OVERVIEW

Disruptive Innovation

There are two types of innovation: disruptive and incremental. We will argue that the types of innovation our opponents talk about from BIG companies are incremental approaches to disruptions, while small firms have the focus and the incentive to innovate. This matters because our O'Sullivan evidece in case explains, quote "innovation is a key driver of economic growth." American growth has been underpinned by disruptive innovations, such as Henry Ford's assembly line that revolutionized manufacturing, the advancement of the personal computer by Apple.

This is significant because in the 1980s, The government conducted a report called project Socrates, which analyzed what makes the American economy fundamentally strong. It found that the FOUNDATION of the American economy was disruptive innovation; "United States generate and lead the next evolutionary step in technology exploitation". The economist quantifies that disruptive technology has created tens of millions of jobs through the internet.
This means that the best way for us to address the issues our opponents bring up in case – research and international competition – is by maximizing disruptive innovation through small businesses.

Equitable Growth

We win
1. Innovation
2. Growth that everyone benefits from

Solon 17 Olivia Solon, 10-20-2017, "As tech companies get richer, is it 'game over' for startups?," Guardian, https://www.theguardian.com/technology/2017/oct/20/tech-startups-facebook-amazon-google-apple //DF

Pushing hard might not be enough when you're going up against some of the world's most powerful companies keen to cling to their empires. **Startups drive job creation and innovation, but the number of new business launches is at a 30-year low** and some economists, investors and entrepreneurs are pointing their fingers at big tech. For one thing, the deep pockets and resources of companies like Facebook, Google, Amazon and Apple – with a combined value of almost $2.5tn – make it increasingly difficult for startups to compete or attract investment. "People are not getting funded because Amazon might one day compete with them," said one founder, who wished to remain anonymous. "If it was startup versus startup, it would have been a fair fight, but startup versus Amazon and it's game over." Even multibillion-dollar startups like Snap, Snapchat's parent company, struggle to compete against these tech titans. Like Houseparty, Snap was nipping at the heels of Facebook. At first, Facebook played nicely, making an offer to buy Snapchat – a strategy that worked with Instagram and WhatsApp. When that failed, Facebook cloned all of Snapchat's features, awkwardly at first but relentlessly and with the resources of a $510bn company, until Snap's potential slice of the advertising market shriveled to a sliver. While there's a clear correlation, it's hard to say for sure whether concentration of money is the cause

or effect of the startup decline. On one hand, the existence of fewer new startups makes it easier for incumbent firms to accumulate more power. However, as industries become more concentrated, it also raises the barriers to new entrepreneurship, choking off innovation elsewhere in the marketplace. "They are financing the next generation research at a scale that no one else can afford," said Tomasz Tunguz, a venture capitalist, citing Google's experimental projects Loon (balloon-powered internet), Fiber (high-speed internet) and Waymo (self-driving cars). "They are playing in big markets, making big bets. Historically, that's been the domain of startups." **As those companies get more powerful and staff salaries get higher, there's even less of an incentive for workers to leave and set up on their own, which used to be a common pathway for entrepreneurs.** If they do leave, the endgame is often to be acquired by their previous employer rather than grow large enough to compete with it. "If your strategy from the outset is to be acquired by Google, that's just fueling consolidation," said Ian Hathaway, an economist at the Brookings Institution. Jonathan Frankel was thrilled when Amazon's investment arm funneled $5.6m into his startup Nucleus after a year of discussions. He was less thrilled when, a year later, Amazon launched its latest voice-controlled device, the Echo Show: an almost perfect clone of the Nucleus product. Nucleus was an Alexa-powered tablet computer that focused on video conferencing and communication, with a plan – that Amazon's investment arm would have seen – to move into other areas. When the Echo Show launched, it too focused on communication, the core of Nucleus's vision, instead of other key features like e-commerce or connected home elements. Frankel, who declined to comment for this piece, was furious, telling Recode earlier this year: "Their thesis is what our thesis was: communication is that Trojan horse to get those devices throughout the home and throughout the extended family's home. "The difference is, they want to sell more detergent; we actually want to help families communicate easier." These kinds of tactics have rattled investors, some founders said, making it harder for startups to raise money even if they're in an adjacent market – particularly those skirting Amazon and Facebook. A venture capitalist confirms this, describing Amazon's launch of an almost identical product as a "very, very strange coincidence". "At the end of the day, Amazon could be theoretically in nearly any consumer business in the world," he said, adding that he was frequently in meetings where investment decisions are informed by the question: "Can Amazon do that?" "Amazon can do anything," he noted. 'From heroes to villains': tech industry faces bipartisan backlash in Washington Read more It's not just a problem within the tech industry. Since 1980, the share of companies less than a year old has almost halved – from 15% of companies to just 8.1%, according to Census Bureau data. The total number of startups formed in 2015 (the last year surveyed) was 414,000 – a huge drop from the pre-recession figure of 558,000 in 2006. "It's been a persistent and fairly precipitous decline," said John Dearie, the founder of the Center for American Entrepreneurship, an organization set up to address the decline. "The reason why this is so troubling is that **new businesses account for virtually all new job creation and account disproportionately for disruptive innovations." "It's not a coincidence that at a time when the startup rate is in a long-term decline, the economy has not grown at 3% or better**," said Dearie. "We are in a growth emergency."

The death of startups at the hands of tech monopolies kills job growth. Paula Dweyer writes in Bloomberg in 2017: prestigious technology brands, using the internet's global reach, are able to push out rivals and become winner-take-all "superstar" companies. They're highly profitable, and their lucky employees generally earn higher salaries to boot. However, these companies employ far fewer people than the largest companies of decades past while taking a disproportionate share of national profits. As they grow and occupy a bigger part of the economy, median wages stagnate and labor's share of gross domestic product declines. Labor's shrinking share of output is widely implicated in the broader economic growth slowdown.

