer-to-peer marketplaces enable two parties to directly exchange goods and services without an intermediary, while peer-to-peer lending platforms enable peers to extend and receive credit/loans through a blockchain. This segment includes crypto-investment companies who invest in cryptocurrencies with the intent to generate a return via value appreciation, as well as tools used to manage crypto-investments. Accordingly, startups providing clearing and settlement blockchain platforms for crypto-trading, forex and crypto-derivative markets are also included. Prediction markets involve speculation trading based on forecasts of economic and political events. Finally, fundraising platforms allow startups to complete blockchain-based fundraising and help prospective investors find such startups.

Identity, Authentication, & Security

An inherent characteristic of a blockchain is the immutability of transaction records. Startups here use digital ledger software to verify the authenticity of data, as well as assets or documents, using blockchain identifiers to represent and/or authenticate tangible assets. Additionally, these startups leverage identity verification methods to track the cryptographic identity of an individual, entity, device, item, etc. Although blockchains themselves are secure by nature, blockchain-based applications are still vulnerable to cyber-attack. Startups in the security category create secure foundations for transactions, data storage, and network communication.

Enterprise Blockchain Solutions
Startups in this category provide enterprise-level blockchain solutions to entities operating in sectors such as financial services, healthcare, insurance, and supply chain. This includes the development of industry-specific software as well as subscription leasing of proprietary blockchain platforms.

Social, Games, & Gambling

In this category, startups leverage decentralized networks to enable social and networking platforms used for recruiting, classifieds, dating, and loyalty programs, among other use cases. One of the primary benefits such companies provide is the ability to share data and content without allowing a centralized third-party to assume any level of ownership of such content. Blockchain games include applications and tournament gaming platforms where users can compete for prize pools. Gambling startups allow users to place bets from anywhere around the world via blockchain peer-to-peer networks.

Ecosystem

This category includes startups furthering blockchain technology via underlying infrastructure improvements and software development tools. The issues such companies address include those related to scalability, interoperability and governance, among others. While some of these companies could also be listed under "Enterprise Blockchain Solutions," they are included here for the contribution of their open-source technology to the ecosystem. Mining companies provide products and services which assist in the computational process of solving cryptographic problems to earn cryptocurrency units. Data storage and hardware companies cater to the operational necessities of blockchain services.

Private equity firms bring creative financing to an untapped sector—private equity

By James Gelfer

Private equity (PE) firms recently have become more creative in how they capitalize their businesses and have heightened their focus on the operations of their management companies. For an industry with a history of pioneering innovative deal structures and a reputation for hyper efficiency, perhaps the most surprising aspect of this evolution is that it's taken so long.

Without going too deep into the history books, suffice it to say that PE firms' initial efforts to tap outside capital via public markets in the late 2000s had mixed results at best. Blackstone President Tony James put it bluntly when speaking to analysts during the firm's 1Q 2017 earning's call: "We think the value is there, but we don't have confidence enough in you guys to figure that out because you have disappointed us consistently." This sentiment has been widely shared by executives of publicly traded PE firms and has served as a deterrent for other firms that may have considered an offering.

While PE firms have shied away from IPOs, their need and desire to tap outside capital has persisted. At the same time, institutional investors have sought new avenues to invest in PE firms. A solution for both sides has been GP stakes deals, whereby an outside investor acquires a minority stake in a PE firm's underlying management company, as opposed to a fund managed by the firm. Deals of this nature have been around for a while, but they historically involved a single outside investor (often an LP in the GP's funds) like a large pension or sovereign wealth fund. In fact, prior to going public Apollo received outside investment from both the Abu Dhabi Investment Authority and CalPERS, while Carlyle first sold a stake to CalPERS in 2001. As the PE industry has matured, however, GP stakes investing has become more sophisticated and expanded beyond one-off transactions.

