INVESTMENT REPORT

The cloud revolution

Democratising computer power in the 21st century

Rathbones
Look forward

"Kick at the rock, Sam Johnson,
break your bones:
But cloudy, cloudy is the
stuff of stones."

Epistemology, Richard Wilbur

Cover illustration:
Michael Driver, Folio Art

Foreword

The cloud is all around us, and our daily routines depend on it – at home, at work or at play – to an extent that would probably surprise most of us. Yet many investors remain unsure what is even meant by 'the cloud', what the driving forces are behind it, and whether the growth opportunity and business models justify the relatively rich valuations of cloud companies.

We believe cloud companies look set to enjoy a decade-long spending boom as enterprises seek to harness the benefits of this powerful new technology.

This report offers an overview of the industry and its origins and an explanation of the cloud's critical role in transforming the IT landscape. While no one can predict the future, we've tried to do a robust and thorough analysis to give you an estimate of how much the transition from on-premise IT infrastructure and services to off-premise cloud computing has left to run. And we then consider where in the cloud we can find the best opportunities for capturing this big structural growth trend.

Of course, we need to consider all of this in the context of the recent sell-off in cloud computing companies. If investors needed a reminder of the fickleness of markets, this sudden reversal has provided it without a doubt. Cloud stocks went from being widely held and hyped to racking up stomach-churning losses in a remarkably short space of time.

Many of the pandemic winners such as RingCentral, Twilio, Zoom Video and Shopify have now erased all or nearly all of the gains they've posted since the world went into lockdown. The valuations of others are back where they were in 2019, when US interest rates were at their highest in a decade. Parallels with the dotcom boom and bust are coming thick and fast, but are they justified? We address this comparison in the last section of the report and explain why we think the cloud is still full of opportunity.

Ben Derber
Equity Analyst

The promise of the cloud

The cloud is the most important yet least understood trend in IT. It may be less noticeable than other major technology shifts like ecommerce, but behind the scenes the public cloud is already powering so much of what we do, from taking photos, listening to music and watching Netflix to signing mortgage documents online.

Over the next decade, we see the cloud as automating every department of business, from customer service to sales and marketing, finance and accounting to supply chain management, and speeding up the pace of innovation. So what, exactly, do we mean by 'the cloud', and why is it so transformative?

What is the cloud?

The cloud is a broad term that refers to the provision of computing services over the internet rather than over a personal device or on-premise hardware. For example, when a photo is saved in the cloud, it is not stored on the phone's memory but externally in a public data centre. This means that if the device is lost the image still exists and can be accessed on a new one. These data centres, which can be the size of several football pitches, house rows of servers (jargon for computers) to provide applications and data to the end user.[1] The important point to note is that the cloud is not a nebulous entity that exists in the sky, as the name might suggest. It is a real physical location with a postal address, like the one in Dublin that is the largest data centre serving the UK run by Amazon Web Services (AWS).

Available from 2006, AWS was the first recognisable public cloud platform. Since then the wide rollout of fast broadband connections has catalysed the adoption of cloud-based infrastructure and services.

Amazon boss Jeff Bezos likened this transition to cloud computing to the advent of electric power grids. "You go back in time 100 years, if you wanted to have electricity, you had to build your own little electric power plant, and a lot of factories did this. As soon as the electric-power grid came online, they dumped their electric-power generator, and they started buying power off the grid. Just makes more sense. And that's what is beginning to happen with infrastructure computing."

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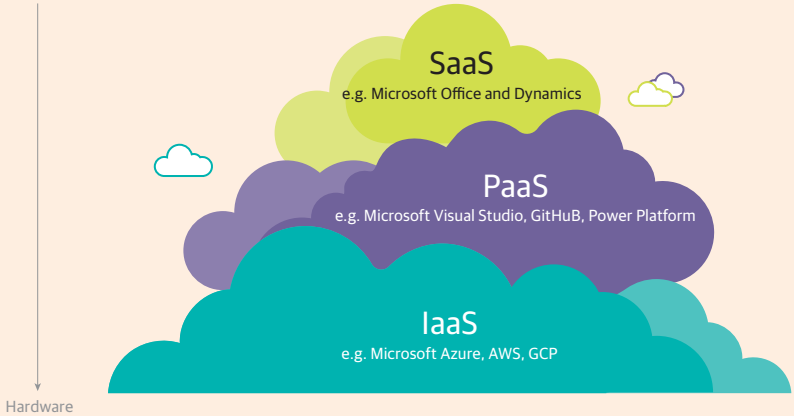
So the cloud providers like AWS could be viewed as the power stations of the digital economy. By driving down the cost of IT resources, we believe the main impact of the cloud is to democratise computer power.

There are three main types of public cloud services (figure 1). Notice that all these layers are defined as a service.

Cloud providers like AWS could be viewed as the power stations of the digital economy.

The description is meant to contrast cloud computing from the old IT model of ownership. It's like the difference between buying a car and renting one from Hertz, a form of cars-as-a-service if you like. It is cheaper and more convenient to rent a vehicle on holiday than to buy one. The same is true for companies renting computing services rather than buying and designing them from scratch in-house.

Figure 1: Types of public cloud services



The base layer is called Infrastructure as a Service (IaaS), which comprises the bare metal of the servers in data centres. The business model of IaaS is to rent out the computing and storage of those servers, on demand, at a very low price. Amazon's original computing service was called EC2, which stood for Elastic Compute Cloud. It enabled users to dial applications up and down as needed. Likewise, Amazon's storage service is called S3 (Simple Storage Service), granting unlimited access to memory in the cloud. The leading IaaS services are Amazon's AWS, Microsoft's Azure and Alphabet's Google Cloud Platform, with Alibaba Cloud being dominant in China. To use a food analogy, IaaS is akin to buying ingredients from the supermarket and cooking at home.

The middle layer, called Platform as a Service (PaaS), glues together the servers with the applications. This provides software tools for developers to build applications in the cloud such as inserting search functionality into an app, as well as software integrations and extensions. Using Microsoft as an example, its PaaS products are Visual Studio, GitHub and Power Platform. IaaS and PaaS are normally bundled together. PaaS is the equivalent of subscribing to a recipe box.

