

WINNER TAKES ALL

There are multiple reasons why technology markets are ‘winner takes all’ and why, once a tech company becomes dominant, it is almost impossible to displace, says **PATRICK BARWISE**

Apple, Amazon, Alphabet (Google), Microsoft, and Facebook, in that order, are the five most valuable public companies in the world by market capitalisation (as of July 2018). Microsoft has been on the list since the 1990s but the others are relative newcomers. These companies are a large part of everyday life in developed economies and increasingly everywhere else except China – a protected market with its own tech giants (discussed later). They wield enormous power, raising difficult questions about their governance, regulation and accountability. That power derives from their dominance of large, profitable markets.

In this article, I address two questions. First, why are technology markets “winner takes all”, characterised by extreme market concentration? Second, how likely is it that market forces will end these companies’ market dominance in the foreseeable future, given that their competitors are “only a click away”?

The five companies vary in many ways. For instance, Apple is primarily a hardware company and Amazon has a huge physical distribution

network, while Google, Microsoft and Facebook are mainly “weightless” online businesses, although that is changing. Also, Facebook’s market capitalisation has now been somewhat left behind by those of the other four (“Maga”: Microsoft, Apple, Google and Amazon). Nevertheless, they all share several features:

- A US west coast base
- Dominant founders: Steve Jobs (Apple), Jeff Bezos (Amazon), Larry Page and Sergey Brin (Google), Bill Gates (Microsoft), Mark Zuckerberg (Facebook)
- Significant control of the digital markets on which consumers and other companies depend
- A business model to monetise this market power by charging users and/or others, such as advertisers, leading to sustained supernormal profits and/or growth
- A capable, hard-driving, innovative corporate culture epitomised by Facebook’s former motto, “move fast and break things”, but with a sustained commitment to R&D and capital investment.

They have a combined annual revenue of \$745bn, net income of \$124bn and market capitalisation of

THE BIG FIVE US TECHNOLOGY COMPANIES

COMPANY	FOUNDED	BASED	MAIN PRODUCT	REVENUES 2017-2018	MARKET CAPITALISATION 31/7/18	TAX INCOME (AFTER-TAX PROFIT) (2017/18)	P/E RATIO
APPLE	1976	Cupertino, CA	Hardware	\$255bn	\$939bn	\$56.1bn	17
AMAZON	1994	Seattle, WA	Commerce	\$208bn	\$885bn	\$6.3bn	141
ALPHABET (GOOGLE)	1998	Mountain View, CA	Search	\$124bn	\$872bn	\$26.2bn	33
MICROSOFT	1975	Redmond, WA	PC software	\$110bn	\$827bn	\$16.6bn	50
FACEBOOK	2004	Menlo Park, CA	Social network	\$48bn	\$506bn	\$19.1bn	26
TOTAL				\$745bn	\$4,029bn	\$124.3bn	32

Source: Company reports and corporateinformation.com

Revenue and net income: 12 months ending 30/6/18. P/E (price/earnings) ratio = share price/latest earnings per share



over \$4 trillion – even after over \$120bn was recently wiped off the value of Facebook in a single day after it warned of slowing growth, lower future margins and higher costs to improve safety and security (see table).

This is the latest stage of a 60 year pattern. In the 1960s, IBM dominated the mainframe computer market. It still does. In the 1980s, Microsoft and Intel dominated the PC software and processor markets. They still do. From the 1990s, with the world wide web, the winners were Amazon in e-commerce, Google in search and Facebook in social networking. They still dominate those markets. Since 2007, Apple and Google (Android) have also dominated the market for mobile internet operating systems.

The pattern is clear. New tech markets are volatile and highly competitive, but once a company achieves clear market leadership – usually as a fast follower with better and bolder execution than the pioneer – it soon attains complete dominance and is then almost impossible to displace. Instead, the threat is that, at some point, a newer, bigger, adjacent market emerges, dominated by another player, as mainframes and PCs have been overshadowed by online, mobile and cloud-based technologies. In the words of industry analyst Ben Thompson, dominant tech companies can be “eclipsed but not displaced”.

