

Agglomeration Effects and the COVID-19 Pandemic

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There are tremendous uncertainties ahead as the COVID-19 pandemic further infects our society. Markets have experienced the most volatility since the 2009 financial crisis². During the financial crisis, it was also nearly impossible to understand which companies had the highest exposure to troubled assets. Today, similar problems persist. Major questions remain about how the virus will affect companies. What companies are most at risk in the coming months? And what companies will be immune to the changes ahead?

In order to understand a company's vulnerability to the virus, we must first understand in what geographies it operates. However, perhaps surprisingly, the geographical distribution of companies is not reported and very difficult to find. Companies are not required to report the geographical distribution of their employees. Earlier last year, the International Organization for Standardization approved a voluntary standard for Human Capital reporting (ISO-30414) that also does not include guidelines for reporting the geographies of their employees.³ Even companies that do voluntarily report this information typically exclude contingent workers. This omission could constitute a large majority of a company's workforce – especially in areas like Information Technology where two thirds of a company's workforce could be contingent workers. This creates an especially muddled view of where a workforce is based because contingent workers are typically in different geographies than their counterparts in the official employee pool. Because of these limitations, measuring the workforce composition of companies is a tremendous undertaking. The data required to find answers is hidden in documents like resumes and online profiles. However, these documents are self-reported, written in natural language, represent only a sample of the underlying workforce, and are not updated on a standard schedule. These complexities present immense statistical challenges for those who'd like to understand something as basic as the locations of employees.

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² <https://www.reuters.com/article/idUSWAOA9NUIRCF192L>

³ <https://www.iso.org/obp/ui/#iso:std:iso:30414:ed-1:v1:en>

We outline an approach below to assessing the vulnerability of companies to COVID-19, based on employee exposure to high-risk geographies.

The natural response for many companies in exposed geographies will be to transition to remote work. But this opens up a Pandora's box, rife with academic debate and controversy. How vulnerable companies react could have enormous economic implications – not just for this crisis, but for decades to come. For that reason, it's helpful to provide historical context for the trends surrounding employee collocation.

Since 1960, there's been a sharp increase in the rate of urbanization. In 1960, 34% of the world lived in cities. Today it's 55%. This trend is only accelerating, with current growth being at around 5 percentage points per decade, up from a low of 2 percentage points per decade in the 1970s.⁴ This trend was not at all obvious at the time. Conventional wisdom in the 1990s and 2000s was that the IT revolution would enable remote work and communication over large distances, decreasing the return to people being in close proximity to each other.^{5 6 7} Economists call the returns to people clustering together "agglomeration effects". Agglomeration effects are ultimately driven by lower costs of interaction and increases in knowledge spillovers that result from close spatial proximity between people. Spatial clustering occurs because of agglomeration effects, until the point that they are overtaken by congestion costs. Although economies of agglomeration are mostly in reference to cities, you can think of any organization as being bound by the same dynamics. A firm grows as a result of efficiency (lower interaction costs) and synergy (knowledge spillovers) and reaches its optimal point when the benefits of size get outweighed by bureaucracy and redundancy (congestion).

⁴ <http://data.worldbank.org/data-catalog/world-development-indicators>

⁵ Gaspar, Jess, and Edward Glaeser. *Information technology and the future of cities*. No. w5562. National Bureau of Economic Research, 1996.

⁶ Leamer, Edward E., and Michael Storper. "The economic geography of the internet age." *Location of international business activities*. Palgrave Macmillan, London, 2014. 63-93.

⁷ Sinai, Todd, and Joel Waldfoegel. "Geography and the Internet: Is the Internet a Substitute or a Complement for Cities?." *Journal of Urban Economics* 56.1 (2004): 1-24.

Agglomeration effects, in fact, did not decrease with more advanced IT technology, but increased.⁸ Big cities became larger and big companies have become more dominant than ever.⁹ Although communication technology was indeed making remote work easier and cheaper, this effect was overridden by what the IT revolution did to the occupational landscape. In a world where technology was everywhere, employees created value by staying on top of the latest trends, making stronger connections throughout an organization – this is when the term “knowledge workers” entered the business lexicon.¹⁰ Knowledge workers had the highest value of being well-connected and benefited the most from the knowledge spillovers of densely populated cities and offices. As more of the global workforce started taking on jobs as knowledge workers, the returns to communication and coordination increased dramatically. Employees were increasingly rewarded for exposure to the latest ideas and industrial know-how.