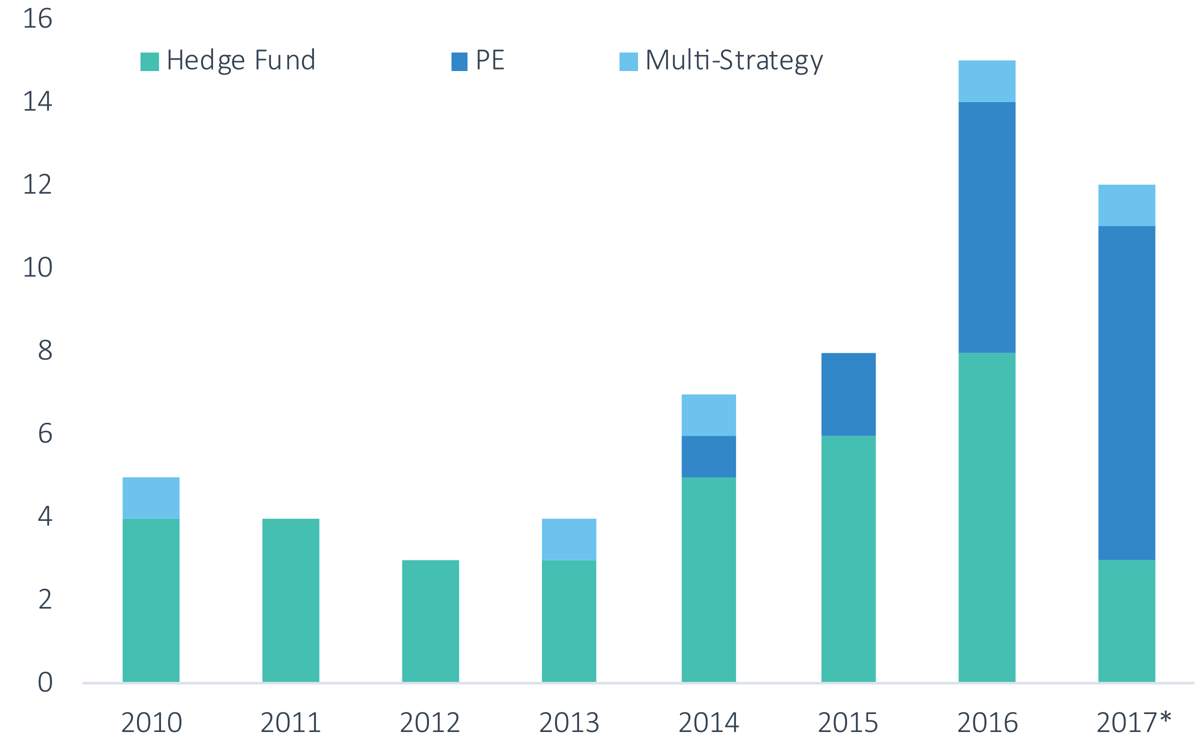
Several alternative investment firms now have dedicated GP stakes funds and teams, with a few new players entering the space in just the last few months. These GP stake deals provide a way to tap into the often-lucrative fees earned by PE firms. GPs, for their part, have leveraged these transactions to facilitate succession planning initiatives, to launch ancillary strategies, and to fund loans to junior investment professionals so that they can fulfill the GP commitment requirement of the funds they oversee.

As GP stakes investing has risen in prominence, many in the industry have questioned whether IPOs are a desirable or necessary route for PE firms. Some argue that an IPO will be the only exit option for many GP stakes deals, while others posit that many PE firms pursue a GP stakes deal specifically because they want to avoid the headaches of an IPO roadshow and the obligation to meet quarterly reporting requirements. If you can get the same access to capital in private markets as you can as a publicly traded entity, what is the point of listing?