To head off this threat and exploit the new opportunities, dominant tech companies invest heavily in high-potential, emerging product markets and technologies, both organically and through acquisitions. Current examples include:

- The augmented and virtual reality (AR/VR) platforms being developed by Apple, Google and Facebook

Apple's futuristic new HQ in Cupertino is testimony to the company's ambition

- The race among Google, Apple, Uber, Tesla and others to develop self-driving car technology
- The creation of ecosystems based on connected, voice-activated home hubs such as Apple's HomePod, Amazon Echo and Google Home
- The internet of things (IoT), with a growing proportion of data processing migrating to smart devices at the edge of telecoms networks.

What are the factors driving this repeated pattern of extreme market concentration with the winner remaining dominant over an extended period?

WHY ARE TECH MARKETS WINNER TAKES ALL?

There are multiple reasons why technology markets are so concentrated. In broad terms, they can be split into “hard” factors based on economics and technology and “soft” factors based more on human behaviour. The hard economic and technological factors include traditional economies of scale, scope and learning; direct (within-market) and indirect (between-market) network effects; and big data and machine learning.

In total I identify nine factors that make the tech giants' markets “winner takes all”. The first four are “hard” factors based on economics and technology. The other five are “soft” factors based more on human behaviour:

- Economies of scale, scope and learning
- Direct (within-market) network effects
- Indirect (cross-market) network effects
- Big data and machine learning
- Strong user brands and habitual usage
- Switching costs and lock-in
- Attractiveness to talent (“employee brand equity”)
- Powerful founders and hard-driving corporate culture
- Economic geography (“cluster economics”). ➔

← **Traditional economies of scale, scope and learning** Traditional economics goes some way towards explaining these companies' market dominance. In particular, most tech markets exhibit extreme economies of scale. Software and digital content have high fixed development costs but low to zero marginal (copying and online distribution) costs. Unit costs are therefore almost inversely proportional to sales volume, giving a big competitive advantage to the market leader. These economies of scale are reinforced by significant economies of scope and learning. For instance artificial intelligence (AI), cloud-based resources and Amazon's leading distribution systems support a wide range of diverse activities, and become ever more effective and efficient the more they are used.

Digital products are also "non-rivalrous" – unlike, say, pizzas, cars or haircuts, they can be used simultaneously by a limitless number of people.^{1,2} This often leads to business models based on advertising (free services, maximising reach) and/or continuing customer relationships rather than one-off sales.

Direct network effects In 1974, Jeffrey Rohlfs, an economist at Bell Laboratories, published a seminal paper, "A theory of interdependent demand for a communications service".³ AT&T, then parent of Bell Labs, was contemplating the possible launch of a video telephony service and Rohlfs was researching how this should be priced if it went ahead. His mathematical model was based on the key qualitative insight that "the utility that a subscriber derives from a communications service increases as others join the system", enabling each person to communicate with more others (although some adopters are more influential than others in driving network externalities).⁴

Economists call this effect a direct network externality, because it involves external third parties in addition to the individual firm and customer; the less technical term, "network effect", is also used. Most direct network effects are positive (revenue economies of scale) but they can be negative, as with congestion in transport and communications networks. There can also be both positive and negative behavioural direct network effects if other consumers' adoption of a product makes it either more, or less, acceptable, fashionable or attractive.

Indirect network effects ("multisided markets") Most tech companies are, at least to a degree, "platform" businesses, creating value by matching customers with complementary needs, such as software developers and users (Microsoft's Windows and Apple's App Store); publishers and book buyers (Amazon); drivers and potential passengers (Uber); and, in many cases including Google and Facebook, advertisers and consumers.

These network effects are called "indirect" because – unlike with the direct, single-market, externalities discussed above – the value to participants in each market (e.g. diners) depends on the number of participants in the other market (e.g. restaurants), and vice versa. Once a platform



Competition is for losers. If you want to create and capture lasting value, look to build a monopoly.

