

COVID-19, the Sell-Everything Trade, and the Impact on Private Markets

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While better capitalized than ever, private markets aren't immune

As has been evident for weeks, the global pandemic and resulting economic environment will test virtually every branch of global government and business. We've experienced a set of capital market events that harken back to prior crises—and reminiscent responses from central banks. While the recent—and what we expect to be ongoing—market turbulence has plunged equity prices across all sectors, we think that many large-cap businesses are standing on solid footing to withstand some sort of economic shock.

As we look across our client base, which is primarily composed of PE and VC investors, we typically see lags between public market valuation moves and mark-to-market/model adjustment for private market funds. A drop-off in the stock prices may or may not have a ripple effect on PE depending on the underlying driver of that move, but a decline in the earnings profiles of those companies certainly poses risk to PE, as portfolio companies aren't immune to the negative economic pressures that public companies face. As we enter into the most significant market drawdown and economic shock we've seen since the financial crisis, PE is equipped to help alleviate pressures, but it will also certainly be challenged. In this analyst note, we'll summarize the impact we expect the pandemic and resulting market turbulence to have on the PE industry.

While broad market turbulence may have a slight impact, the main risk the industry faces is a genuine economic deterioration

With broad government-mandated policies intended to stem the spread of the novel coronavirus coming into effect, massive shocks are set to jar the US and global economy. The travel & leisure industries have already seen demand plunge, while retail foot traffic is down dramatically and the service industries—including restaurant and bar operators—have been shut down in various cities. Outside of the consumer space, many manufacturers and retailers have seen disruptions to international supply chains. The energy market is also facing extensive pressure with a pricing spat between Saudi Arabia and Russia. Oil demand had already declined due to COVID-19, but because of this supply shock, prices plunged below \$30 per barrel during trading on Monday, March 16.

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A brief recap of the past two weeks

The spread of COVID-19 has inflicted devastating human repercussions and, as a result, global economic activity has started to show cracks. Work-from-home policies have been implemented wherever possible throughout much of the US, while schools, social gatherings, sporting events and, in some cases, even restaurants and bars have been shut down. Health officials have also encouraged individuals to simply stay home when possible. In a country where roughly 2/3 of the economy relies on services, mass shutdowns and declines in consumer spending will certainly result in what we see as material economic deterioration.

The bond market effectively came to a halt; high-yield spreads initially spiked toward the end of February, before massive bond sell-offs sent spreads to 400bps—levels we haven't seen since 2016—in the span of just about a week. Equities have appeared to be in free fall at times in recent weeks but have just as quickly reversed course, with the S&P 500 experiencing daily movement of 5% nearly every day the week of March 9th. The S&P has declined some 25% over the last couple of weeks and, in true panic form, even short-term Treasury yields spiked simultaneously, with yields on the ten-year moving from a low of 0.66% on Monday, March 9, only to close last week at 0.9%. In rare occurrences, we effectively saw broad sell-offs of both risk and risk-free assets as companies assumedly liquidated treasuries to raise cash.

These forces point toward negative revisions to global corporate earnings expectations. Cash-flow profiles will likely decline as revenues drop. Cost reductions may mitigate cash-flow declines, but many businesses will find themselves looking for capital to help cover negative cash flow. In fact, many public companies such as Boeing have already tapped their revolving credit lines, and various PE firms have asked their portfolio companies to do the same. We think cash-burning venture-backed companies will surely follow suit. The Federal Reserve has taken aggressive measures to ensure liquidity and the positive flow of credit to both households and businesses. In an effort to support loan issuances and credit extension, we've seen the Fed effectively re-introduce broad monetary policy, lowering key interest rates, while committing to various asset purchases and introducing an unprecedented expansion in repo market liquidity. Bank reserve requirements have also been lifted, and the Federal Open Market Committee has encouraged banks to tap into liquidity buffers should they need to in order to extend credit. As the largest US banks today hold over \$1.3 trillion in common equity and \$2.9 trillion in liquid assets, according to the FOMC, US banks have never been more capitalized to handle such measures. A reduction in reserve requirements should, in theory, help create an unbounded money multiplier; however, time will tell how this liquidity helps promote or stabilize economic activity as businesses face cash crunches.