Publicly traded PE firms may have found an answer. The latest wrinkle in this ever-evolving story is publicly traded PE firms' newfound penchant for issuing preferred stock—a development that may have swung the sentiment pendulum back in favor of being public. KKR, Carlyle and Apollo have all recently used their standing as publicly traded companies to issue preferred shares that offer yields in the mid-single-digits—an attractive return proposition for investors in this low-yield environment. As is the case with some GP stakes deals, these preferred shares boast a call feature that allows the issuer to purchase back the securities after a given period. In addition to this flexibility after issuance, these preferred shares require neither underwriting nor a roadshow, so they can be an efficient means of raising capital (if you've already gone through the IPO dog and pony show). Investors have exhibited a strong appetite for these opportunities. Indeed, Carlyle reportedly doubled their initial capital target when they issued preferred shares in September 2017.

PE's proportion has grown significantly as of late

GP stake deals by target firm type



Source: PitchBook
*As of 9/1/2017

What preferred shares do not address, however, is PE firms' acrimony with the persistent undervaluation of their shares—but developments may be coming on that front as well. A recent report by Michael Cyprys at Morgan Stanley claimed that by converting to C-corps, PE firms could "alleviate the complexities of current K-1 tax reporting and expand the universe of eligible investors in the Alts," which could boost share prices as much as 26%.

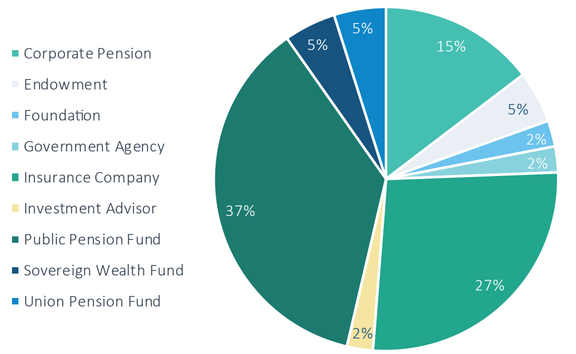
Even with these enhancements to the public market model, we think that PE firms are unlikely to opt for public offerings when large pools of capital are available in private markets. Recent GP stakes fundraises have been met with enthusiasm. Dyal Capital closed on $5.3 billion for its third GP stakes fund in early 2017 after increasing the target by more than $2 billion during the fundraise, then immediately went back to market with fund IV. AlpInvest is targeting $500 million for its first GP stakes fund, while both Blackstone and Goldman Sachs are in the midst of deploying large funds.

Some see public markets as the eventual exit route for many GP stakes deals, but we think it is unlikely that this option would entail a full listing of the firms. Instead, a GP stakes fund may decide to package their minority stakes into a listed vehicle, which would allow the underlying firms to maintain more anonymity than a typical public company while still providing an ongoing liquidity option.

Over the next year, we expect to see heightened activity in GP stakes deals, including more investments in lesser-known PE firms as smaller GP stakes funds begin deploying capital. We think that new listings of PE firms are unlikely in the near term, but there are tailwinds for those that are already public. More innovation is certainly coming to this space, especially as founders start to turn over the reins with long-discussed succession plans finally coming to fruition. Hardly a week goes by that a new deal structure or instrument isn't introduced, and as long as investors remain interested, one thing is for certain: PE firms will continue to seek out new avenues to tap that capital.