At the top of the pyramid is the application itself, Software as a Service (SaaS), which is hosted in public data centres such as AWS or Azure. For Microsoft that application could be Office or Dynamics. SaaS customers generally pay an annual subscription, or pay based on use, equivalent to only paying for miles driven in a rental car. This obviates the need to buy a licence, install the software, ensure regular backups, provide security and fix bugs. All customers use the same generation of the software, whereas for on-premise versions one user could be on Windows 7 and another on Windows 10. The advantage for the customer is they get the latest version, while the vendor benefits from not having to support multiple versions and having more predictable revenue streams. This makes planning easier. SaaS and PaaS are often sold together to provide integrations and extensions of the software. To continue the food analogy, SaaS is like ordering take-out.

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Benefits of the cloud

Moving sensitive and crucial data and services off premises can seem like a risky and potentially costly loss of control. So why would companies want to venture into the cloud?

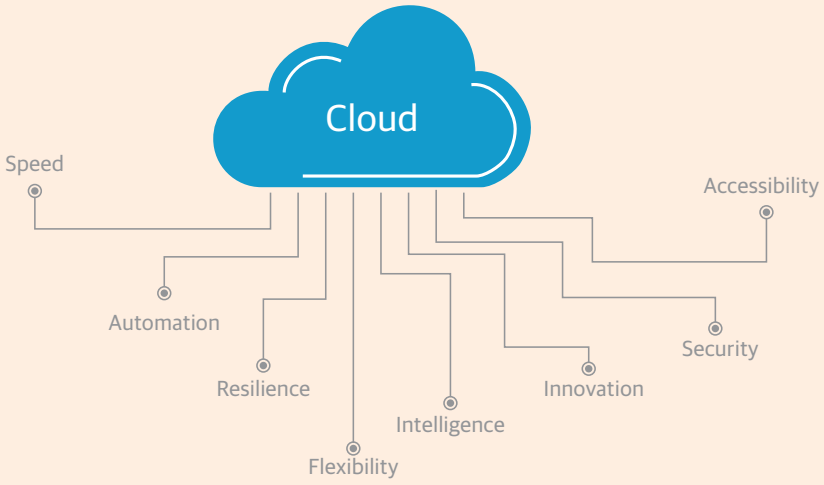
Silver linings in the cloud

The cloud is driving down the cost of computing. According to Microsoft, using a public cloud server costs on average about 80% less than buying and maintaining a server on-premise[3]. Public data centres can aggregate the demand of millions of users and allocate it across their servers around the clock to ensure utilisation levels remain high, spreading the cost of equipment and maintenance across their customer base. All the troubleshooting, maintenance and hosting are the responsibility of the vendor, further reducing costs for customers.

The cloud is unlocking significant latent demand for digital tools. Low-cost, and, in many cases, free software can automate back- and middle-office functions, helping companies reduce their operating costs, which has become more pressing as inflation spirals, and potentially steal a march over competitors that are slower to invest.

Some of the additional benefits of the cloud are highlighted in the figure below and on the following page.

Figure 2: Enhanced functionality of cloud applications



Speed. Users can get up and running on cloud software in minutes without having to manage a lengthy implementation process. For example, companies were able to adopt Slack, a provider of workflow automation and communications services, or Zoom across their organisations at lightning speed at the start of the pandemic. In addition, companies like Netflix have been able to roll out their services globally using the likes of AWS without having to build out costly server infrastructure around the world first.

Automation. While investors often associate automation with robots on factory production lines, most automation is performed by software, either by speeding up workflows such as data entry or replacing them altogether. As barriers to adoption fall (see later section in the report), organisations are embracing cloud applications to reduce labour-intensive processes. One example is DocuSign, which enables cloud-based e-signatures for employee onboarding, purchase agreements, mortgages and property sales, etc. The legally binding digital agreements are replacing wet ink, saving companies significant admin costs, estimated at £25.80 on average per document.

Resilience. Cloud providers have robust disaster recovery measures in place to protect businesses from IT hardware failure or natural disaster. Those cloud centres are looked after by dedicated professionals and company data and applications are also backed up in a secondary server location. Data and software can be recovered quickly and easily. According to Amazon, if 10,000 files were saved in its S3 storage service, only one of those files would be lost every 10 million years.[4]

Flexibility. The cloud offers vast storage and access to massive computing power on demand. Personal devices like our phones and laptops have limited memory – they can only save so many books, albums, photos and videos. Consumers can access all this data as needed, as long as they have an internet connection. From a company's perspective, it is hard to know precisely what computing capacity they will need to meet growth in demand. By outsourcing to the cloud, companies do not need to worry about correctly predicting capacity and can simply rent as much cheap computing capacity as they need at the time.

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Intelligence. This can be most clearly seen in ecommerce, where companies using cloud-based services like Snowflake are harvesting data from their websites, storing it in the cloud and applying machine learning to it to gain better insights into their customers. For instance, Amazon's ecommerce site uses machine learning to make product recommendations based on a shopper's buying history and comparing it against other shoppers. Because Amazon captures more data than most of its peers, it can make more precise recommendations, which can lead to more frequent purchases.[5] (See more examples of this cloud computing intelligence in the diagram on page 10.)

Innovation. Companies can take advantage of the processing power in public data centres to deploy next generation services like AI, data analytics and voice recognition at a fraction of the cost of deploying the same functions on-premise. Cloud software also has more rapid innovation cycles as updates are automatic. Customers of SAP's cloud-based resource planning system, for instance, will receive automatic updates every four weeks, whereas the on-premise version would be updated twice a year and require manual implementation.