Peter Thiel, cofounder of PayPal and Palantir



or untrustworthy, e.g. posting malicious reviews on TripAdvisor or fake news on Facebook, or overstating the size and quality of their homes (or, conversely, throwing a noisy, late-night party as a guest) on Airbnb. Platforms often incorporate governance processes to limit these behaviours.⁵

The need to appeal to both buyers and sellers simultaneously has been known since the first organised markets. But there was no formal modelling of two-sided markets until the late 1990s, when Jean-Charles Rochet and Jean Tirole noted structural similarities between the business models of payment card businesses, telecoms networks and computer operating systems.⁶ All exhibited network effects under which the value of the service for one group (e.g. payment card users) depended on how many members of the other group (e.g. merchants) were in the system, and vice versa.

More recent work uses the term "multisided" – rather than two-sided – markets because some platforms facilitate interaction between more than two types of participant. For instance, Facebook connects six distinct groups: friends as message senders, friends as message receivers, advertisers, app developers, and businesses as both message senders and receivers.

Digital devices with compatible software, such as Microsoft's Xbox video games player, exhibit indirect network effects because each device's installed user base constitutes an addressable market for software developers, and the range and quality of software available for the device are key to its user appeal. Similarly, automated online marketplaces such as Amazon, Airbnb and Uber operate in multisided markets with indirect network effects.

All businesses that depend on indirect network effects face the chicken-and-egg challenge of achieving critical mass in both or all the key markets simultaneously. Until the business reaches this point, it will need to convince investors that early losses will be justified by its eventual dominance of a large and profitable multisided market. Most start-up tech businesses, such as Twitter, Uber, Snapchat and Pinterest are heavily loss-making for years and the casualty rate is high.

Achieving critical mass is easier if the product or service offers immediate benefits independent of network effects. For instance, at its 2007 launch, the iPhone already offered 2G mobile (voice, texts, email and web browsing) and music, with a market-leading touch-screen interface, driving rapid adoption. The App Store then created a virtuous circle of further adoption and app development.

dominates the relevant markets, these network effects become self-sustaining as users on each side help generate users on the other.

Most indirect network effects are, again, positive, although they too can be negative for behavioural reasons if some participants are antisocial

Hosting a large digital platform requires massive infrastructure – servers, data storage, machine learning, payment systems, etc. Most of these have marked economies of scale and scope, enabling the business to take on other markets and to rent out capacity to other firms, further increasing its efficiency and profitability. The pre-eminent example is Amazon – both in its logistics arm and its market-leading cloud computing business, Amazon Web Services (AWS). Google, too, sells cloud storage, machine learning, data analytics and other digital services that have grown out of, or complement, its core search business, while Microsoft is rapidly building up its cloud services business, Azure.

Big data and machine learning The internet enables tech companies to collect extensive, granular, real-time usage data at low cost. The resulting datasets are challenging for traditional software to process because of their size, complexity and lack of structure. But new data analytics techniques, increasingly automated (by machine learning), can use big data to drive relentless improvement in products, services, pricing, demand forecasting and advertising targeting. For instance, Netflix constantly analyses viewing and preference data to inform its content purchases and to automate its personalised recommendations.

The more detailed the data, the wider the range of transactions, the bigger the user sample and the greater the company’s cumulative analytics experience, the better: quantity drives quality. Data and machine learning therefore offer both cost and revenue economies of scale, scope and learning, encouraging digital businesses to offer free or subsidised additional services, at least initially, to capture more data.

The business benefits of big data are both tactical (continuous improvement) and strategic. These are interlinked: over time, continuous improvement can give the dominant provider an almost unassailable strategic advantage in service quality, customisation, message targeting and cost reduction. Subject to privacy regulations (recently loosened in the US), the data can also be sold to other, complementary companies, enabling them to obtain similar benefits. Finally, data can be analysed at a more aggregate level to provide strategic insight into market trends. An important example is access to aggregate data on the many start-up clients of AWS and other cloud companies, giving early intelligence on which are doing well and might be a competitive threat and/or investment opportunity.