Public pension funds & insurance companies predominate

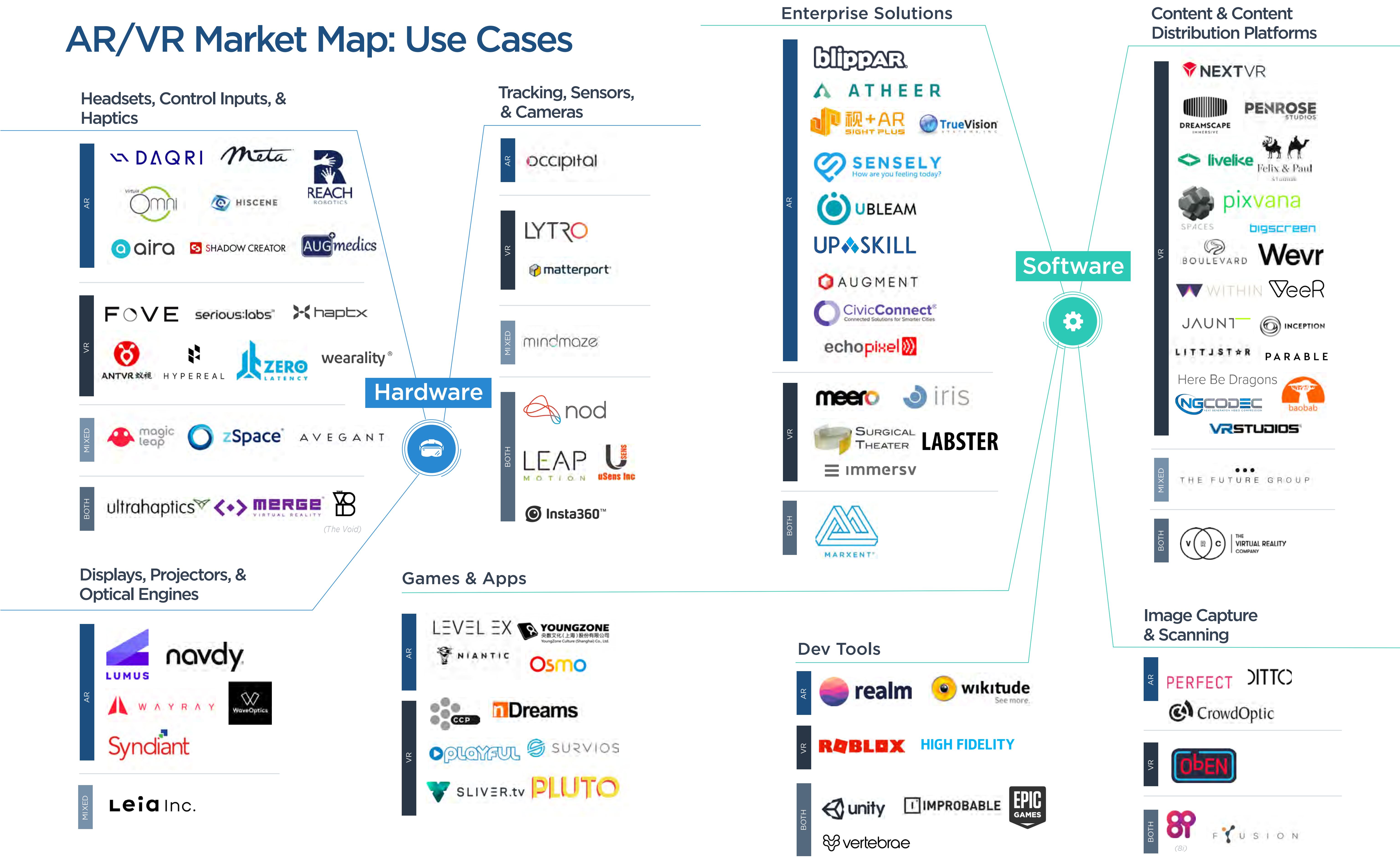
LP components of GP stake funds



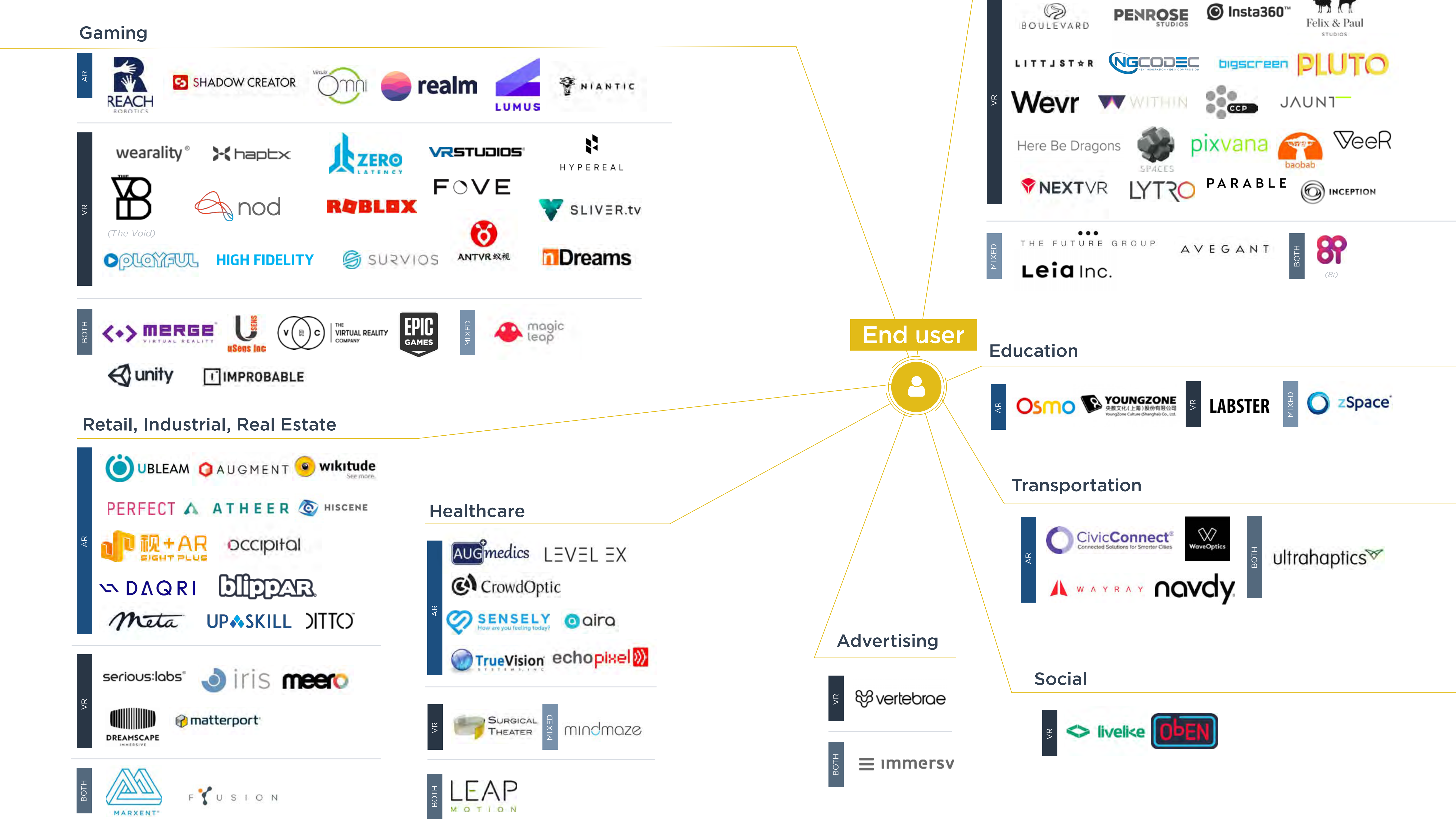
Source: PitchBook
*As of 9/1/2017

	LP INVESTED IN A GP STAKE FUND	GP SELLING A MINORITY STAKE	LP INVESTED IN THE GP'S FUNDS
PROS	• Achieve a stable and recurring cashflow from the firm's management fees • Receive access, often with preferential terms, to top funds that are closed to new LP relationships • Potentially develop deeper ties with the best-performing GPs • Gain access to back-office operations and processes of the GP	• Achieve liquidity for founders and partners • Raise capital to enhance the GP management company o Raise new/larger fund(s) o Make strategic acquisitions of other PE firms o Help to fund GP fund commitments by junior investment professionals • Operational assistance o Expertise of a GP stake investor that often has allocated to hundreds of managers via fund-of-funds, secondary funds, and/or advisory relationships o Broaden network of potential LPs • Maintain a higher level of control relative to other liquidity options, such as an IPO	• Potentially retain key investment personnel who otherwise would've cashed out entirely • Increased back-office efficiency can potentially improve reporting mechanisms, creating greater transparency
CONS	• Limited options for liquidity • Like other PE vehicles, GP stake funds come with relatively high fees that can erode cashflow yields	• Potentially limits opportunities for the GPs' junior professionals to grow their stake in the management company • May feel pressure to expand investment offerings to increase management fees and the concomitant cashflows to minority stake investors	• New alignment of incentives with an outside investor in the GP management company, which could lead the GP to place greater emphasis on the needs of stake investors rather than fund LPs • Deepening relationship between GPs and minority stake investors could cause conflicts regarding new funds and co-investments • Pressure to expand and grow business could affect returns of current fund investments