Dweyer 17 Paula Dweyer, 7-20-2017, "Should America's Tech Giants be Broken Up?" Bloomberg, https://www.bloomberg.com/news/articles/2017-07-20/should-america-s-tech-giants-be-broken-up

He has a point, judging by market-research figures. Alphabet Inc.'s Google gets about 77 percent of U.S. search advertising revenue. Google and Facebook Inc. together control about 56 percent of the mobile ad market. Amazon takes about 70 percent of all e-book sales and 30 percent of all U.S. e-commerce. Taplin pegs Facebook's share of mobile social media traffic, including the company's WhatsApp, Messenger, and Instagram

units, at 75 percent. Economists have noticed these monopoly-size numbers and drawn even bigger conclusions: They see market concentration as the culprit behind some of the U.S. economy's most persistent ailments—the decline of workers' share of national income, the rise of inequality, the decrease in business startups, the dearth of job creation, and the fall in research and development spending. Can Big Tech really be behind all that? Economists are starting to provide the evidence. David Autor, the MIT economics professor who famously showed the pernicious effects of free-trade deals on Midwestern communities, is one. A recent paper he co-wrote argues that **prestigious technology brands, using the internet's global reach, are able to push out rivals and become winner-take-all "superstar" companies. They're highly profitable, and their lucky employees generally earn higher salaries to boot.** They don't engage in the predatory behavior of yore, such as selling goods below the cost of production to steal market share and cripple competitors. After all, the services that Facebook and Google offer are free (if you don't consider giving up your personal data and privacy rights to be a cost). However, academics have documented how **these companies employ far fewer people than the largest companies of decades past while taking a disproportionate share of national profits. As they grow and occupy a bigger part of the economy, median wages stagnate and labor's share of gross domestic product declines. Labor's shrinking share of output is widely implicated in the broader economic growth slowdown.** Still others have shown that, as markets become more concentrated and established companies more powerful, the ability of startups to succeed declines. Since half of all new jobs spring from successful startups, this dampens job creation. It's no wonder the superstar companies are getting supernormal returns on capital, further adding to income inequality, writes Peter Orszag in Bloomberg View. He and Jason Furman, chairman of President Barack Obama's Council of Economic Advisers, point out that higher returns on capital haven't resulted in increases in business investment—yet another manifestation of monopoly power.

The destruction of jobs by tech giants is significant. Scott Galloway, professor at the NYU Stern School of Business, estimates that Facebook and Google added $29 billion in revenue in 2017. That $29 billion in revenue translates to nearly 200,000 people losing their jobs.

Galloway 18 Scott Galloway [professor at New York University's Stern School of Business, where he teaches brand strategy and digital marketing to second-year MBA students. A serial entrepreneur, he has founded nine firms, including L2, Red Envelope, and Prophet. In 2012, he was named one of the "World's 50 Best Business School Professors" by Poets & Quants. His weekly Youtube series, Winners and Losers, has generated tens of millions of views], 2-8-2018, "Why Amazon, Apple, Facebook, and Google Need to Be Disrupted," Esquire, https://www.esquire.com/news-politics/a15895746/bust-big-tech-silicon-valley/ //DF

Apple is hardly alone. General Electric also engages in massive tax avoidance, but we're not as angry about it, as we aren't in love with GE. The fault here lies with us, and with our democratically elected government. We need to simplify the tax code—complex rules tend to favor those who can afford to take advantage of them—and we need to elect officials who will enforce it. **The destruction of jobs by the Four is significant, even frightening. Facebook and Google** likely **added $29 billion in revenue in 2017**. To execute and service this additional business, they will create twenty thousand new, high-paying jobs. The other side of the coin is less shiny. Advertising—whether digital or analog—is a low-growth (increasingly flat) business, meaning that the sector is largely zero-sum. Google doesn't earn an extra dollar by growing the market; it takes a dollar from another firm. If we use the five largest media-services firms (WPP, Omnicom, Publicis, IPG, and Dentsu) as a proxy for their industry, we can estimate **that $29 billion in revenue** would have required about 219,000 traditional advertising professionals to service. **That translates to 199,000** creative directors, copywriters, and agency executives deciding to "spend more time with their families" each year—nearly four Yankee Stadiums filled with people dressed in black holding pink slips. The economic success stories of yesterday employed many more people than the firms that

dominate the headlines today. Procter & Gamble, after a run-up in its stock price in 2017, has a market capitalization of $233 billion and employs ninety-five thousand people, or $2.4 million per employee. Intel, a new-economy firm that could be more efficient with its capital, enjoys a market cap of $209 billion and employs 102,000 people, or $2.1 million per employee. Meanwhile, Facebook, which was founded fourteen years ago, boasts a $542 billion market cap and employs only twenty-three thousand people, or $23.4 million per employee—ten times that of P&G and Intel.

BLOCKS

R/T Chinese Competition

R/T Artificial Intelligence

1. Big tech will always lose to China with data because they can collect so much more

Davenport 19 Thomas H. Davenport [professor of information technology and management at Babson College and the author of "The AI Advantage: How to Put the Artificial Intelligence Revolution to Work."], 3-7-2019, "China is overtaking the U.S. as the leader in artificial intelligence," MarketWatch, https://www.marketwatch.com/story/china-is-overtaking-the-us-as-the-leader-in-artificial-intelligence-2019-02-27 //DF

Another element in long-term AI success is how particular regions build mutually reinforcing communities of companies, university ecosystems and government agencies. Silicon Valley is the world leader in this regard, and China doesn't have anything to match it yet. Both the U.S. and China could learn from efforts in Canada, such as the work by the Montreal Institute for Learning Algorithms, which has offered companies access to facilities, venture capital and university research partnerships to accelerate AI development in that city. A final key element in AI progress is data: **The more data a country's companies have, the better able they are to develop capable AI systems.** Chinese online firms have massive amounts of consumer data on which to train machine learning algorithms. **Because of its very large number of inhabitants, the population's heavy use of digital services and its lax regulatory environment, China clearly beats the U.S. on data.** I still think the U.S. has the edge over China in AI capabilities at the moment. However, as much as I would like the U.S. to win this race over the long run, if I were a betting man I would bet on China. As I describe in my new book "The AI Advantage," China is executing its strategy for AI, and the U.S. is still wrestling to create one. China is also reaping the benefits of having a determined government, an inexhaustible pot of money, a growing cadre of smart researchers and a large, digital-hungry population.