Big data and machine learning can powerfully reinforce network effects, increasing the dominant companies’ returns to scale and helping to entrench incumbents and deter market entry. However, economic theory has not yet caught up with this. For instance, David Evans and Richard Schmalensee do not mention big data, analytics, algorithms or machine learning in their 2016 book on multisided markets.⁷ Another book from 2016 does list leveraging data as one of the ways in which platforms compete, but the discussion is barely two pages long and gives no references, reflecting the

lack of relevant economic research to date.⁵

There has been some broadly related work in a special issue of MIS Quarterly on the use of big data analytics in business intelligence,⁸ while its potential is explored in management⁹ and economics¹⁰ research, respectively. But overall, although data and machine learning are key drivers of the tech giants’ market and civic power, existing economic theory provides an insufficient framework for making this power accountable and regulating it to sustain effective competition.^{11,12} (See article on page 31 for more on this issue – Ed.)

These economic and technological drivers of market concentration (economies of scale, scope and learning; direct and indirect network effects; and big data and machine learning) are reinforced by a number of both demand-side and supply-side behavioural factors. On the demand side, there are two closely interrelated drivers of sustained market concentration: strong user brands and habitual usage; and switching costs and lock-in.

Strong user brands and habitual usage

In November 2017, advertising firm WPP ranked Google, Apple, Amazon, Microsoft and Facebook – in that order – as the five most valuable brands in the world, worth a total of just over a trillion dollars, nearly 30% of their \$3.6 trillion combined market capitalisation at that time. Digital products are “experience goods”: users need to try them and



Big data and machine learning can powerfully reinforce network effects.



learn about them – from their own or trusted others’ usage experience – to judge their quality. Well-known, trusted brands are essential in online markets to encourage trial and discourage switching to a competitor. Usage becomes habitual or even addictive, reinforcing the incumbents’ dominance: “Google” is now widely used as a verb.

Switching costs and lock-in All five companies – and most other tech companies – use multiple additional ways to lock users in by increasing the cost or effort of switching to a rival product or service. It takes time and effort to learn how to use unfamiliar systems and software. The greater the amount of such learning (“brand-specific consumer human capital”), the greater is the switching cost.¹³ Often, there are also technical incompatibility issues locking users into a particular company’s ecosystem or “walled garden”: for instance, apps bought on iOS cannot be carried over to an Android device. Similarly, users’ personal data archives may not be portable to another platform.

Some services’ utility also increases with use by allowing for customisation by the user (e.g. creating playlists on iTunes or Spotify) and/or the company (based on the individual’s usage data) or enabling the user to accrue, over time, a reputation or status (e.g. Amazon marketplace ratings) or to accumulate content they do not want to lose (e.g. Facebook message histories), all of which reinforces lock-in. ➔

◀ Turning to the supply side, there are three more behavioural factors further reinforcing the market leaders' sustained dominance of these markets: attractiveness to talent; powerful founders and a hard-driving corporate culture; and – often overlooked – economic geography.

Attractiveness to talent The brand valuations mentioned above relate to consumer brand equity – the brand associations in consumers' long-term memory that make them more likely to buy or use the brand in future. Tech giants also have significant employee brand equity, the equivalent in the talent market. This enables them to attract the best technical, managerial and commercial staff.

Powerful founders and hard-driving corporate culture All the tech giants have, or had, strong, hard-driving, hands-on founders such as Jeff Bezos, Steve Jobs and Mark Zuckerberg. Their corporate culture is epitomised by Intel cofounder Andy Grove's "Only the paranoid survive" and Facebook's former motto, "Move fast and break things". At Amazon, Bezos insists that every day is still treated as "Day one for the internet". This relentlessly active, innovative corporate culture is a significant strength, reinforcing the tech giants' continuing market dominance. Arguably, it also drives their hyper-aggressive tax and acquisition policies, further adding to their competitive advantage.