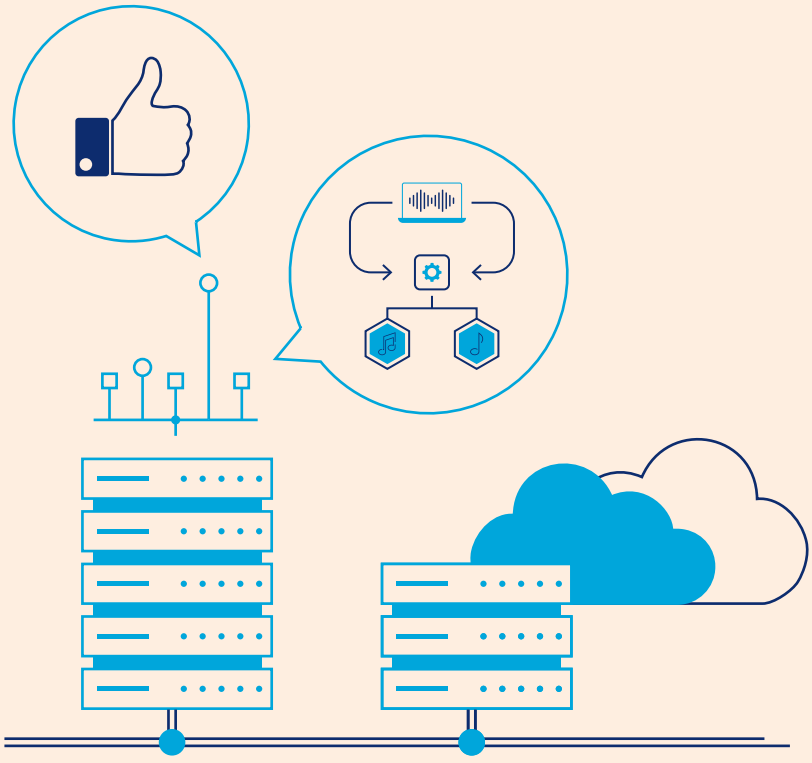
An auto manufacturer could have multiple designers working on different aspects of a car. If the design software is cloud based, like Autodesk's Fusion product or PTC's Onshape, they can all make modifications to the design regardless of time, location, or device.

Security. By subscribing to cloud services, businesses can outsource part of their security responsibility via a 'shared responsibility model'. Cloud providers protect the cloud's physical servers and ensure security patches are updated as needed. To most companies, this is an enormous security upgrade considering that the major cloud providers employ teams of experts and adopt the latest security technologies.

Accessibility. The cloud enables work to be done on projects remotely and simultaneously. For instance, an auto manufacturer could have multiple designers working on different aspects of a car. If the design software is cloud based, like Autodesk's Fusion product or PTC's Onshape, they can all make modifications to the design regardless of time, location or device. For office employees on the road, they can access their files and applications from any location on any device, allowing for more seamless working.

Intelligence in the cloud

Ever wonder how Spotify guesses what music you like? Its software predicts this based on the preferences of millions of other users who have liked the same songs. In the world of commerce, Salesforce.com cloud software helps sales teams work out which leads have the highest probability of becoming customers, and where to focus their time and resources by looking for patterns in data from the 150,000 companies it serves. It uses data such as visits to pricing pages, revenue performance of clients, number of interactions and seniority of contact.



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A growing cloud

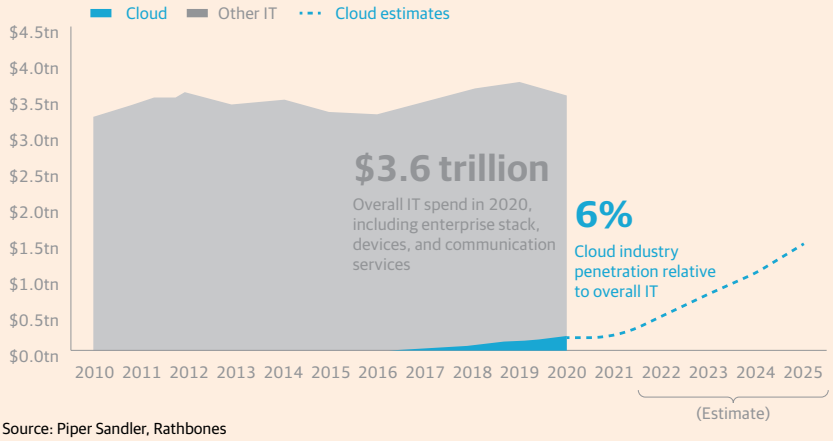
After the first on-premise databases and servers were introduced in the early 1980s, it took another 40 years for the growth in on-premise vendors to reach full maturity. If the next platform shift follows a similar trajectory, our best guess is that we are only in the first or second inning of a multidecade transition to the cloud.

Given its ubiquity, you may find it surprising that companies have so far only redirected a small fraction of their IT budgets to the cloud. This offers investors one of the most compelling secular growth opportunities of the next decade.

In 2020, only 6%[6] of the $3.6 trillion spent globally on IT was spent on the cloud (about $220 billion – see figure 3). When comparing that with the growth in US online spending as a percentage of total retail sales, that's about where ecommerce was a decade ago (figure 4). The rest of 2020's IT spending went towards on-premise equipment, consultants, IT staff, software, communications and devices.[7]

The pandemic has accelerated the transition to the cloud as companies worldwide, making a virtue out of necessity, have started to experience the advantages of remote hosting services. According to 451 Research Group, 90% of companies have now

Figure 3: IT spending
Spending on cloud IT has plenty of room to grow



Source: Piper Sandler, Rathbones

moved some operations to the cloud.[8] But a lot more of them remain on premise.

Microsoft's CEO, Satya Nadella, expects companies to double their spending on IT as a percentage of GDP from around 5% today to 10% over the next 10 years.[9] While Mr Nadella may have a pro-cloud bias, we certainly think companies will increasingly be convinced of the benefits of allocating more of their overall IT budgets to cloud computing, for the reasons outlined above and explored in more detail below.

As companies around the world join an arms race to compete in the digital era, we see annual spending on cloud services growing nearly five times by

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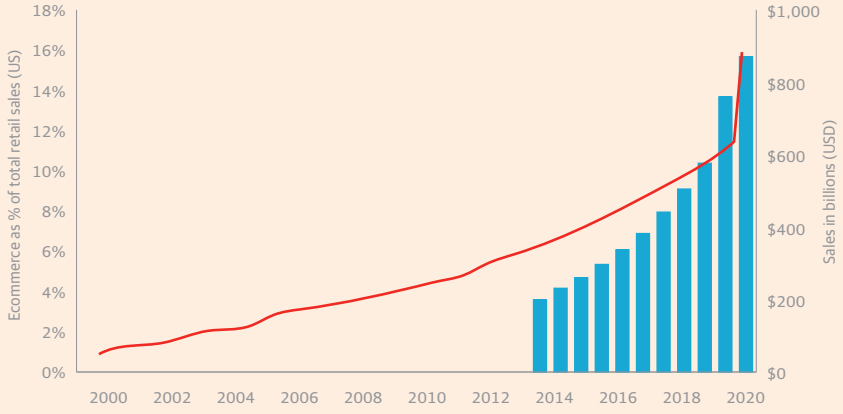
We think cloud services can sustain similar levels of long-term growth to US ecommerce sales, which grew at an average 16% annual rate between 2010 and 2020 (figure 4).[11]

Figure 4: The growth in US ecommerce
Online shopping took off during the pandemic and looks set to stay



Source: US Department of Commerce

So where will all that extra spending come from?