2. Reams of data aren't useful for the type of targeted AI that we want to create.

Watney 18 Caleb Watney [technology policy fellow at the R Street Institute, where he leads the organization's work on emerging technologies, including autonomous vehicles, artificial intelligence, drones and robotics. He received his master's degree in economics from George Mason University], 10-2018, "REDUCING ENTRY BARRIERS IN THE DEVELOPMENT AND APPLICATION OF AI," R Street, https://2o9ub0417chl2lg6m43em6psi2i-wpengine.netdna-ssl.com/wp-content/uploads/2018/10/Final-No.-153-.pdf //DF

This is not inherently an issue, as these large technology companies have invested billions of dollars to create services that provide significant value for consumers and in return, consumers have shown a willingness to contribute their data.27 We should aspire for other companies to create services that prove to create as much value for consumers. However, it is undoubtedly an advantage in particular domains of AI work that startups are currently unable to replicate.28 We should be careful to note, however, that **beyond a certain threshold,**

increases in the sheer volume of data possessed generate decreasing returns to scale.29 This means that while possessing high-quality data is vital for performance, simply having more data than a competitor is no guarantee of victory.30 In fact, we are seeing that the role of sophisticated algorithmic design and ML feedback loops is only increasing.31 **Sometimes a smaller competitor with an adequate dataset and insightful algorithmic design can outperform an incumbent with a superior dataset but mediocre design**. Given all this, we can potentially create high-leverage opportunities for startups to compete against established firms if we can increase the supply of high-quality datasets available to the public. As with increasing the supply of AI talent, this will help both incumbents and startups but on the margin, it will be the smaller firms with less access to consumer data who benefit most.

Even a broken-up Facebook would have more than enough wealth and data to build AI; breaking up these companies that are too big will enable competition that will put the US ahead of China, just like what happened in the 1970s with Japan

Perriello 19 Tom Perriello [formerly represented Virginia's 5th District in the U.S. House, is executive director of Open Society-U.S. at the Open Society Foundations],, 6-17-2019, "Don't worry about China when breaking up Facebook," TheHill, https://thehill.com/blogs/congress-blog/politics/448834-dont-worry-about-china-when-breaking-up-facebook //DF

Washington took a big step forward last week in the battle to break up Big Tech. The House Judiciary Committee launched a sweeping antitrust probe of the major players, and key regulatory agencies have sort out jurisdictional questions, preparing to follow suit. It was a hopeful sign that the federal government may at last be prepared to do something to rein in the immense power of social media platforms, and the impacts—seen and as yet unseen—they play in buying, selling, and shaping data affecting all aspects of our lives. As these arguments gain momentum among thought leaders and economists across the political spectrum, including a co-founder and original investor in Facebook, the company has battled back. I've been talking to people on Capitol Hill, and a number of them seem to have bought into Big Tech's latest scare tactic: China. Over the past few weeks, such tech company executives as Sheryl Sandberg of Facebook and Eric Schmidt of Alphabet have trotted out a nationalist line to protect their corporate interests. You can't break us up, the argument goes, because Chinese companies will take over. They make two arguments. The first claims that increased competition in the United States tech industry would open up space for Chinese companies like Alibaba or Tikor to infiltrate our markets. A level playing field allowing Chinese companies access to U.S. markets could hurt American interests. Secondly, breaking up the U.S. tech giants could imperil America's place in the race to develop the most advanced artificial intelligence (AI). Because AI depends on vast amounts of data and computing power to "learn," smaller tech companies in the United States wouldn't have the same vast datasets or computing resources to compete with large Chinese competitors, the argument goes. Both of these arguments are red herrings, cynically setting up alternative futures, designed to create a culture of fear and intimidate people into defending the status quo power of Big Tech. **We heard similar arguments decades ago from executives at IBM and AT&T facing antitrust scrutiny in the 1980s. In that case, the competition was Japan and its state-supported computer monopoly that threatened to take over U.S. challengers.** Federal regulators didn't buy the arguments then, and they moved to break up IBM and later Microsoft. Neither suit ended in a full break-up, but the litigation caused both companies to open their platforms to encourage more competition.) **In the end, Japan's monopolistic market fell behind, and the United States, with its culture of competition, raced ahead.** There is little reason to believe American consumers will race to use a Chinese-based social network. No Chinese Internet company has ever made any meaningful entrance into the American consumer market, even in earlier periods when competition was more robust. Even if they did, it would encourage the American companies to compete in turn and improve their own service offerings. "This is a classic straw man argument," says Facebook co-founder Chris Hughes. "Breaking up Facebook would not hamstring its ability to compete, or allow China to walk all over us. In fact, a more level playing field would drive new and innovative investment. A post-breakup Facebook would still be massively profitable, with plenty of resources to make such investments. And the federal government could respond to any Chinese intervention using the same tools of trade, tariffs and incentives it has used on other fronts." "This is a classic straw man argument," says Facebook co-founder Chris Hughes. "Breaking up Facebook would not hamstring its ability to compete, or allow China to walk all over us. In fact, a more level playing field would drive new and innovative investment. A post-breakup Facebook would still be massively profitable, with

plenty of resources to make such investments. And the federal government could respond to any Chinese intervention using the same tools of trade, tariffs and incentives it has used on other fronts." Similarly, **while it is true that artificial intelligence relies on vast amounts of data and computing power, Big Tech firms that have been broken up would still have plenty of both. In Facebook's case, hundreds of millions of Americans use Facebook's core product**, Facebook.com, and even in a break-up scenario, it would be worth hundreds of billions of dollars. (Indeed, many see this as a weakness in the break-up arguments.) **Facebook's revenues alone would still be in the tens of billions of dollars, making it one of the largest companies in the world and giving it more than enough resources to power AI research.** From a civil society perspective, it's concerning that even a post-breakup Facebook would still be a dominant force in the research and development of AI. But the argument that breaking up the company would dramatically impair its impact on AI doesn't hold water. The irony of the China defense is that it is a form of admitting the crime. Facebook once claimed that anti-trust wasn't needed because they don't share data across their platforms. Now, they are saying they can't be split up because their business advantage comes precisely from aggregating data across all platforms. Arguing for monopoly protection here is like companies claiming the Foreign Corrupt Practices Act undermines the ability of U.S. companies to compete. Reasonable regulation can protect consumers while allowing healthy competition to flourish.

DA: Competition will result in products that serve consumers better

Wright 18 Robert Wright, 2-23-2018, "Why We Can't Let Google Monopolize AI," WIRED, https://www.wired.com/story/google-artificial-intelligence-monopoly/ //DF

Even during the next few years, when digital assistants will barely qualify as intelligent, they'll shape more and more of a person's information flow, subtly influencing shopping, lifestyle choices, even political views. And these assistants will know more and more about us, compiling deeply revealing databases that sit on the server of some company that may or may not keep them safe from hackers, that may or may not resist government nosiness. There's no single fix for these and other such concerns, but the least we can do is make sure people have the option of choosing from among several AI providers. **Companies that compete for our business are more likely to address our concerns—to guard our data closely, to be transparent about the algorithms that guide us, to give us the option of trading off convenience for privacy**, and to avoid various kinds of dubious backroom behavior that, if exposed, would help their rivals. I don't know exactly what forms of creepiness AI will bring as it evolves, but I'd like the option of choosing less creepy over more. Today the key arena of competition for eventual AI dominance is the voice assistant—Google Assistant, Amazon's Alexa, Apple's Siri, Microsoft's Cortana.