Geography – or "cluster economics" Finally, despite earlier expectations¹⁴ and the beliefs of many Brexit enthusiasts such as UK trade minister Liam Fox (who claimed that we are now entering a "post-geography trading world"), geography still matters. Innovation clusters like Silicon Valley, Hollywood and the City of London derive their strength from a potent combination of talent, social capital (informal networks and a shared culture), a range of support services, and infrastructure.¹⁵

Apple, Google (Alphabet) and Facebook are all located in Silicon Valley. Amazon and Microsoft are in Seattle, a 2 hour plane ride to the north. Seven of the other 14 tech firms in the global 100 most valuable public companies – Intel, Cisco, Oracle, Netflix, Nvidia, Adobe and PayPal – are also based in Silicon Valley, while Salesforce is in nearby San Francisco (the only other US firm on the list is New York-based IBM). Beyond the US, there are just four Asian companies (Tencent, Alibaba, Samsung and Taiwan Semiconductor) and one European (SAP) on the list. So, including the top five, 13 of the world's top 19 public tech companies are based in or near Silicon Valley. China has two, in different cities. No other country has more than one.

Silicon Valley is also the leading global cluster for tech start-ups. An analysis in late 2017 found that, of the top 50 global tech "unicorns" – companies founded after 2000 with a valuation over \$1bn – 21 were US-based and 16 of these were in Silicon Valley, including Uber, Airbnb and Palantir (big data analytics), ranked 1, 4 and 5. The other five were scattered around the US: even America has only one Silicon Valley.¹⁶

WILL THE MARKET END THE DIGITAL DOMINANCE?

Tech companies' exploit these factors as well as other classic sources of competitive advantage such as product quality and innovation, design (notably at Apple), brand extensions, and bundling.

Increasingly, they also operate in multiple product markets, often with products and services offered free or below cost as part of a wider strategy to protect and extend their core market dominance and capture more data. Examples include Amazon's Kindle and Google's Maps and Gmail. All this makes for a very powerful winner-takes-all cocktail.

David Evans and Richard Schmalensee partly dispute this view. They argue that "winner takes all thinking does not apply to the platform economy", at least for Google and Facebook, on the grounds that – although they dominate consumer search and social networking – in the advertising market they have to compete with each other and with other media.¹⁷

Google and Facebook do, of course, have to compete for advertising. But advertising media are not homogeneous: advertisers use different media

for different purposes.

Google completely dominates search advertising and Facebook has a dominant, and still growing, share of online, especially mobile, display advertising. Because marketing budgets are

finite, they do compete indirectly against each other and against other advertising media – and other ways of spending marketing money (promotions, loyalty schemes, etc.) – just as all consumer products and services indirectly compete for consumers' expenditure. But advertisers have no credible substitutes of comparable scale and reach as Google in search and Facebook in online display advertising. That they continue to use them despite the numerous problems (fraud, audience measurement, etc.) reflects this lack of choice.

It is hard to see another company any time soon overtaking Google in search, Microsoft in PC software or Amazon in e-commerce. Facebook's lead in social networking looks almost as strong, despite the potential for users to "multi-home" (i.e. use multiple social media) and its recent problems with audience measurement, Cambridge Analytica, etc. This bullish view is reflected in these companies' high P/E ratios, showing that the financial markets expect their earnings not only to withstand competitive pressures but to continue growing faster than the market average for the foreseeable future. Some of this expected future growth presumably relates to the perceived long-term potential of their non-core activities, perhaps especially in the case of Alphabet, but it is hard to see how these P/E ratios could be justified if their core businesses were seen as being under significant competitive threat.

Amazon's P/E of 140 also reflects its strategy of reinvesting most of its profit to achieve additional long-term growth. This leads to a double whammy:



Advertisers have no credible substitutes of comparable scale and reach for Google and Facebook.



artificially low short-term profits and high long-term growth expectations. Apple's lower P/E of 17 reflects its lower expected future growth rate as Samsung and other Android manufacturers gradually catch up with the quality and ease of use of its devices and ecosystem, boosted by the growing superiority of Google services such as Assistant, reflecting the high penetration of Android and Google's lead in AI. As Apple is increasingly forced to include Google's services in its ecosystem, its price premium over Android devices – the big driver of its high margins – is likely to be eroded.