Most of the increase in spending on cloud computing will be at the expense of on-premise hardware, software and staff. This comes in the context of a long-term trend of an increasing proportion of global economic activity being driven by digital technology (figure 5). If Mr Nadella's prediction is right that IT spending will double as a percentage of GDP, then these forecasts could prove to be too conservative.

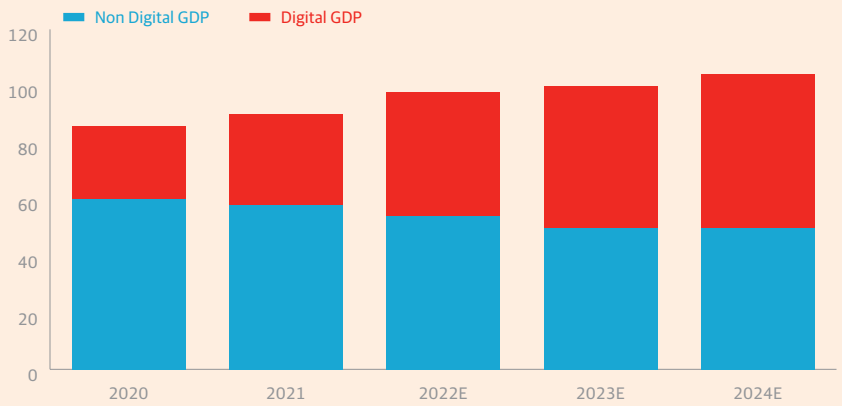
Growth rates will vary by region. China, for instance, has significantly lagged the US in cloud penetration, spending half as much of its GDP on cloud computing.

Barriers to cloud adoption

While many companies starting from scratch will make the calculation that moving straight to the public cloud makes financial and strategic sense, long-established companies that have invested heavily in on-premise systems face a harder choice. The cost of shifting into the cloud can be exorbitant, and take a long time to recoup. US investment platform provider Charles Schwab, for instance, said that moving to the cloud would not improve its profit margins in the near term.

But other large and IT-intensive firms like CME, the US derivatives exchange, have decided to make the shift. There could also be a future cost to pay for staying on premise. The danger is

Figure 5: Global GDP's increasing dependence on digital technology ($ trillion)



Source: IDC. Note: E = estimated.

that incumbents with on-premise systems could suffer a competitive disadvantage against new entrants, who can provide a more flexible service offering the latest technologies.

Companies can also be reluctant to shift to the cloud because they are worried about data security or falling foul of local data rules around storage. There is also confusion around pricing models for the cloud and a shortage of expertise in managing the transition.

We acknowledge that on-premise systems will remain entrenched perhaps for decades to come due to the expense in shifting to the cloud, the limitations of one-size-fits-all cloud solutions and/or security concerns. Both systems can co-exist, but our analysis points to the majority of incremental spending on IT likely flowing into the cloud. Our forecasts that spending on the cloud will more than triple by 2030 would still leave 70% of IT spending on premise.

In the cloud or under a cloud?

We see the cloud transformation as being enormously beneficial for society, driving productivity gains and higher GDP growth as access to cheap software tools that lower the barriers to starting a new business stimulates entrepreneurial activity. Put simply, because cloud software has lower upfront costs and is easier to deploy, businesses are consuming a lot more of it. Indeed, the arrival of cloud software tools like Shopify appears to be one factor driving a sharp pick-up in new businesses in the US.

From an investment perspective, any company across the whole supply chain that is involved in selling the 'picks and shovels' needed for building the cloud is going to benefit – from the chip makers like Nvidia to the cloud software providers, infrastructure providers and consultants advising companies through this transition.

On the other hand, the cloud could also pose a risk to legacy infrastructure providers like HP, Dell, Cisco, Oracle, and IBM, although these companies are striving to reengineer their business models for the cloud era. We also think the cloud is likely to lead to a reduction in low-skilled jobs, for example in call centres, data entry and office administration roles. But on the plus side, these workers may be redeployed to more rewarding tasks (we wrote about this potential a few years ago in our disruptive technologies report, *How soon is now?*).

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ESG in the cloud

One of the questions many investors will be asking is how the cloud stacks up on environmental, social and governance (ESG) factors.

Clouds are good for the environment

By centralising computing resources in public clouds, various studies suggest that companies can reduce the amount of energy spent on IT by 50% to 90% compared to on-premise systems.[12] Most of the savings come from higher utilisation rates of cloud infrastructure, where demand is aggregated, with one estimate suggesting that nearly a third of on-premise servers sit permanently idle,[13] while still consuming electricity. The custom servers used in public clouds also use less energy, and in many cases are located near renewable power sources. A significant demand for energy in data centres is for cooling systems, as servers generate significant heat.

Public cloud providers have also invested in advanced cooling systems that save material cooling costs per server.

Data residency: partly cloudy

Regulations like the General Data Protection Regulation (GDPR) and the California Consumer Privacy Act (CCPA) can be a barrier to cloud adoption, as storing data in the cloud means loss of control over where that data is located and risk of non-compliance. These complex rules around where customer data resides mandate processing and storage in the country of origin for a mixture of reasons, including national security, personal data protection and economic protectionism. While the major public cloud providers have global networks of data centres that can address these issues, confining data to a single region comes at the expense of performance, reliability and even security. As a result, companies are opting to keep some

data on premise or using so-called edge networks (which, as the name suggests, are closer to their users), allowing them to keep their data local without sacrificing performance.

Social trends: in the cloud for good?