We've always maintained that PE tends to be a GDP-linked business. As consumer spending and business investment are set to decline, we believe we will undoubtedly see a slowdown in PE transaction volume to follow the expected economic contraction.

Tighter credit markets will force adjusted transaction capital structures, creating private debt and special situations opportunities

As mentioned previously, high-yield bond spreads have skyrocketed as investors look to sell risk assets with heavy velocity, which we'll explore later in this note. In addition, leveraged loan volume witnessed a dramatic decline over the last month or so. As of the beginning of March, roughly \$860 million in leveraged loans came to market, relative to roughly \$81 billion as of the end of January, reflecting a decline of more than 99%, according to LCD.¹ We view these securities as adequate proxies for the pricing and availability of debt that goes into LBO transactions. Given the falloff in demand for such risk assets, we expect to see continued tightening in the credit markets applicable to the upper ends of PE. In addition, the volatility in the energy sector, which accounts for over 11% of high-yield debt, could produce a contagion effect should banks experience a sharp rise in defaults given the current situation in the energy market. On a positive note, according to Moody's, only about \$2 billion of the \$53 billion in energy-related junk debt due between now and 2024 will come due this year. This should allow some relief to cash-strapped energy businesses—and, as a result, hopefully the broader high-yield market.

While we think larger issuances will prove difficult to execute, private debt funds are indeed sitting on record levels of capital to lend throughout the middle market, as we'll explore later in the piece. In our most recent [Global](#)

1: "Leveraged Loan Trends," LCD. Accessed March 16, 2020.

A brief recap of the past two weeks (continued)

Furthermore, a supply-side route in oil prices spurred by a spat between major oil producers, coupled with an existing demand-side shock driven by COVID-19, has only made matters worse for the entire economic landscape.

Many balance sheets are strong, with significant working capital and sufficient cash to allow companies, at a minimum, to meet expenses such as payroll, general administrative costs and near-term debt obligations. As equities have plunged, we understand that many public equity investors now have an attractive opportunity to take advantage and buy securities at more normalized levels. However, we make no mistake that earnings growth, and in many cases, outright earnings, are more than likely to decline for a large proportion of companies.

Private Debt Report, we showcase the rise of direct lending funds and other substrategies in the credit space. While a flight to quality for various non-bank lenders will occur, distressed and special situation funds have never been more capitalized to take advantage of opportunities to acquire assets at depressed prices or to be creative and efficient in accumulating assets via mid-capital structure entry points.

As of the end of 2019, more than 75% of PE deals included debt multiples greater than six times EBITDA, a stark difference from that same figure following the GFC, which came in at around 25%, according to a recent report from Bain & Company. While leverage ratios have become consistently high, we believe they are bound for a reversal from that sustained trend. With tighter lending, PE firms will be forced to enter transactions with more conservative capital structures that include a larger equity proportion. That said, funds are indeed better positioned to do that than ever before. In our most recent **Global Private Fund Strategies Report**, we noted over \$2.4 trillion in dry power sitting in private vehicles. In 2019, capital committed to PE alone grew 20% YoY to \$1.3 trillion. Private debt funds were also sitting on record capital bases (\$275.0 billion) by year-end, which should be paramount for middle-market transactions and companies.