Of course, whether – and if so, how soon – this happens will depend on Apple's continuing ability to come up with new, better products, content and services to reinforce its dominance of the market for premium-priced mobile devices. In the wider mass market for mobile devices, Android is already the global standard, accounting for 77.3% of smartphones shipped in the year to 30 June 2018, versus 19.4% for iOS, according to StatCounter. However, Apple has an outstanding track record in product quality, ease of use, design and branding. As the number of different types of device continues to proliferate – PCs (where Apple's share is growing), mobile, wearable and smart home devices, VR/AR, automotive, etc. – Apple may be able to keep exploiting its ability to integrate devices and services into a superior, seamless user experience at a premium price.

In contrast, Google, Microsoft and Amazon, like IBM before them, all fit the long-term pattern that dominant tech players are rarely displaced as market leaders in their core markets, because the winner-takes-all dynamics are so powerful. Facebook's position is almost as secure, reflected in a P/E of 26 even after its recent fall. Only Apple is in significant danger of seeing its margins squeezed by a gradual process of commoditisation.

COMPETITION BEYOND THE TECH GIANTS' CORE MARKETS

For all five companies, the question remains whether, in line with the pattern discussed in the introduction, they will be eclipsed (as opposed to displaced) by a rival – either another large established player or a start-up – becoming the dominant provider of a new, important product or service. Microsoft has already been surpassed by Apple, Amazon and Alphabet in terms of market capitalisation and all five companies are acutely aware of the potential threats – and opportunities – presented by new product markets and technologies.

Major product markets currently of interest – in addition to Amazon's 2017 move to transform grocery retailing by acquiring Whole Foods – are transport, home automation, entertainment, healthcare, business and professional processes, and a wide range of applications under the broad heading of IoT that will generate even more data – and further increase society's vulnerability to cyberattack. Key supporting technologies include AI, voice and visual image recognition, VR/AR, cloud-based services, payment systems and cybersecurity. All the tech giants are investing in



If any firm does overtake one of these firms in the next few years, it is likely also to be in or near Silicon Valley.



several of these, both organically and through acquisition. Their access to vast amounts of user data makes them well placed to spot trends early and their scale and profitability give them plenty of capacity to invest in and acquire new businesses and technologies.

The only national market of comparable scale to the US is China. Chinese retail e-commerce is booming, with an estimated value already more than double that in North America: \$1.15tr versus \$453bn in 2017, reports Digital Commerce 360. Chinese tech companies operate under tight government controls and a constant threat of having their activities curbed, but benefit from protection from foreign competition and a somewhat cavalier view of privacy, data security, corporate governance and intellectual property (not unlike the US in the 19th century), although IP protection may improve as they build up their own patent portfolios and brands.

China's "big four" tech companies are Tencent (mobile messaging and other content and services), Alibaba (e-commerce, digital entertainment and cloud), Baidu (search and AI) and Huawei (mobile devices). Reflecting broader differences in business culture, Chinese tech companies tend to be less focused than those based in the US, but the two are starting to converge as the top US tech groups diversify beyond their core businesses.¹⁸

We can expect to see more Chinese tech successes over the next 10 years, increasingly based on innovation as well as imitation and with growing international sales, in competition with the US players. However, their current activities are still largely focused on Greater China and there is no realistic prospect of their offering a major challenge to the US elsewhere in the next few years.

If any firm does overtake one of these companies in the next few years, it is more likely to be also based in or near Silicon Valley, for the reasons already discussed.

In conclusion, with the partial exception of Apple, the tech giants seem unlikely to lose their dominance of their core market(s) any time soon, although they all, to varying degrees, face competitive threats at the margin. They are at greater risk of being overtaken by another company building a dominant share of a new, bigger, market. If and when that happens, the successful rival – either another tech giant or a start-up – is also likely to be based in Silicon Valley.

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