Another reason — and perhaps underrated reason – why agglomeration effects have dominated the effect of communication technology is because distributed work is not all about communication tools. A company that can operate effectively with a distributed team is fundamentally different from a colocated company. Teams that work remote, not only need to manage meetings differently, but need different ways to evaluate and promote employees, different ways to train employees and share knowledge, different ways to collaborate on projects, different ways to set agendas, different recruiting and onboarding strategies, and different ways to incorporate feedback from employees and manage engagement. Remote employees are also less likely to be promoted than their on-site counterparts, be much less engaged at work, have lower levels of trust with their coworkers, and be less likely to leave.^{11 12}

Many of these effects do not only relate to teams, but also to the company at large. Jobs, the collection of activities associated with each position, depend largely on the ability of each job to interact with complementary jobs.¹³ Cultures centered around employee connection can face challenges as teams transition to working remote.

⁸ Kolko, Jed. "The death of cities? The death of distance? Evidence from the geography of commercial Internet usage." *The internet upheaval: Raising questions, seeking answers in communications policy* (2000): 73-98.

⁹ Cowen, Tyler. *Big Business: A Love Letter to an American Anti-hero*. St. Martin's Press, 2019.

¹⁰ Drucker, Peter. *The effective executive*. Routledge, 2018.

¹¹ <https://workplacetrends.com/the-work-connectivity-study/>

¹² A primary reason for this difference is that remote workers are often employed in less competitive labor markets and have fewer competing job prospects.

¹³ Gibbs, Michael, Alec Levenson, and Cindy Zoghi. "Why are jobs designed the way they are?." *Research in Labor Economics* 30 (2010): 107-154.

Many companies have organized around remote work with tremendous success. Distributed teams can be much less expensive than teams located in cities with high costs of living and expensive office space. If companies can organize effectively enough to offset agglomeration effects, they can stand to run more efficiently and flexibly than their geographical concentrated counterparts.

There's been an ongoing debate among organizational theorists and practitioners of what the future of remote work will look like. The debate reached its most contentious in 2013 with Marissa Mayer's controversial decision to ban working from home at Yahoo. A leaked memo reads, "To become the absolutely best place to work, communication and collaboration will be important, so we need to be working side-by-side... Speed and quality are often sacrificed when we work from home". Richard Branson captured the backlash best in a blog post where he wrote, "This seems to be a backwards step in an age when remote work is easier and more effective than ever". There were hundreds of articles criticizing Mayer's decision, mostly concluding that she was fighting the zeitgeist of technological optimism in the age of amazing progress. In hindsight, we know that Mayer was actually moving with the trend rather than against it.

As we are all readying ourselves for the possibility of mass quarantine, remote work could be the new normal for the foreseeable future. While some companies are organized for distributed work, most are not.

Using Revelio Labs human capital data¹⁴, we have measured the risk of each company to COVID-19 using two approaches. The first, measures exposure to the virus. The second, measures a company's adaptability to changing work conditions.

First, we take COVID-19 exposure data -- the concentration of cases by countries and states -- and apply these measures to each company, weighting by the shares of employees in each location.

$$Exposure_{company} = \sum_{i=1}^N \frac{x_i}{x_{company}} \frac{Cases_i}{Population_i}$$

¹⁴ Revelio Labs develops technologies to understand the workforces of companies. One specific area of concentration is the geographical distribution of workers

In the equation above, N is the number of sites, x_i is the count of employees in location i . $\frac{Cases_i}{Population_i}$ is the COVID-19 exposure rate of location i . We simply take a weighted average of exposure proportional to employee counts.

Second, as workers transition to remote work, especially in high-risk areas, we identify the companies that are most well-suited to adapt to this transition. These companies will be well positioned to deliver without much disruption to their operations. Companies that are organized around colocation, however, will have a much harder time adapting to this changing reality. To identify this distinction at companies, we've derived a measure of employee concentration based on the Theil Index, which is widely used to understand diversity, economic inequality, and information redundancy.