YoY fundraising changes by strategy*

Strategy	Capital raised (\$B)	YoY change	Fund count	YoY change
Private capital	\$888.0	1.0% ▲	1,064	-12.9% ▼
PE	\$474.1	6.3% ▲	353	1.1% ▲
VC	\$75.5	-14.5% ▼	436	-6.2% ▼
Real assets	\$170.2	-9.3% ▼	114	-47.0% ▼
Debt	\$131.1	20.7% ▲	96	-7.7% ▼
Funds of funds	\$15.6	-22.5% ▼	45	-18.2% ▼
Secondaries	\$21.6	-23.3% ▼	20	-41.2% ▼

Source: PitchBook | Geography: Global
*As of December 31, 2019

We also expect to see increased scrutiny placed on underwriting practices. Today, EBITDA add-backs have become common practice. Underwriters can ignore portions of “non-recurring” expenses to help boost EBITDA figures and, as a result, lend more capital to target and portfolio companies. We see no way in a subdued economic environment for this to continue playing out, particularly with companies already carrying heavy or risky debt loads. We could very well see a resurgence of covenants introduced to protect lenders. While “covenant-lite” loans have become standard practice, they have not yet been tested in a volatile and uncertain market environment. Some may argue covenant-lite packages are needed especially in times of turmoil, while others think the extra leeway will lead to a rash of defaults. We’ll be closely monitoring the potential impact this may have on existing and future debt packages in the coming quarters.

Return profiles will likely face pressure

As we've detailed, a combination of tighter and more scrutinized lending markets—in addition to depressed earnings and cash-flow profiles—will pressure companies. In times of heavy market distress, we find it important to emphasize two central components for valuing a business: free cash flow projections and the weighted average cost of capital. As economic activity subsides, we still expect to see an enhanced risk premium in the types of leverage and debt solutions used by PE, which will drive yields in those pockets higher despite the Fed's actions to depress overall rates. Thus, as we see earnings fall and the cost of capital rise, asset prices will decline across the board, hurting exit multiples.

In addition, we think well-funded PE vehicles will be forced to inject more liquidity into portfolio companies, reducing the leverage that provides the enhanced returns in the LBO market. We think this will also force firms to underwrite deals to lower return profiles, which might remove a significant portion of viable target companies almost overnight. That said, as certain assets trade at cheaper prices, PE might be able to make transactions work with the intent of re-levering later in the holding period.

Finally, we expect to see holding periods increase as firms will be forced to hold struggling assets and may find exit markets to be completely subdued for most assets, particularly across the strategic M&A and IPO avenues. In turn, as we look at the basic IRR equation, we expect to see the return profiles of recent vintages shrink. Given the well-capitalized state of current private capital markets, we do emphasize that we believe PE has more levers to support portfolio companies than ever and, as a result, will show positive performance through this period relative to other risk asset classes. PE firms might also hold on to their most prestigious assets as they look to weather an economic shock and look for multiples to regain steam.

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Impact on private asset classes

In the following section, we lay out a series of questions and responses from our lead analysts to help create better understanding of the current climate.

Performance

How will the recent market drawdown and volatility be reflected in private market performance?

Our research has shown that returns in private markets are less volatile than in public markets, where both the peaks and valleys of performance are more extreme. Since 2001, PE trailed public markets in 24 of the 28 quarters when the S&P 500 TR was up 5% or more. Conversely, PE funds have outperformed in all 21 of the quarters in which the S&P 500 TR was negative over that period. We think this historical pattern will hold in the current environment, meaning that the drawdown the public markets are experiencing in Q1 2020 is likely to be more extreme than what the private markets will realize.

Quarterly returns from private market strategies remained **strongly positive through Q2 2019** (the most recently available data), but the trendline had been turning downward for more than a year when looking at the one-year horizon IRR on a rolling basis. The downturn in PE can at least partially be attributed to a slowdown in exit activity through 2019. On the VC side, valuations plateaued and dipped a bit at the late stage in 2019; the current environment should sustain that trend, which will likely dampen the aggressive portfolio markups and concomitant strength in short-term fund performance seen recently.

What if there is a prolonged economic downturn?