Hybrid working required companies to find new ways to collaborate, which needed cloud-based communication tools. Consumers and businesses turned to cloud-based software to replace in-person activities, and though they may have slowed as the pandemic has subsided, we believe the greater efficiency and ease of cloud-based services means that new users are unlikely to go back to the way things were. We believe cloud adoption will lead to a reduction in low-skilled jobs, but rather than drive up unemployment, we believe these jobs could well be replaced by more rewarding employment.

The cloud is helping small businesses prosper by providing tools that automate their bookkeeping, marketing campaigns and payroll, while cloud-based software can make jobs safer, less labour intensive and more productive. For example, PTC's software for factory floors can be used for training, operating machinery correctly, safely carrying out repairs and prioritising tasks.

Where to look in the cloud

Many companies operating in the cloud have high rates of growth and strong business models. One key drawback is that they are expensive, with share prices trading at much higher multiples of their sales and earnings than the average for the overall stock market.

With a few notable exceptions, most cloud-related businesses have low or negative profit margins as they invest heavily in expansion. Because platform services tend to be bundled together with infrastructure and/or software services, we will focus on the latter two.

Firm foundations

When looking for cloud-related investment opportunities, we think it makes sense to start with the base layer of the cloud, the infrastructure (IaaS).

The big four IaaS providers — Amazon, Microsoft, Alphabet and Alibaba — provide this foundation that cloud applications are built on. As spending on the cloud increases, it will be hard to avoid paying some of those dollars to one of these four vendors.

The top three IaaS vendors control 80% of the market outside of China[14] (figure 6). One of the reasons is that they were able to leverage their huge data centre capacity, which they needed to service their core businesses, by effectively renting it to third parties. Without this pre-existing infrastructure, it probably wouldn't be economical to build a public cloud business from the ground up.

In addition, once a customer commits to one infrastructure provider, it's tricky to switch to another. They all have unique programs and applications and companies do not have the resources to engage with more than a few cloud vendors. Vendors also have economies of scale to keep prices low and are continuously investing in value-added services, like machine learning and voice recognition, that are bundled together with their core services. For these reasons, AWS earns an estimated post-tax return of 25% on the capital it invests in its public cloud business.

Some important caveats for investors: none of the big four are 100% pure plays on cloud infrastructure, and only Amazon and Microsoft have profitable IaaS operations. The leading

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public cloud providers have diverse operations, which means they derive between roughly 10% and 25% of revenue from their infrastructure business. As a result, investors in these companies must also take a view on the prospects of their other divisions, which for Amazon is ecommerce, for Alphabet is primarily Search and YouTube, and for Microsoft is a wide array of businesses, including Office and Windows software, gaming and LinkedIn. Over time, we believe the public cloud will generate an increasing proportion of their sales growth and profits. Investors in major cloud providers also incur higher regulatory and antitrust risk as their dominant positions attract government scrutiny.

We see IaaS as a relatively low risk way of gaining exposure to the growth in cloud demand as the market is more consolidated and the bulk of cloud software and services end up running over this established infrastructure.

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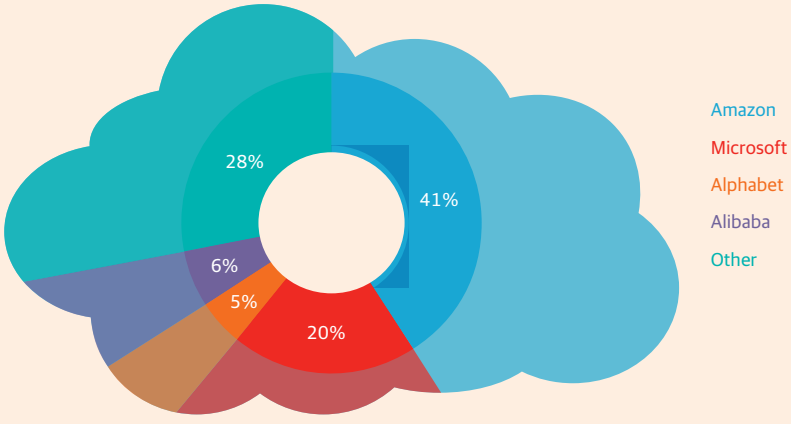
Figure 6: Public cloud market share 2020
Amazon dominates the market



Source: Gartner

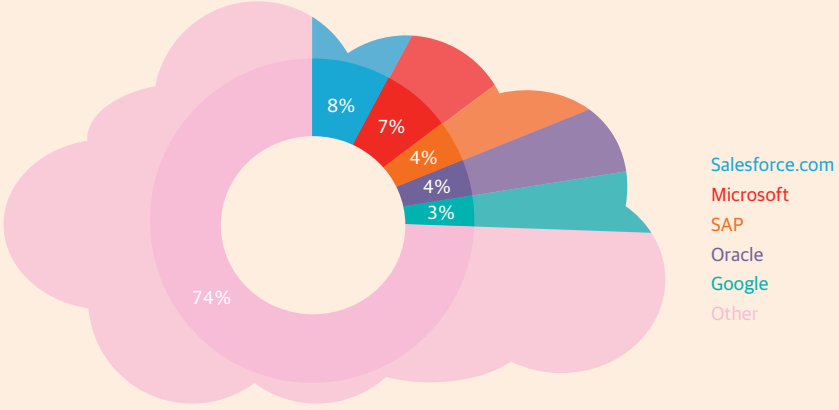
Software: a fragmented cloud

We believe cloud software spending should continue to grow at a healthy clip for the next five to 10 years. But gaining exposure to that growth is more complicated: in contrast to the big four in cloud infrastructure, the cloud software market is much more fragmented, with the top 10 players only having a 30% share (figure 7). Investors face much more choice than for infrastructure services, because software is a more specialised area, with many industry-specific solutions, and scale is less of a barrier. Compared to IaaS companies, software vendors have simpler business models, lower regulatory risk and they require less capital investment.

The SaaS market is undergoing a Cambrian explosion in the number and type of applications being created and consumed. According to SaaS platform provider Blissfully, the number of unique applications used per company grew 30% to 137 in 2019 versus 2018.[15] This trend accelerated in the pandemic, with ever more cloud software solutions being adopted to address specific pain points across industries and functions, particularly software development, marketing and sales, and product development.