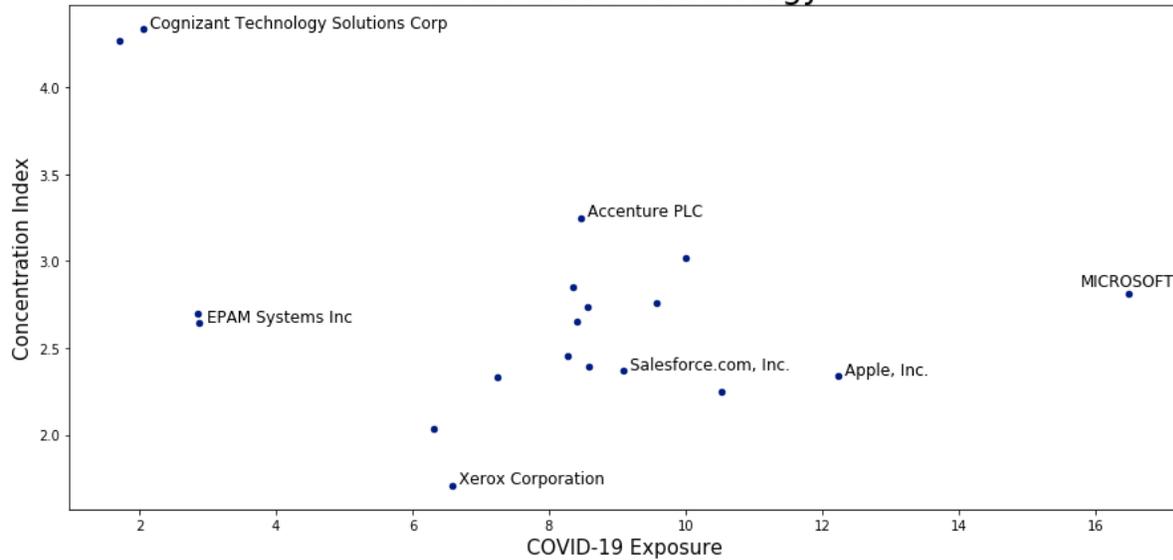
$$Theil_{company} = \frac{1}{N} \sum_{i=1}^N \frac{x_i}{x} \ln\left(\frac{x_i}{x}\right)$$

In the equation above, N is the number of sites, and x_i is the count of employees in location i . The Theil Index can be thought of as a measure of inequality, similar to the Gini Coefficient. The benefits of the Theil Index is that it is infinitely decomposable so that it can be explored in greater depth and detail, rather than simply providing a singular coefficient.

Having applied both approaches across all companies, the results stand out as non-obvious and helpful in determining, not just which companies are most exposed, but which companies are best poised to adapt to the new environment.

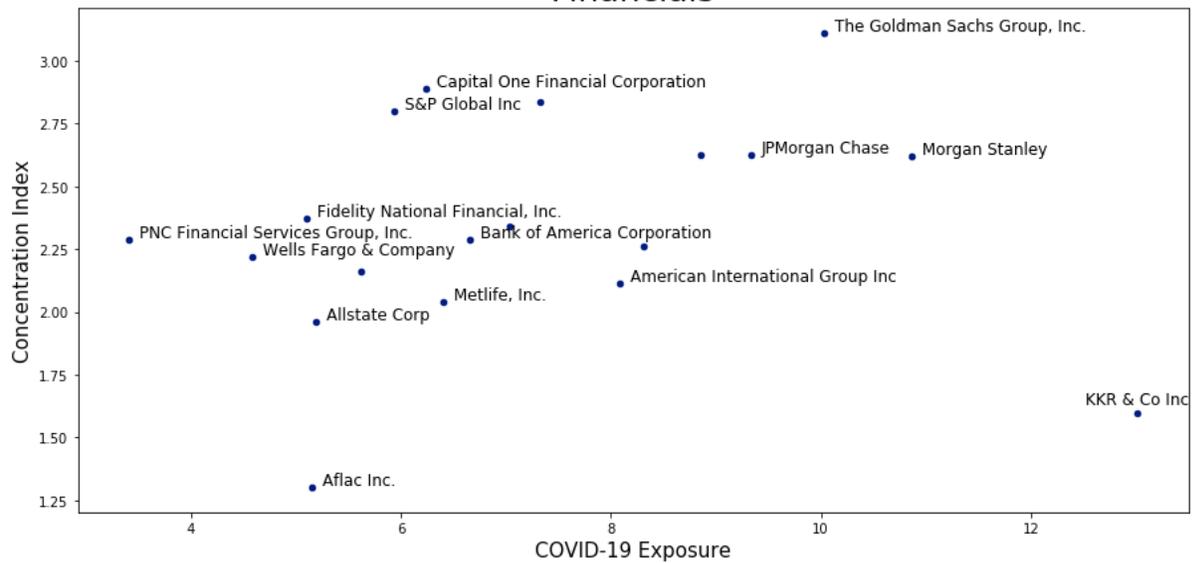
Because there are significant differences across industries that should be controlled for, we present these results for different industries below.