Our research has shown that PE and VC funds raised in the run-up to a downturn, wherein prices are rising and excess capital is raised, tend to underperform. The best-performing vintages tend to be those that invest at the nadir of a downturn and into the early stage of recovery, when entry multiples are lower, competition abates and portfolio companies benefit from macro tailwinds. PE funds exhibit a high degree of cyclicality, and **their correlation to public markets has only increased over time.**

Each market cycle is different, however, and strategies respond in a variety of ways. In the dot-com era, unviable business models led to widespread startup failures and previously untouched lows in VC performance. Funds in this time period produced negative returns for LPs on a median basis. There was no subsequent rebound for VC funds in aggregate, with middling returns for vintages through the GFC years of the late 2000s. But VC performance improved considerably in the years following the depths of the GFC. Unprecedented valuation growth in private markets led to the dawn of the unicorn era. As a result, VC funds willing to deploy capital posted strong relative returns; 2009 is the first vintage since the 1990s where VC funds produced a median IRR in the double digits, and returns have remained strong for vintages through the 2010s as well.

Based on distribution rates, it currently appears that performance is largely baked in for vintages 2012 and earlier for PE, and 2010 and earlier for VC. Funds with the most recent vintages (i.e. 2017-2019) are most susceptible to long-term underperformance should a macroeconomic downturn ensue. Performance for more recent vintages has been trending well, but paper gains account for the lion's share of those funds' returns. The validity of private market valuations (i.e. the unrealized value in funds), particularly in the VC space, has been questioned for some time. This consternation increased following the sell-off of several prominent newly listed VC-backed companies in 2019 and will only be further stoked by recent market volatility.

Fundraising

How is the pullback in public markets going to affect allocations and commitment pacing to private markets?

For allocators to private funds, sell-offs in public equities reduce the overall asset pool available for investment. Consider an investor with \$100 and target allocations of 60% equities, 20% fixed income and 20% private

markets. If equities were to sell off by 20%, the total asset pool would fall to \$88; this would effectively result in the private market allocation target falling from \$20 (20% of \$100) to \$17.6 (20% of \$88). This phenomenon is commonly referred to as the “denominator effect.”

Many institutional investors were already overallocated to private markets when the GFC ensued, meaning that the denominator effect had outsized consequences. As a result, the drawdown in public equities during the GFC led to liquidity issues as LPs struggled to make capital calls. Overallocations also forced certain institutions to sell LP interests at steep discounts on the secondaries market.

Today, while illiquidity remains a concern and will be an issue for some LPs, we think the risk of the denominator effect is somewhat mitigated because many LPs are currently underallocated to private markets. As a result, while there may be a pullback in fundraising (as our [PE analysts predicted](#) entering the year), we do not anticipate a dramatic downturn. We also do not foresee panic-selling on the secondaries market, as was the case in the GFC. For those LPs who do need liquidity, the secondaries market is deeper and more developed than it's ever been—even if transactions may take longer in a challenging environment.

If institutions were forced to turn to the secondaries market, we think there would be sufficient demand from well-capitalized secondaries funds, as well as institutions with prolonged time horizons (e.g. SWFs, endowments, foundations) that have been actively seeking more access to illiquid opportunities. The narrative around illiquidity in private markets has been shifting, with AQR being particularly vocal that illiquidity is in fact “a feature, not a bug.” The typical transaction on the secondaries market is valued at 101% of net asset value mean, according to Palico's latest survey of LPs who've purchased stakes in closed funds over the last six months. As the composition of buyers and sellers inevitably shifts, it may take some time for pricing to settle and liquidity to return to the secondaries market. That said, given current pricing levels and the unprecedented depth of the market, we don't anticipate prices to be discounted to the extremes observed in the GFC.

Which GPs are most and least likely to be affected by an adverse fundraising environment?

Smaller firms are naturally more susceptible in a downturn, particularly generalists without a differentiated strategy. Recent fundraising for both PE and VC has been characterized by fewer but larger funds, with smaller offerings requiring certain inimitable qualities to attract LPs. On the other end, consolidation within PE has led to large asset managers with multiple platforms that can still capitalize on a range of opportunities in a variety of economic environments. Our research and the studies of others have shown that both specialists and large, [diversified asset managers have a tendency to outperform](#).