In the on-premise world, businesses tended to buy software from a single mega vendor as it was expensive to install and integrate multiple

Figure 7: SaaS market share 2019
The software market is relatively fragmented



Source: Gartner

independent applications. In cloud computing, companies can now buy best-of-breed solutions targeting specific workflows at the click of a button. Examples include workplace collaboration (Slack), document signing (DocuSign) or video conferencing (Zoom), which are pre-integrated with core applications like email and are hosted and managed by the vendor.

The rise of 'freemium' – giving away the lowest tier product for free – has been another factor driving adoption and helps explain how software companies like Zoom have been able to post such meteoric growth rates during the pandemic.

The cloud enables the freemium model to exist because distribution costs are low, and with gross margins often around 90%, the software can be offered at or close to zero. That drives huge global adoption and means that even a small percentage of paying users can generate billions of dollars in revenue. From the customers' perspective, they gain access to a multitude of free software products, so it's a win-win situation

Cloud software providers tend to have more dependable, recurring cashflows relative to legacy software vendors because of their subscription-based business models. They have also had higher growth rates, in line with the trend of increased spending on cloud software from a low base.

For these reasons, SaaS companies tend to command higher prices than legacy software businesses relative to their earnings.

Keep an eye on profits

Risks to be aware of when investing in cloud software providers are that most are still unprofitable, the market may be saturated with similar services, and it's often unclear who the long-term winners will be for cutting-edge solutions.

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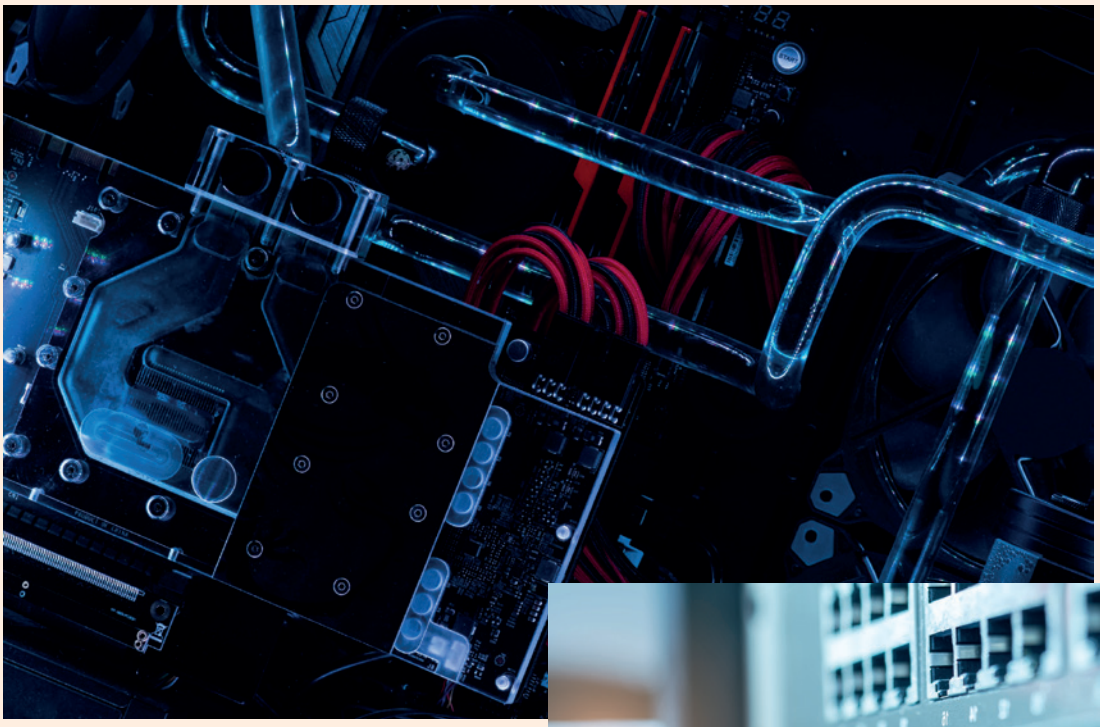


The cloud enables the freemium model to exist because distribution costs are low

From cloud boom to cloud burst?

Before the recent sharp correction, many SaaS stocks were trading on eye-watering multiples that were difficult to justify, and they remain lofty compared to more mature peers in the technology sector.

Cloud companies peaked in November 2021 on extreme enthusiasm for their recurring revenue business models and unbridled confidence in their growth prospects. Emergency rate cuts and other monetary stimulus unleashed during the pandemic threw fuel on the fire. Combined with the supercharging of growth rates, as companies invested heavily in cloud services to negotiate the move to remote work and selling online, this led to a double valuation boost. Investors' growth forecasts and their willingness to pay more for every extra unit of growth both went through the roof.

For some unprofitable companies, share prices reached over 100 times their sales. To justify those valuations, revenue growth at these companies would have had to comfortably exceed what Amazon produced over the past 20 years. The probability of even a tiny fraction delivering that kind of growth were minute, and yet the market was predicting many cloud companies would do just that.

Lightning strikes not once but thrice

Three catalysts have contributed to a sudden bursting of this bubble.

Firstly, inflation has remained above expectations, with the end of the pandemic now in sight and an expected series of interest-rate hikes has begun in the US and UK. That matters because higher rates make expected returns far out into the future less valuable today.

The second blow has come in recent quarterly earnings updates, with many tech investors forced to lower their projections after realising that growth enjoyed during the pandemic by the likes of Zoom, DocuSign and Netflix was a one-time surge that in many cases pulled forward future demand. Microsoft's Nadella might be right that two years of digital transformation occurred in two months,[16] but this is not necessarily a good thing for investors if this means growth in the subsequent two years is lower when valuations assumed it would be maintained.

Cloud companies peaked in November 2021 on extreme enthusiasm for their recurring revenue business models and unbridled confidence in their growth prospects.