AR/VR Market Map: Use Cases



AR/VR Market Map: End-User



AR/VR market map methodology

By Joelle Sostheim

Since the 80's, tech enthusiasts and government organizations like NASA have harnessed VR to simulate real life experiences, and for gaming and entertainment. Though interest fizzled for some time, the recent resurgence of VR has brought about innovations that improve user experience and cost, and opened the gate for new technologies like augmented reality (AR) and mixed reality (MR). As with any emerging field of technology, understanding the current landscape provides valuable insights into where the space is, where it is headed, and the opportunities that lie in between. This market map is an overview of prominent companies in the VR/AR ecosystem, categorized into hardware and software segments ("Side A"), and then by end-user ("Side B"). The map includes the 97 VR/AR/MR startups which have received the most venture funding, globally. While we recognize some startups could belong in multiple segments or have multiple end-users, they are categorized based on our understanding of their primary use case or end-user.

Though VR/AR technology is most commonly associated with gaming and entertainment experiences, an emerging segment focuses on streamlining VR/AR tech into every day processes. With use cases ranging from medical imaging projection to skilled labor training, these technologies deliver solutions that could become invaluable to professional workflows in areas of healthcare, infrastructure, retail, and beyond. We hope this map will prove useful to you in your practice and shed some light on this vertical of emerging technology.

DEFINITIONS

VR involves immersion in an artificial world, typically achieved channeling the user's sensory factors through a headset and headphones and tuning out the real world. AR on the other hand, incorporates 3D visuals into the user's environment, augmenting surroundings rather than blocking them out. MR incorporates virtual objects into an augmented reality, a balance of VR and AR. Startups under the "both" tag provide products or services for both VR & AR markets.