Many name-brand VC firms also seem primed to benefit in the current environment. We predicted that VC fundraising would remain strong coming into 2020, and it has been so far (and several prominent firms have high targets for open funds). With many LPs underallocated to VC, and the relatively small size it represents in portfolios, it seems like VC fundraising in aggregate should be resilient. The main headwind seems to be the potential for a prolonged hiatus of in-person meetings, which could delay approval processes that are critical to consummate a fund commitment.

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Deal sourcing & underwriting

What are the implications for deal flow?

New deal announcements are often a trailing indicator of activity, and the ripple effects of restricted travel, fewer meetings and heightened volatility likely won't be fully realized in the data until April or May (i.e. Q2 numbers). Deals are still being announced, but these transactions have mostly been in negotiation for some time. For example, Aon's \$30 billion takeover of Willis Towers Watson was announced on March 9—a day when trading was temporarily halted on US stock exchanges—but there had been interest since the two disclosed negotiations in March 2019. In terms of VC activity, early March has seen announcements by autonomous vehicle startup Waymo (\$2.25 billion) and mobile banking platform Chime (\$700 million), but future activity (and valuations) is likely to take a hit.

For both PE and VC, dry powder levels are at record levels on an absolute basis, but more reasonable when compared to recent investment activity (which is also at all-time highs). This capital is likely to be deployed, albeit more slowly and perhaps more prudently than in the last few years. In some cases during prior market downturns, GPs were forced to return capital to investors. This is unlikely to happen, particularly in VC, given the more mature nature of VC-backed startups and VCs' resulting ability to deploy capital more quickly with larger check sizes.

We expect a more sustained pullback in VC- and PE-backed exits, which were already slowing through the end of 2019. The IPO market underpinned record VC exits in 2019, but that seems unlikely to repeat in 2020, with several high-profile listings rumored to be delayed. In PE, GPs are less willing to part with choice assets in a bear market. We expect to see more special-purpose continuation vehicles and GP-led secondaries funds. For example, TA Associates is raising a vehicle solely to take minority stakes in existing portfolio companies as a means of extending the holding period.

Will PE firms still be able to finance their deals?

Today, a higher proportion of LBO financing comes from dedicated direct lending funds (as opposed to banks). While banks are likely to pull back in a recessionary environment, private debt funds are sitting on \$241.4 billion in dry powder globally as of Q2 2019 and are likely to continue investing through a downturn. As such, we don't expect debt financing for LBOs to dry up to the same extent it did during the GFC. The largest deals, however, still rely on syndicated leveraged loans which are largely arranged by banks, so those may be more affected by a credit crunch.

An extended downturn could be the first real test for the new covenant-lite-dominant regime in the leveraged loan market. The recent surfeit of capital and proliferation of covenant-lite loans have left creditors with fewer protections and had already spurred concern that this sort of scenario would develop. In a similar vein, recent volatility in the energy markets could spur more bankruptcies in an industry that was already struggling to service its debt. The lack of a deal between Russia and OPEC has led to a price war, with Saudi Arabia slashing prices in an effort to drive higher-cost producers out of the market. Back in 2015 and 2016, when crude prices last experienced such a shock, volatility in the price of oil reverberated through the rest of the high-yield bond market, which made buyout financing more difficult even in non-energy-related sectors. High-yield bond spreads indicate we are nearing a similar situation; the ICE BofA US High Yield Index Option-Adjusted Spread reached 7.42% on March 12, levels not seen in more than four years.

Will GPs change their tactics during this volatile period?

Many GPs are claiming the current pullback represents a buying opportunity, following several years of rising purchase-price multiples. We are likely to see some funds pivot toward more opportunistic sourcing, including investing in public equities and distressed opportunities. The lines between public and private equities had already become more blurred with PE funds holding stakes in public companies and hedge funds raising dedicated private market vehicles.