Non unique: China has advantages over the US that will win it the AI war

1. A determined government

Davenport 19 Thomas H. Davenport [professor of information technology and management at Babson College and the author of "The AI Advantage: How to Put the Artificial Intelligence Revolution to Work."], 3-7-2019, "China is overtaking the U.S. as the leader in artificial intelligence," MarketWatch, https://www.marketwatch.com/story/china-is-overtaking-the-us-as-the-leader-in-artificial-intelligence-2019-02-27 //DF

Researchers, companies and countries around the world are racing to explore — and exploit — the possibilities of artificial intelligence technology. China is working on an extremely aggressive multi-billion-dollar plan for government investment into AI research and applications. The U.S. government has been slower to act. **The Obama administration issued a report on AI near the end of its term. Since then, little has happened** — until a

Feb. 11 **executive order from President Donald Trump encouraging the country to do more with AI**. The executive order has several parts, including directing federal agencies to invest in AI and train workers "in AI-relevant skills," making federal data and computing resources available to AI researchers and telling the National Institute of Standards and Technology to create standards for AI systems that are reliable and work well together. These are all good ideas, but they **lack funding and bureaucratic structure.** So after researching how large organizations use AI for the past five years, in my view the executive order alone is not likely to transform the American approach to AI. Government spending China is doing far more than talking about AI. In 2017, the country's national government announced it wanted to make the country and its industries world leaders in AI technologies by 2030. The **[China's] government's latest venture capital fund is expected to invest more than $30 billion in AI and related technologies within state-owned firms**, and that fund joins even larger state-funded VC funds. One Chinese state alone has said it will devote $5 billion to developing AI technologies and businesses. The city of Beijing has committed $2 billion to developing an AI-focused industrial park. A major port, Tianjin, plans to invest $16 billion in its local AI industry. These government programs will support ambitious major projects, startups and academic research in AI. The national effort also includes using AI in China's defense and intelligence industries; the country's leaders are not reluctant to use AI for social and political control. For example, both AI-driven facial recognition, even to catch jaywalkers, and "social credit" — an AI-driven credit score that factors in social behaviors — are already in use. U.S. investment plans, mostly in the defense industry, are dwarfed by the Chinese effort. DARPA, the Defense Department's research arm, has sponsored AI research and competitions for many years, and has a $2 billion fund called "AI Next" to help develop the next wave of AI technologies in universities and companies. It's not yet clear how much real progress its efforts have made. Private-sector contributions The U.S. has a strong private-sector effort in this technology. There are, for instance, many more AI firms in the U.S. than in China. Private-sector contributions The U.S. has a strong private-sector effort in this technology. There are, for instance, many more AI firms in the U.S. than in China. American investment appears strong, too. In 2015, for example, the combined research and development spending at the U.S.-headquartered companies Google GOOG, -1.28% GOOGL, -1.33% Apple AAPL, -1.81% , Facebook FB, -3.03% IBM IBM, -1.99% Microsoft MSFT, -1.63% and Amazon AMZN, -2.27% was $54 billion. Much of that spending went toward AI research, but some of the work actually happened in China and elsewhere outside the U.S. That work has been used to personalize ads, improve search results, recognize and label faces and generally make products smarter. In China, the private sector is much more closely tied to government plans than in the U.S. The Chinese government has asked four large AI-oriented firms in China — Baidu BIDU, -1.63% Tencent 700, +0.49% TCEHY, +0.41% Alibaba BABA, -1.20% and iFlytek 002230, +0.59% — to develop AI hardware and software systems to handle autonomous driving and language processing, so other companies could build on those skills. China may have also surpassed the American historic advantage in venture capital investments. In 2018, U.S. AI startups received $9.3 billion in venture funding — a record amount, but the number of deals was down from 2017. However, one report from China suggests that in the first half of 2018, Chinese venture investments — many of which involved AI — were higher than in the U.S. Data from 2017 suggest that Chinese AI firms received more venture funding than U.S. companies, although the American funding went to many more firms. Beyond investment money There are other factors than investment that determine a country's long-term competitiveness on AI. Talent is an important one. The U.S. had a historical edge in this regard, with strong technical universities, many technology sector employers and relatively open immigration policies. A recent analysis of LinkedIn data suggests the U.S. has far more AI engineers than China does. But China is closing the gap rapidly, with a variety of education and training programs beginning as early as elementary school. The Trump administration's restrictions on immigration are encouraging some of the world's best AI researchers to stay home, rather than come to the U.S. Read: Telemigrants are coming for your white-collar job, and a wall won't stop them Another element in long-term AI success is how particular regions build mutually reinforcing communities of companies, university ecosystems and government agencies. Silicon Valley is the world leader in this regard, and China doesn't have anything to match it yet. Both the U.S. and China could learn from efforts in Canada, such as the work by the Montreal Institute for Learning Algorithms, which has offered companies access to facilities, venture capital and university research partnerships to accelerate AI development in that city. A final key element in AI progress is data: The more data a country's companies have, the better able they are to develop capable AI systems. Chinese online firms have massive amounts of consumer data on which to train machine learning algorithms. Because of its very large number of inhabitants, the population's heavy use of digital services and its lax regulatory environment, China clearly beats the U.S. on data. I still think the U.S. has the edge over China in AI capabilities at the moment. However, as much as I would like the U.S. to win this race over the long run, if I were a betting man I would bet on China. As I describe in my new book "The AI Advantage," **China is executing its strategy for AI, and the U.S. is still wrestling to create one. China is** also **reaping the benefits of having a determined government**, an inexhaustible pot of money, a growing cadre of smart researchers and a large, digital-hungry population. Perhaps if the leadership of the U.S. government devoted as much attention and investment to AI as it does to its other strong priorities, the U.S. could maintain its lead in the field. That seems unlikely over the next couple of years, however.