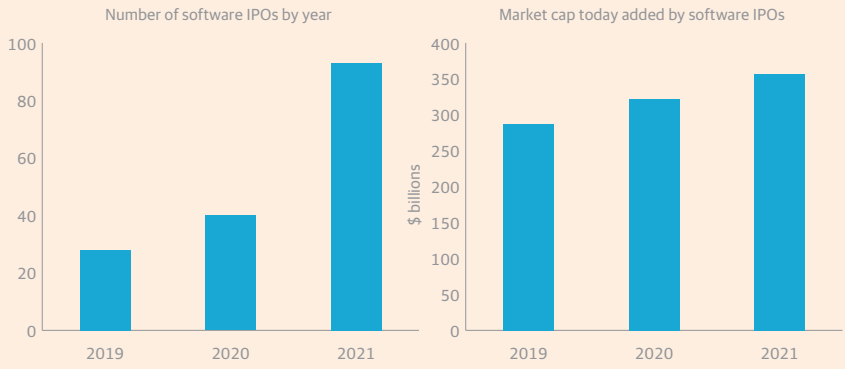
Finally, high valuations attracted a wave of capital into cloud start-ups, as evidenced by a surge in tech IPOs in 2020 and 2021 (figure 8). In this more competitive environment, losses deepened as companies vied to win market share by outspending each other on marketing and product development. With higher rates expected, and less money sloshing around, investors became less tolerant of companies burning capital. They saw that with multiple copycat software companies competing against each other, not all could succeed (as their share prices suggested).

A similar cycle occurred in 2000 when excess investment in telecom infrastructure led to a bust as exuberant investors overpredicted demand for internet services. Over the long term the internet became a bigger force than even the optimists imagined, but in the near term their forecasts for company profits were too optimistic. Sceptics point to a similar pattern today of heady projections of cloud growth with signs of over-investment in cloud software businesses and potentially even cloud infrastructure.

High valuations attracted a wave of capital into cloud start-ups, as evidenced by a surge in tech IPOs in 2020 and 2021.

As in 2000, a hike in interest rates was responsible in part for bursting the bubble. However, there are also key

Figure 8: Initial public offerings (IPOs) of software companies
A diminishing bang for your IPO buck ($ billions)



Source: Factset, EVR–ISI Research

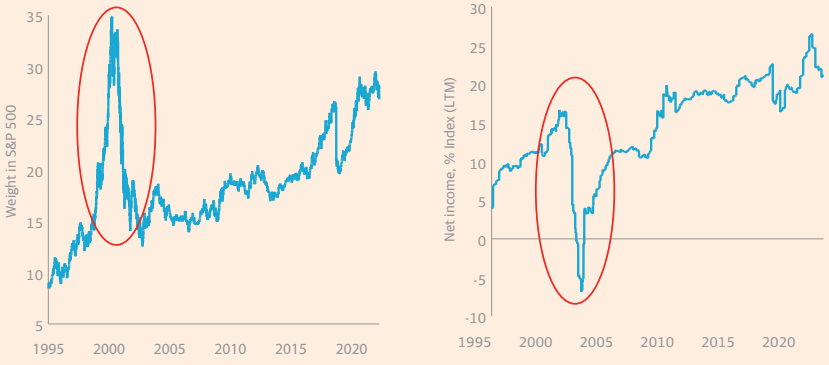
differences that make us believe cloud companies will not experience a lost decade as internet stocks did at the turn of the millennium.

In aggregate the tech industry was losing cash in 1999, whereas today cash generation and profitability are strong and we are generally not seeing the same level of euphoria that there was in 1999. That sort of exuberance has largely been transferred to cryptocurrency. Today, the tech-heavy Nasdaq trades at 24 times estimated earnings for the next 12 months of the companies in the index, a fraction of the 175 times estimated earnings at the height of the 2000 dotcom bubble.[17] The competitive landscape was also very immature then as it was not obvious at all who the winners would be in search engines or ecommerce. Now the leaders in certain areas of software and infrastructure have been established.

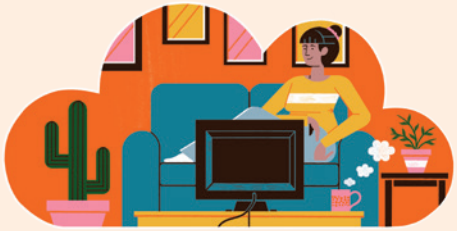
As we can see in figure 9, the outperformance of technology has mainly been driven by their growing share of the overall index earnings, rather than investors paying higher multiples of those earnings. While there were some signs of speculative mania creeping in to newly minted software businesses, even these tend to have higher-quality business models with highly recurring subscription-based revenue and clean balance sheets compared to the more flaky and debt-laden business models that defined the late-90s technology boom.

Figure 9: Measuring performance

The technology sector's outperformance has mainly been driven by earnings; in the dotcom bubble, prices and earnings moved in opposite directions



Source: Factset, EVR-ISI Research



Clearer skies ahead?

There are two main questions investors must now ask themselves: how will cloud demand normalise after the explosive growth in 2020 and 2021, and what is the right price to pay for investing in the cloud as we head into an atmosphere of higher rates?

Cloud infrastructure providers have been expanding capacity aggressively to meet insatiable demand. Comments from CEOs suggest demand remains firm, with analysts' estimates for AWS sales, for example, having gone up by 15% for 2022, with growth this year expected to be 32%.

Has this demand been pulled forward such that growth estimates in 2023 need to be revised down? The market has repeatedly been caught out by the growth in Amazon's AWS exceeding expectations, so not necessarily. At the time of its latest earnings release, Microsoft reported a step up in cloud usage, observing that a combination of labour shortages, cost pressures and competition is forcing companies to increase their investment in digital transformation, which remains in its early stages. If there has been a slowdown in growth in cloud services, we believe signs of it would have emerged by now, and if it is still to come the underlying impetus for the cloud transition means any deceleration would be short-lived. Our analysis also suggests that share prices for the cloud infrastructure players may now reflect undue pessimism in future sales and earnings growth from these services.

We see a more nuanced picture in software services, where growth for some vendors has certainly slowed as the world begins to emerge from the pandemic and analyst expectations may still be too high. But others that are more tapped into enterprise applications (i.e. for organisations rather than individuals), appear to be maintaining momentum. We think the brunt of the slowdown has been felt by companies that benefited from stay-at-home orders, namely ecommerce businesses, video conferencing and online payments. Many of these don't strictly fall into the cloud bucket but have pulled down the whole IT sector, as investors have rotated into 'old economy' sectors.