In VC, GPs with capital seem keen to write checks for the time being, but many are prepping companies for a potential pullback in funding—most prominently Sequoia Capital, which also penned the infamous “R.I.P. Good Times” deck.² Many VCs were already recalibrating their outlooks, placing greater emphasis on sustainable revenue growth and profitability while telling portfolio companies to reduce their burn rates, but the Sequoia letter seems to have been an alarm bell.

Many seem to be remembering the lessons of the GFC, with both VCs and startup companies tapping available sources of capital early. As the GFC ensued, our research shows that startups funded through the recession underwent longer periods between financings, saw considerably lower valuation step-ups between rounds and had a higher concentration of bankruptcies in second-round outcomes, with a lower propensity to raise follow-on funding.

Today, it seems that virtually every VC remains “open for business,”³ but deal terms appear to have shifted in favor of investors as startups do whatever they can to close on capital. This could be a catalyst for a shift from the prevailing market in recent years, which has been categorized by a broad-based shift toward founder-friendly terms and ever-higher valuations. Startups do have a variety of **options outside of traditional VC**, but the viability of most those options in a downturn has yet to be tested.

2: “Coronavirus: The Black Swan of 2020,” Sequoia, March 5, 2020

3: “Venture Capital Open for Business on Record Amounts of Dry Powder,” Axios, Dan Primack, March 13, 2020

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The crisis and the remote economy

Digital technologies helping mitigate a pandemic

Over the past decade, innovations in digital and remote technology have dramatically altered commerce and communications. While recent scrutiny of the digital revolution has focused primarily on its shortcomings, it is nonetheless proving critical in ensuring some level of economic and societal normalcy amid a global pandemic where the best remedy is to simply stay home. Technology is helping to mitigate the impacts of the current situation by supporting employees and students as they try to be productive from remote locations, allowing commerce to take place from home, enabling quicker testing and treatment for exposed populations, tracking disease migrations and accelerating drug production. As the crisis evolves and the recovery ensues, emerging technologies—and the venture ecosystem that supports them—are likely to play an important role in supporting as well as in preventing future pandemics.

Enabling the remote enterprise

As more employees work from home, organizations are turning to technology to help ensure business continuity. This will prove relatively painless for companies in the technology and information industry. Unicorn startup GitLab, for example, has maintained a fully remote policy across its entire workforce. The company recently published a survey that found 26% of remote workers are employed by organizations that are 100% remote.⁴

Even non-technology organizations have been gradually shifting investment toward activities related to the creation of digital IP. Powerful laptops, low-cost monitors, high-resolution cameras, and SaaS-based communication & collaboration tools are helping facilitate the transition. Equally important are the advances in underlying technology infrastructure such as hybrid computing, cloud file storage, high-speed networking and endpoint security systems.

The potential benefits of working from home could cause some organizations to continue the practice even after the crisis has passed. For example, video conferences and meetings could reduce corporate travel while a remote workforce could lessen the need for real estate in densely populated city centers. Additionally, many remote-work companies, especially small businesses, cite the advantages of being able to hire candidates from anywhere. Finally, businesses may view working from home as a smart long-term strategy when it comes to continuity planning or reducing carbon footprints.

Modern management software is also critical in understanding how recent disruptions have an impact clients and supply chains. CRM, ERP and supply chain software has evolved dramatically in recent years, helping firms improve visibility into customer and supplier channels in order to respond to changes in underlying business conditions. This has been particularly notable in the current crisis, as businesses are able to relatively quickly

4: "The Remote Work Report by GitLab: The Future of Work Is Remote," GitLab, March 2020

inform customers of product shortages, cancellations and potential refund procedures.

Despite these advances, working from home will remain much more challenging for workers in many industries, such as hospitality, manufacturing, transportation, healthcare and construction. These industries will struggle to balance reduced demand, business continuity and worker safety and are more likely to face furloughs, layoffs and closures. Longer term, emerging robot and automation technologies may become more of an investment focus area for these industries. The healthcare industry in particular is likely to see significant adoption of robots and telemedicine technology.