Hardware

Headsets, Control Inputs, & Haptics: VR and AR headsets such as head-mounted displays (HMDs) and smart glasses, serve as the hardware medium for VR and AR experiences, respectively. HMDs shut out input from the outside world to submerge users in VR experiences, while smart glasses incorporate visuals and graphics into the user's real-world environment. Control inputs are pieces of hardware such as hand controllers, treadmills, and floor pads that integrate user movements to allow for interactive motion control. Finally, haptics technology enables the transmission of sensory (touch) information between users and VR/AR platforms.

Displays, Projectors, & Optical Engines: This category includes the hardware components that enable content or images to be displayed on various VR/AR interfaces. Displays are the screens or lenses that receive or project content from optical engines or projectors. Optical engines are essentially tiny projectors that are embedded within a VR or AR device, which project images or content onto a display. Projector hardware is also used to project holographic images (or light field displays) before users, typically in augmented or mixed reality environments.

Tracking, Sensors, & Cameras: Sensors track a user's motions or gestures in the real world and translate these into actions into the VR/AR interface. Sensors can also be used to track a user's position in reference to spaces in VR/AR environments, to aid in collision avoidance and object detection. Cameras include light-field and 3D computational cameras, which capture 4D or 3D models rather than 2D images to create accurate replicas of real-world environments

Software

Content & Content Distribution Platforms: This category includes startups which create VR/AR-specific content such as films, art, and sporting events. Content platforms distribute this content across hardware mediums, including mobile and PC VR/AR devices. We also include cloud computing platforms in this segment, as they are used for creating, editing, and processing high resolution virtual reality experiences and content.