2. China's government supports its companies and compels them to develop AI

Thompson and Bremmer 18 Nicholas Thompson [editor in chief of WIRED] and Ian Bremmer [political scientist and president of the Eurasia Group], 10-23-2018, "The AI Cold War That Threatens Us All," WIRED, https://www.wired.com/story/ai-cold-war-china-could-doom-us-all/ //DF

And these benefits may compound with interest. So far, at least, AI appears to be a centralizing force, among companies and among nations. The more data you gather, the better the systems you can build; and better systems allow you to collect more data. "AI will become concentrated, because of the inputs required to pull it off. You need a lot of data and you need a lot of computing power," says Tim Hwang, who leads the Harvard-MIT Ethics and Governance of AI Initiative. The Chinese government can access personal data for reasons of public or national security without the same legal constraints a democracy would face. China has two fundamental advantages over the US in building a robust AI infrastructure, and they're both, generally, advantages that authoritarian states have over democratic ones. The first is the sheer scope of the data generated by Chinese tech giants. Think of how much data Facebook collects from its users and how that data powers the company's algorithms; now consider that Tencent's popular WeChat app is basically like Facebook, Twitter, and your online bank account all rolled into one. China has roughly three times as many mobile phone users as the US, and those phone users spend nearly 50 times as much via mobile payments. China is, as The Economist first put it, the Saudi Arabia of data. Data privacy protections are on the rise in China, but they are still weaker than those in the US and much weaker than those in Europe, allowing data aggregators a freer hand in what they can do with what they collect. And the government can access personal data for reasons of public or national security without the same legal constraints a democracy would face. Of course, data isn't everything: Any technological system depends on a whole stack of tools, from its software to its processors to the humans who curate noisy inputs and analyze results. And there are promising subfields of AI, such as reinforcement learning, that generate their own data from scratch, using lots of computing power. Still, China has a second big advantage as we move into the era of AI, and that's the relationship between its largest companies and the state. **In China, the private-sector companies at the cutting edge of AI innovation feel obliged to keep Xi's priorities in mind.** Under Xi, Communist Party committees within companies have expanded. **Last November, China tapped Baidu, Alibaba, Tencent**, and iFlytek, a Chinese voice-recognition software company, **as the inaugural members of its "AI National Team." The message was clear: Go forth, invest, and the government will ensure that your breakthroughs have a market not just in China, but beyond. During the** original **Cold War, the US relied on companies like Lockheed, Northrop, and Raytheon to develop cutting-edge strategic technology.** Technically, these companies were privately owned. In practice, their vital defense mission made them quasipublic entities. (Indeed, long before the phrase "too big to fail" was ever used to describe a bank, it was applied to Lockheed.) **Fast forward to today, and the companies at the forefront of AI—Google, Facebook, Amazon, Apple, and Microsoft—don't exactly wear flag pins on their lapels.** This past spring, employees at Google demanded that the company pull out of a Pentagon collaboration called Project Maven. The idea was to use AI for image recognition in Defense Department missions. Ultimately, Google's management caved. Defense Department officials were bitterly disappointed, especially given that Google has a number of partnerships with Chinese technology companies. "It is ironic to be working with Chinese companies as though that is not a direct channel to the Chinese military," says former secretary of defense Ashton Carter, "and not to be willing to operate with the US military, which is far more transparent and which reflects the values of our society. We're imperfect for sure, but we're not a dictatorship."

3. A growing cadre of talent

Davenport 19 Thomas H. Davenport [professor of information technology and management at Babson College and the author of "The AI Advantage: How to Put the Artificial Intelligence Revolution to Work."], 3-7-2019, "China is overtaking the U.S. as the leader in artificial intelligence," MarketWatch, https://www.marketwatch.com/story/china-is-overtaking-the-us-as-the-leader-in-artificial-intelligence-2019-02-27 //DF

Beyond investment money There are other factors than investment that determine a country's long-term competitiveness on AI. Talent is an important one. The U.S. had a historical edge in this regard, with strong technical universities, many technology sector employers and relatively open immigration policies. A recent analysis of LinkedIn data suggests the U.S. has far more AI engineers than China does. But **China is closing the gap rapidly, with a variety of education and training programs beginning as early as elementary school. The Trump administration's restrictions on immigration are encouraging some of the world's best AI researchers to stay home, rather than come to the U.S.** Read: Telemigrants are coming for your white-collar job, and a wall won't stop them Another element in long-term AI success is how particular regions build mutually reinforcing communities of companies, university ecosystems and government agencies. Silicon Valley is the world leader in this regard, and China doesn't have anything to match it yet. Both the U.S. and China could learn from efforts in Canada, such as the work by the Montreal Institute for Learning Algorithms, which has offered companies access to facilities, venture capital and university research partnerships to accelerate AI development in that city.

5. China looks like a better route for developing nations to build their tech than the US

Thompson and Bremmer 18 Nicholas Thompson [editor in chief of WIRED] and Ian Bremmer [political scientist and president of the Eurasia Group], 10-23-2018, "The AI Cold War That Threatens Us All," WIRED, https://www.wired.com/story/ai-cold-war-china-could-doom-us-all/ //DF

IMAGINE IT'S 2022: America's confrontational economic policies have continued, and China has refused to yield. Huawei and ZTE have been banned from the networks of the US and key Western allies. Through investment and theft, Beijing has reduced its reliance on US semiconductors. Rival tech superpowers have failed to develop common standards. US and Chinese academics increasingly deposit their cutting-edge AI research in government safes instead of sharing it at international conferences. Other countries—like France and Russia—have tried to build homegrown technology industries centered on AI, but they lag far behind. The world's nations can commit to American technology: buying Apple phones, using Google search, driving Teslas, and managing a fleet of personal robots made by a startup in Seattle. Or they can commit to China: using the equivalents built by Alibaba and Tencent, connecting through the 5G network constructed by Huawei and ZTE, and driving autonomous cars built by Baidu. The choice is a fraught one. **If you are a poor country that lacks the capacity to build your own data network, you're going to feel loyalty to whoever helps lay the pipes at low cost.** It will all seem uncomfortably close to the arms and security pacts that defined the Cold War. And we may be seeing the first evidence of this. **In May 2018**, about six months after **Zimbabwe** finally got rid of the despot Robert Mugabe, the new government announced that it was **[is] partnering with a Chinese company** called CloudWalk **to build an AI and facial-recognition system.** Zimbabwe gets to expand its surveillance state. China gets money, influence, and data. In July, nearly 700 dignitaries from China and Pakistan gathered in Islamabad to celebrate the completion of the Pak-China Optical Fibre Cable, a 500-mile-long data line connecting the two countries through the Karakoram Mountains, built by Huawei and financed with a loan from China's Export-Import Bank. Documents obtained by Pakistan's Dawn newspaper revealed a future plan for high-speed fiber to help wire up cities across Pakistan with surveillance cameras and vehicle-monitoring systems, part of a "Safe Cities" initiative launched in 2016 with help from Huawei and other Chinese firms. China has effectively constructed its own Marshall Plan, one that may, in some cases, build surveillance states instead of democracies. **It's not hard to see the appeal for much of the world of hitching their future to China. Today, as the West grapples with stagnant wage growth and declining trust in core institutions, more Chinese people live in cities, work in middle-class jobs, drive cars, and take vacations than ever before.** China's plans for a tech-driven, privacy-invading social credit system may sound dystopian to Western ears, but it hasn't raised much protest there. In a recent survey by the public relations consultancy Edelman, 84 percent of Chinese respondents said they had trust in their government. In the US, only a third of people felt that way.