The at-home consumer

The expansion of the digital economy is proving extremely useful for those working from home, those who are under self-quarantine or those who are simply too nervous to go out in public. Nearly 94% of Americans have broadband access in their homes, up from 75% 10 years ago;⁵ and 4G mobile—which was virtually nonexistent 10 years ago—is pervasive today.⁶ These technologies have gone a long way in taking the friction out of at-home commerce. The gradual penetration of 5G connectivity and eventual introduction of autonomous delivery services over the next decade could further strengthen the at-home economy.

Online commerce and food delivery services have improved dramatically in recent years and enable consumers to get just about anything delivered (provided items are still in stock and drivers are available). The penetration of digital payments can also be credited with driving this shift. Amazon's recent announcement that a surge in demand was causing shipping and stocking delays underscores the pervasiveness of online shopping. The food delivery industry, which has evolved significantly in recent years, is seeing demand spikes, which should be further catalyzed as cities dictate that dine-in restaurants close. Emerging ghost kitchen business models that help restaurants establish delivery-only operations, such as Travis Kalanick's CloudKitchens, could be beneficiaries of the current crisis.

In addition to food and goods, broadband internet and streaming services enable access to real-time information and entertainment services. In addition to Disney+, which launched in late 2019, HBO Max, venture-backed Quibi and NBCUniversal are all planning launches later in 2020. Online education providers are likely to see an uptick in demand as schools shift to fully remote learning. The need for public and private school systems to ensure remote capabilities will likely drive significant investments in digital learning platforms in coming years.

Digital health

Emerging life sciences technologies have been at the forefront of efforts to deal with this crisis and will be critical in dealing with future outbreaks. From the very beginning of the COVID-19 outbreak, technology has played a role.

5: "The Decade in Broadband: 2020 Statistics & Predictions," BroadbandNow, Tyler Cooper, January 15, 2020
6: "How America's 4G Leadership Propelled the US Economy," Recon Analytics, April 16, 2018

Venture-backed startup BlueDot helped spot the initial outbreak in China back in December. The company uses Big Data from a range of sources, combined with AI and human analysis, to provide updates about infectious disease activity. Disease tracking will likely become a continued area of investment for both public and commercial applications.

Disease testing has been another area of technological progress. Despite ongoing issues related to the supply and distribution of test kits, advances in molecular diagnostics have at least enabled the potential for widespread testing, and suppliers are rapidly expanding production to meet the current need. Pharmaceutical giant Roche has developed a test that can screen 4,000 samples a day, a 10x improvement over existing methods. Alphabet subsidiary Verily is devising an online screening platform that will direct people to local testing locations if they meet testing requirements.

Life sciences technology is also contributing to efforts to create a vaccine. US-based companies with potential vaccines entering trial and testing phases include public companies Novavax and Moderna and venture-backed Greffex. Recent advances in gene sequencing can be partially attributed to the speed with which potential vaccines can be generated.⁷ Another factor is the ability of biotech firms to build off of vaccines developed for prior coronavirus outbreaks including SARS and MERS. Companies are also employing emerging approaches to vaccine development that differ from traditional approaches to immunization.

Advances in telemedicine are playing a key role in the response to COVID-19. Hospitals and care centers are relying heavily on digital communications to keep patients informed, prevent people from overcrowding physical locations and protect healthcare workers. High demand for doctor appointments is driving more providers to implement digital consultations and other digital diagnosis options. Startups including 98point6 and Amwell have cited surges in demand. Robots that can allow communication with patients, scan temperatures, sanitize rooms, and deliver food and supplies are being deployed primarily in China, but will likely be an area of increased investment in other countries as well.

In addition to the VC industry, governments and foundations are likely to be major investors in health products and services that can address future health crises. Once the current emergency has passed, legislators will focus on establishing more robust rules related to outbreak preparedness and response, including how supplies are stockpiled and how tests are made available. Centralized disease tracking and health records are also likely to get a boost as lawmakers prioritize public health over lingering privacy concerns.

7: "When Will a Coronavirus Vaccine Be Ready?" The Guardian, March 16, 2020