Valuations for some cloud software companies have corrected back to 2019 levels, though they still remain lofty compared to the overall market.

Keep moving higher

Valuations for some cloud software companies have corrected back to 2019 levels, though they still remain lofty compared to the overall market.

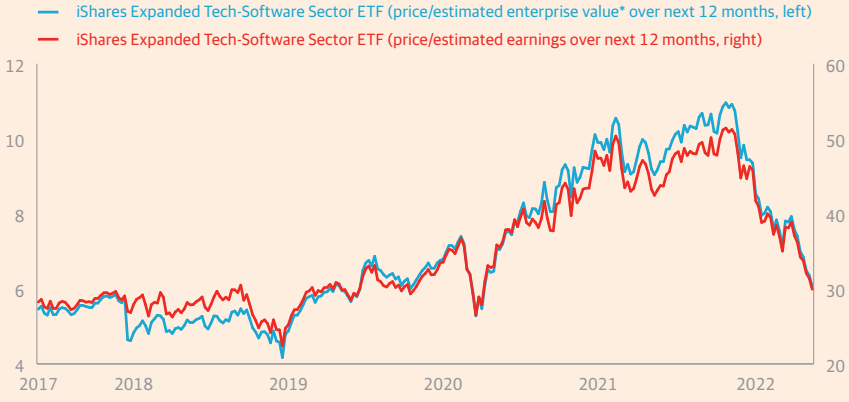
For example, the software index now trades at six times sales, in line with 2019 (figure 10) when US short-term interest rates were a much higher 2.5%.

Investors who may have avoided participating in the cloud sector on valuation concerns should welcome a correction. In the dotcom implosion of 2002, the tech-heavy Nasdaq index corrected over 70% from its previous peak. Although it hasn't come close to this kind of decline today, we have seen a similar correction in many cloud names such as Zoom, Shopify and DocuSign, which had all experienced declines of between 60% and 70% at the time of writing.

The impact of a big correction is firstly to make valuations cheaper. The second order impact is that capital will exit the sector, resulting in fewer start-ups, and coupled with a rising rate environment, investors will become less tolerant of losses. Hence, the post-crash period will likely lead to a greater focus on profitability, and less competition as weaker players either exit or consolidate.

We continue to think it makes sense overall to avoid unprofitable cloud software companies on valuation grounds, and because of the intensive battles for market share they are engaged in with no clarity about who will emerge victorious. However, even some unprofitable technology companies,

Figure 10: Value in the cloud
Valuations for some cloud software companies have corrected back to 2019 levels



Source: Factset. *Enterprise value is the measure of a company's total value, including equity and debt.

such as Cloudflare in cloud networking and Unity Software in game engines, are sustaining colossal rates of sales growth and carving out dominant positions in their industries. Some profitable cloud software companies that are clear leaders have also seen their valuations knocked back, although to a lesser degree. We think these companies are unlikely to be knocked off their perch, and can continue to generate predictably solid, though not outlandish, growth.

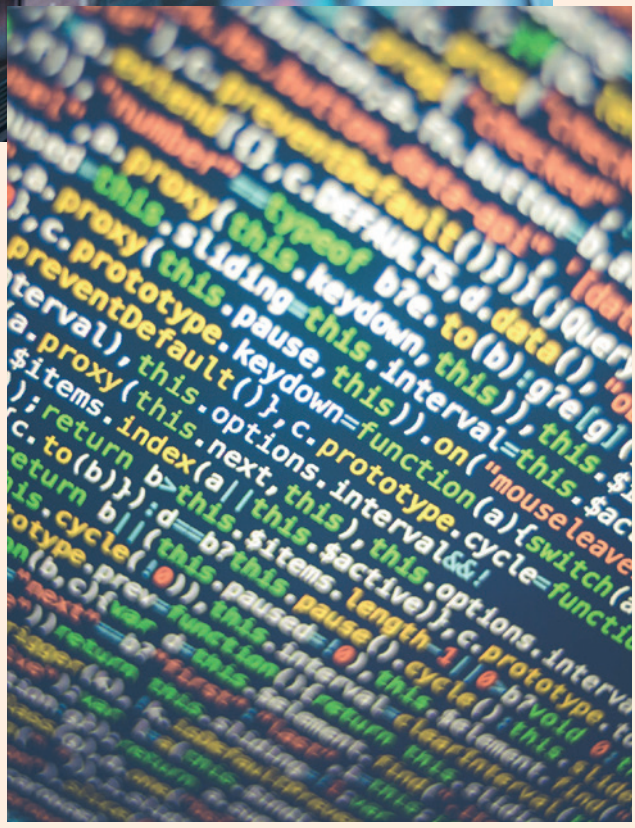
Zoom's shares, for example, had fallen about 65% from their peak at the time of writing, though unusually for a young SaaS business, it's highly profitable and its sales are forecast to grow 18% from customers with more than 10 employees this year (despite the transition back to office working). Zoom has rapidly become a leading provider of video conferencing software for businesses of all sizes as its ease of use, reliability and freemium model have driven widespread adoption. Some more established cloud software providers that are now more moderately valued by the market, such as Autodesk and Intuit, have controlling shares of their respective fields of engineering software and accounting and should be able to sustain strong earnings growth over the long term.

The adage of being fearful when others are greedy and vice versa is as true for the cloud sector as it is for the overall stock market. The past few months have shown that cloud companies are as vulnerable to boom and bust as previous tech cycles. The pendulum may now swing too far the other way, raising the possibility of finding some outstanding software businesses at valuations that suggest more pedestrian levels of growth and lower profit margins than they are capable of.

The future is in the cloud

Our conviction that the future is in the cloud remains unshaken. The path of growth to get there may not be as steep as investors priced in six months ago, and we could be in for a bumpy ride before growth reaccelerates. Nevertheless, with valuations of cloud computing companies in general back to within 10% of where they were before the pandemic, we believe these are attractive levels for finding long-term investment opportunities.

Still, investors must tread carefully, and in our view favour companies that are clear winners in their categories, with easy to articulate competitive advantages and plenty of growth runway ahead. We are doing our research on these companies now, while there is a window for buying them at a discount. And some, even now, whisper it, are starting to look cheap for the first time in years.



Our conviction that the future is in the cloud remains unshaken

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