China is producing better and better quality research and will soon overtake the US in number of high-quality papers

Vincent 19 James Vincent, 3-14-2019, "China is about to overtake America in AI research," Verge, https://www.theverge.com/2019/3/14/18265230/china-is-about-to-overtake-america-in-ai-research //DF

In July 2017, China's government published an ambitious policy paper, outlining how the country would become the world leader in AI by the year 2030. But by some measures China has already succeeded in this goal — a decade ahead of schedule. A new study shows that **China's output of influential AI research papers will soon overtake that of the US**, the world's current number one in AI research. **The finding suggests that China's plan to expand its AI capabilities with the help of generous government investment in both educational facilities and private industry is paying off**. In terms of sheer volume of AI papers published each year, China surpassed America back in 2006, but critics have pointed out that quantity does not necessarily equal quality. China has well-documented problems with scientific fraud, and in AI there is a stereotype of Chinese research as incremental. For these reasons, some have suggested that counting the sheer number of papers is not necessarily a meaningful metric for AI achievement. "THE QUALITY OF CHINESE PAPERS IS HIGH AND GETTING HIGHER." But new research from the Seattle-based Allen Institute for Artificial Intelligence (AI2) accounts for this by measuring not just the number of papers, but how often they are cited, a good shorthand measure for influence in the wider community. After analyzing more than two million AI papers published up until the end of 2018, the Allen Institute found that China is "poised to overtake the US in the most-cited 50 percent of papers this year, in the most-cited 10 percent of papers next year, and in the 1 percent of most-cited papers by 2025." The researchers found that America's share of the most-cited 10 percent of papers declined from a high of 47 percent in 1982 to a low of 29 percent in 2018. China's share, meanwhile, has been "rising steeply," reaching a high of 26.5 percent last year. Two graphs from AI2 showing China and America's share of top 10 percent and top 1 percent of most-cited papers. Credit: Allen Institute for Artificial Intelligence Oren Etzioni, a professor of computer science and CEO of the Allen Institute, told The Verge that this research "refutes" the stereotype of Chinese contribution to AI as incremental. "Clearly, the quality of Chinese papers is high and getting higher," said Etzioni over email. "Of course, one might argue that citation statistics could be influenced by more Chinese scientists citing each other, but if you look at the list of Best Paper Awards you'll see several Chinese entries there which represents the absolute cream of the crop."

R/T Americans use Chinese tech

Americans have never used Chinese tech and won't

Perriello 19 Tom Perriello [formerly represented Virginia's 5th District in the U.S. House, is executive director of Open Society-U.S. at the Open Society Foundations],, 6-17-2019, "Don't worry about China when breaking up Facebook," TheHill, https://thehill.com/blogs/congress-blog/politics/448834-dont-worry-about-china-when-breaking-up-facebook //DF

They make two arguments. The first claims that increased competition in the United States tech industry would open up space for Chinese companies like Alibaba or Tikor to infiltrate our markets. A level playing field allowing Chinese companies access to U.S. markets could hurt American interests. Secondly, breaking up the U.S. tech giants could imperil America's place in the race to develop the most advanced artificial intelligence (AI). Because AI depends on vast amounts of data and computing power to "learn," smaller tech companies in the United States wouldn't have the same vast datasets or computing resources to compete with large Chinese competitors, the argument goes. Both of these arguments are red herrings, cynically setting up alternative futures, designed to create a culture of fear and intimidate people into defending the status quo power of Big Tech. We heard similar arguments decades ago from executives at IBM and AT&T facing antitrust scrutiny in the 1980s. In that case, the competition was Japan and its state-supported computer monopoly that threatened to take over U.S. challengers. Federal regulators didn't buy the arguments then, and they moved to break up IBM and later Microsoft. Neither suit ended in a full break-up, but the litigation caused both companies to open their platforms to encourage more

competition.) In the end, Japan's monopolistic market fell behind, and the United States, with its culture of competition, raced ahead. **There is little reason to believe American consumers will race to use a Chinese-based social network. No Chinese Internet company has ever made any meaningful entrance into the American consumer market**, even in earlier periods when competition was more robust. **Even if they did, it would encourage the American companies to compete in turn and improve their own service offerings.** "This is a classic straw man argument," says Facebook co-founder Chris Hughes. "Breaking up Facebook would not hamstring its ability to compete, or allow China to walk all over us. In fact, a more level playing field would drive new and innovative investment. A post-breakup Facebook would still be massively profitable, with plenty of resources to make such investments. And the federal government could respond to any Chinese intervention using the same tools of trade, tariffs and incentives it has used on other fronts."

R/T Loon

Startups are producing better alternatives to this and much more quickly

Sheetz 19 Michael Sheetz, 2-27-2019, "OneWeb launches first satellites as global internet race with SpaceX and Boeing heats up," CNBC, https://www.cnbc.com/2019/02/27/oneweb-launches-first-satellites-as-global-internet-race-with-spacex-and-boeing-heats-up.html //DF

The race is on to provide the world with high speed internet using next-generation networks of small satellites. OneWeb sent its first six satellites to space on Wednesday, using an Arianespace Soyuz rocket launched from French Guiana. Eventually, the startup plans to launch 650 satellites in an interconnected network, called a constellation. Once in orbit, the satellites will provided internet coverage across the entire globe, CEO Adrian Steckel explained to CNBC. "It's a big launch for us because it makes it real," Steckel said. "These are fully working satellites." Several other companies are also racing to launch satellite internet constellations, including Boeing, SpaceX and Telesat. SpaceX launched the first two test satellites last year for its Starlink network, which aims to put 4,425 satellites into orbit. OneWeb has raised more than $2 billion to fund its massive satellite network. Due to the heavy capital and technical requirements of OneWeb's goal, the company has also either partnered with or received investment from SoftBank, Qualcomm, Airbus, Virgin Group, Coca-Cola, Maxar Technologies, Hughes Communications and Intelsat. Despite the big names backing the company, OneWeb has largely remained quiet ahead of this first launch. "I think a lot of people may have wondered what is going on with us but we've been keeping our heads down and working," Steckel said. "Our mission is for the OneWeb network to provide seamless global Internet coverage by 2021," the company said in a tweet.