Dev Tools: This segment includes companies whose proprietary software, or software development kits (SDKs) assist in the creation of new software. Several startups in different segments also release proprietary SDKs, but companies in this segment advertise their development software as their primary use case to customers or users. Currently, software development tools are used predominately for developing VR/AR games, content, environments and worlds, or applications. However, some VC-backed startups provide tools to develop VR/AR advertisements, as well as AR visualizations for applications like skills training programs.

Enterprise Solutions: Enterprise Solutions include software used to satisfy VR/AR use cases for other companies or organizations rather than individual consumers. Primary applications of enterprise VR/AR tech include interactive retail experiences, employee training software for complex labor processes, medical visualizations and simulations, and digital ads. Accordingly, end-users of VR/AR enterprise software include users in retail, the industrial sector, real estate, digital advertising, healthcare, as well as transportation.

Games & Apps: This segment includes startups that create games and apps for VR, AR, or mixed reality systems or platforms. VR and AR games are highly interactive, as users actively influence the game via direct inputs, though the level of control a user has depends on the medium, platform, and the type of game. Game types range widely from shooter games, to exploratory games, to multi-player online games, while apps include uses from digital communication to education.

Image Capture & Scanning: This segment is the software complement to the "Sensors & Cameras" hardware category. Startups in this segment develop applications and software that capture and record real-life environments or objects to produce 360-degree images and videos, and 3D models. This segment also includes scanning software which allows users to project augmented reality images onto themselves (think face filters) or import their physical likeness into a virtual environment.

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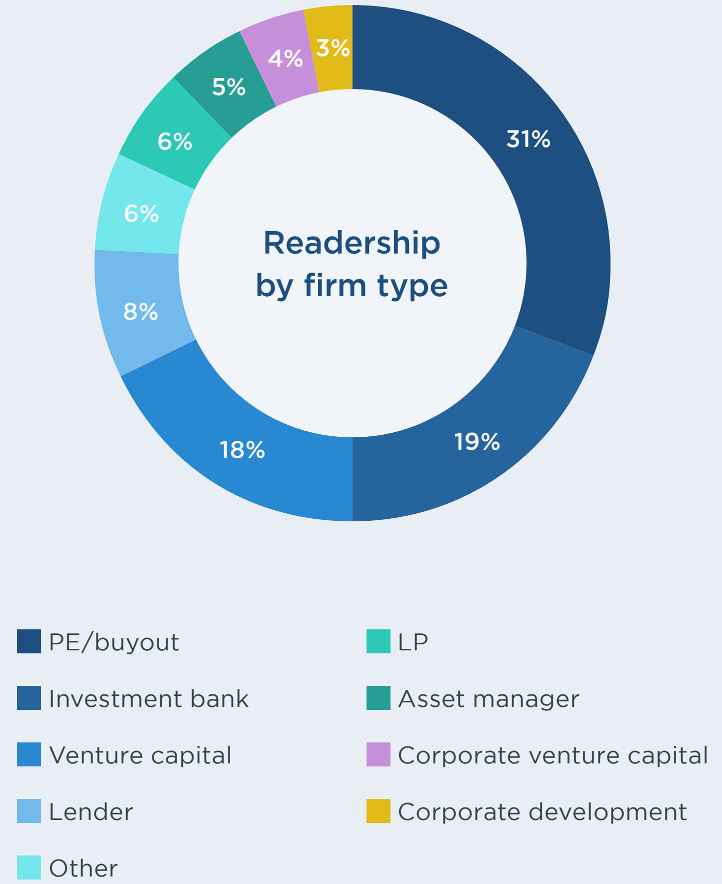

Readership by title/position

23% – VP/SVP/EVP

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