R/T Open-Source Software

1. Open-source data has already been released to the public, so antitrust won't change that

2. Open source moves at a glacial pace and is beaten to the development punch by privately owned

Chris Hoffman 17, 1-3-2017, "The Downsides of Open Source Software," How-To Geek, https://www.howtogeek.com/287113/the-downsides-of-open-source-software/

Many open source projects seem to suffer from a slow development pace, where new versions are endlessly delayed, new features come slowly if ever, and it's difficult to prioritize difficult-but-important features.

Just look at Ubuntu's attempts to launch its Unity 8 desktop and Mir display server, enabling its vision of "convergence". This new version of the Linux desktop was supposed to be stable many years ago, and still isn't. The project has moved at a glacial pace, so much so that Canonical was beaten to the punch by Microsoft, which announced its own vision PC-powered-by-smartphone before Windows 10—and delivered on it. Canonical still hasn't delivered its long-promised vision yet. Maybe it'll be stable in a few more years.

Mozilla has also had some difficulty prioritizing. They still hasn't delivered multi-process and sandboxing features in Firefox. These are critical to keep the browser secure, prevent crashes from taking down the whole browser, and better utilize multi-process CPUs. All other major browsers have delivered these features, including the hated Internet Explorer. Mozilla crated the "Electrolysis" project to add these features, but halted it in 2011 because it was too difficult. Mozilla then had to restart it in 2013. This feature looks set to arrive in 2017—which is really, really late. In the meantime, Mozilla wasted time working on Firefox OS, a failed smartphone operating system.

When a project uses so many volunteer developers, it may have difficulty finding the people to do the hard work that isn't fun to do.

An open source project's source code is available for anyone to change. That's the point! If an open-source project changes in a way you don't like, then you—or the community—can take that old source code and continue working on it as a new project. But community projects are often so wrapped up in internal drama that they cause things to split apart into multiple projects, confusing and alienating users.

For example, when GNOME 3 launched and many GNOME 2 users weren't happy, there wasn't an immediate obvious path. Developers had to fork the GNOME code into other projects like MATE and Cinnamon. One desktop environment turned into three, and development resources are more scattered between projects. As a result, it took some time for the community to get these new projects going.

3. Open-source doesn't help startups because even if the software is public, the data that these companies would need to compete with a targeted advertiser like Facebook are kept under lock and key

Wheeler 19 Tom Wheeler, 4-11-2019, "Should big technology companies break up or break open?," Brookings, https://www.brookings.edu/blog/techtank/2019/04/11/should-big-technology-companies-break-up-or-break-open/ //DF

The good old days of competition are gone from the digital marketplace. The big tech execs like to say that "competition is a click away," but that is myth. The young and spunky Facebook was able to beat the more established Myspace in the early days of social media through traditional "my product is better than yours" competition. But this couldn't happen today, no matter how much better the new product is. **Taking on Facebook today would mean taking on the data hoard of two and a quarter-billion users and the precision targeting it offers advertisers.** The digital reality is that **if you do not have the targeting precision, you don't have the revenue, no matter how good your new product may be.** Siphoning your personal information and hoarding it is not limited to platform companies like

Facebook and Google. The networks that take you to and from the internet—companies such as AT&T and Comcast—watch everything you do on the network. They, too, hoard that information for their own exploitation. When network company AT&T acquired media content company Time Warner, for instance, executives made no bones about how they intended to use the information AT&T's network collects about you to target Time Warner programming and advertisements. When the Obama Federal Communications Commission (FCC) imposed consumer privacy protections on the internet networks, the companies complained it was not "fair," since the platform companies had no such rules. Together the networks and platform companies convinced the Republican-led Congress to repeal the FCC's privacy rules. Now, however, the opportunity exists to treat both the networks and the platforms alike and require them to open their data hoards. LESSONS FROM CABLE TV AND BRITISH BANKS Congress has faced such a situation before. In the late 1980s, both cable television and direct satellite broadcasting were new, growing, and competitive industries. Through ownership and contract, however, cable television operators made it hard for the satellite companies to acquire the programming consumers wanted. In 1992, Congress required open access to the video content essential for satellite to become a viable competitor. Related Books From Gutenberg to Google From Gutenberg to Google By Tom Wheeler 2019 The 1992 solution echoes today. This time, the asset necessary for digital competition is information about consumers, and it needs to be similarly open and available. This does not necessarily mean it is free, but it should no longer be locked away and usable only by a company for the purpose of gaining market dominance. Such an open data policy will also have to contain consumer privacy protections and accompanying oversight. An open data policy now exists for the largest banks in the United Kingdom. Before the Open Banking initiative, consumers could use only the services of the bank that held their information. Under the new rules, however, the consumer's digital information remains the asset of the financial institution, but with the consumer's permission, it is accessible by third parties. There are now approximately 200 companies in the process of taking advantage of the open data to develop innovative new apps for consumers. The U.K.'s Open Banking initiative also provides an example of 21st century regulation in the rapidly changing digital world. Rather than rigid government-imposed rules, the financial institutions were mandated to develop a data sharing protocol, including an enforcement review organization. As technology evolves, the industry protocol can as well, without the limitations of clumsy regulation—yet it still must pass muster with the government-supervised enforcement organization. Our antitrust laws were written in the late 19th and early 20th centuries. They reflect both the eternal concept of competitive markets as well as the industrial realities of the time. Yes, if companies get too big and abusive, physical breakup is an option. But first, let's require those companies to have an internal break up, and break open the data that gives them their power.

4. Even if the data were open, the big tech companies use patents to prevent startups from using any of their ideas

Duhigg 12 Charles Duhigg and Steve Lohr, 10-7-2012, "In Technology Wars, Using the Patent as a Sword," New York Times, https://www.nytimes.com/2012/10/08/technology/patent-wars-among-tech-giants-can-stifle-competition.html //DF

Patents are vitally important to protecting intellectual property. Plenty of creativity occurs within the technology industry, and without patents, executives say, they could never justify spending fortunes on new products. And academics say that some aspects of the patent system, like protections for pharmaceuticals, often function smoothly. However, many people argue that the nation's patent rules, intended for a mechanical world, are inadequate in today's digital marketplace. Unlike patents for new drug formulas, **patents on software often effectively grant ownership of concepts**, rather than tangible creations. Today, the patent office routinely approves patents that describe vague algorithms or business methods, like a software system for calculating online prices, without patent examiners having demanded specifics about how those calculations occur or how the software operates. As a result, **some patents are so broad that they allow patent holders to claim sweeping ownership of seemingly unrelated products built by others**. Often, companies are sued for violating patents they never knew existed or never dreamed might apply to their creations, at a cost shouldered by consumers in the form of higher prices and fewer choices. "There's a real chaos," Richard Posner, a federal appellate judge who has helped shape patent law, said in an interview. "The standards for granting patents are too loose." Almost every major technology company is involved in ongoing patent battles, but the most significant player is Apple, industry executives say, because of its influence and the size of its claims: In August in California, the company won a $1 billion patent infringement judgment against Samsung. Former Apple employees say senior executives made a deliberate decision over the last decade, after Apple was a victim of patent attacks, to use patents as leverage against competitors to the iPhone, the company's biggest source of profits. Apple has filed multiple suits against three companies — HTC, Samsung and Motorola Mobility, now part of Google — that today are responsible for more than half of all smartphone sales in the United States. If Apple prevails with its claims — which

include ownership of minor elements like rounded square icons and of more fundamental smartphone technologies — it will most likely force competitors to overhaul how they design phones, industry experts say. HTC, Samsung, Motorola and others have filed numerous suits of their own, also trying to claim ownership of market-changing technologies. The evolution of Apple into one of the industry's patent warriors gained momentum, like many things within the company, with a terse order from its chief executive, Steve Jobs. It was 2006, and Apple was preparing to unveil the first iPhone. Just months earlier, Apple reluctantly agreed to pay $100 million to Creative Technology, a Singapore-based company. Five years before, Creative applied for a broad software patent for a "portable music playback device" that bore minor similarities to the iPod, an Apple product that had gone on sale the same year. Once the patent was granted to Creative, it became a license to sue. Apple settled three months after Creative went to court. "Creative is very fortunate to have been granted this early patent," Jobs said in a statement announcing the settlement in 2006. Privately, Jobs gathered his senior managers. While Apple had long been adept at filing patents, when it came to the new iPhone, "we're going to patent it all," he declared, according to a former executive who, like other former employees, requested anonymity because of confidentiality agreements. "His attitude was that if someone at Apple can dream it up, then we should apply for a patent, because even if we never build it, it's a defensive tool," said Nancy Heinen, Apple's general counsel until 2006.

One consequence of all this litigation, policy makers and academics say, **is that patent disputes are suffocating the culture of start-ups that has long fueled job growth and technological innovation.** "Think of the billions of dollars being flushed down the toilet," said Ms. Heinen, the former Apple general counsel, who left the company and paid $2.2 million in connection with a federal investigation of stock option backdating. "When patent lawyers become rock stars, it's a bad sign for where an industry is heading," she said, adding that she had no issue with the lawyers themselves.

The new law did make one fundamental change. Since the patent system was overseen by Thomas Jefferson, the United States has awarded ownership of an innovation to whoever created the first prototype, a policy known as "first to invent." Under the America Invents Act, ownership will be awarded to whoever submits the first application, or "first to file." The shift, inventors like Mr. Perlman say, makes life harder for small entrepreneurs. **Large companies with battalions of lawyers can file thousands of pre-emptive patent applications in emerging industries. Start-ups, lacking similar resources, will find themselves easy prey once their products show promise.** That is the concern of people like Mr. Phillips, the voice recognition specialist and one-time Siri partner who founded Vlingo. "Start-ups are where progress occurs," he said in an interview. "If you spend all your time in court, you can't create much technology."

5. Open source code doesn't help startups because once the startups make a product with the code, the big tech companies can just steal it

Innovation based on open source is not profitable and venture capital runs away from it. This is because it falls prey to the economic pitfalls of either the free rider or tragedy of the commons problems.

Daniel Oberhaus, 2-14-2019, "The Complicated Economy of Open Source Software," Vice, https://www.vice.com/en_us/article/43zak3/the-internet-was-built-on-the-free-labor-of-open-source-developers-is-that-sustainable

In 2015, Nadia Eghbal left her job as a venture capitalist and set out to discover why it was so hard for many open source projects to monetize their work. Eghbal told me she became interested in the economics of open source software after repeatedly hearing about FOSS projects that were widely used, but couldn't figure out how to fund their development. To Eghbal, there seemed to be a contradiction at play. **Many popular open source projects had all the hallmarks of a successful startup: Rapid adoption, a large user base, and low development costs. Yet most of these projects were anathema to venture**

capital, where investors are only interested in scaling software if it means large returns. The problem, then, was to identify alternative mechanisms that could be used to sustainably fund open source.

To find out solutions, Eghbal went to the source: The maintainers of open source projects. After a year of interviewing hundreds of open source developers, **Eghbal published Roads and Bridges, which is arguably most extensive research on the economics of open source software development ever undertaken.**

Eghbal's report frames open source software as a non-excludable public good. This is a technical term in social science that describes a resource that can be used by anyone regardless of whether they have paid for it—like roads and bridges, for example. Non-excludable public goods are a cornerstone of a healthy community, but they're also **subject to what economists call "the free rider problem" and the "tragedy of the commons."**

The free rider problem describes a situation in which a good is either over-consumed or under-produced because there is no way to prevent people who haven't paid for the good from using it. Open source is, by its very definition, a non-excludable good. For example, a company like Google may spend considerable resources developing an open source tool like TensorFlow, a machine learning platform, but because it is open source, Google can't stop other companies from using it, too. If enough companies start using TensorFlow without contributing equally to its maintenance, this could lead to the software being under-produced in the sense that the maintainers can't keep up with the number of feature requests or bug reports submitted by users.

The free-rider problem is related to **the tragedy of the commons**, which describes a scenario where all the members of a community benefit from unregulated access to a common good, but no one is incentivized to individually bear the cost of maintaining that good. When each member of the community uses the common good according to their own self-interest, the good eventually becomes depleted and available to no one in the community. In the case of FOSS, the common good is the billions of line of open source code. While code itself can't be used up in the same way as other economic goods like food or land, the resource that can be depleted is the attention and energy of the programmers responsible for developing and maintaining that code.

The tragedy of the commons is a well-studied problem in economics, but Eghbal realized its usual solutions—turning the commons into a private or regulated good—weren't really applicable when it came to open source software development. Turning the software into a private good would undermine the entire point of open source development: The efficient production of quality software that is available to anyone who needs it.