Information Technology

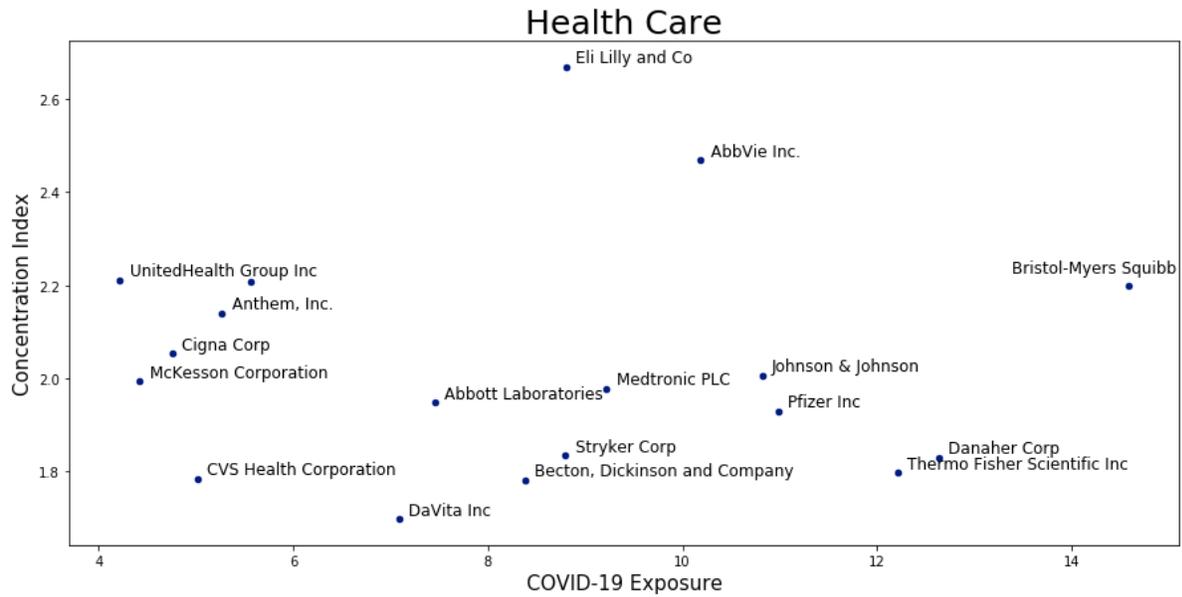


Microsoft stands out as particularly exposed because of their heavy share of their workforce in Washington, the most exposed state in the United States. Cognizant has a heavily concentrated workforce but has the largest share of the workforce in India which has, to this point, had low exposure to COVID-19.

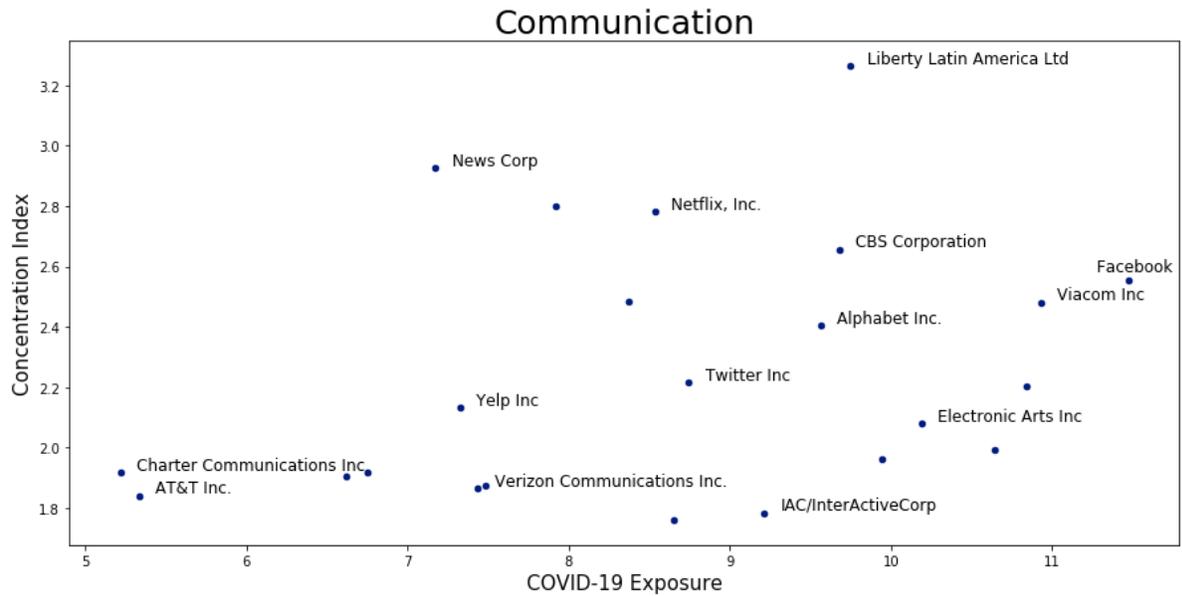
Financials



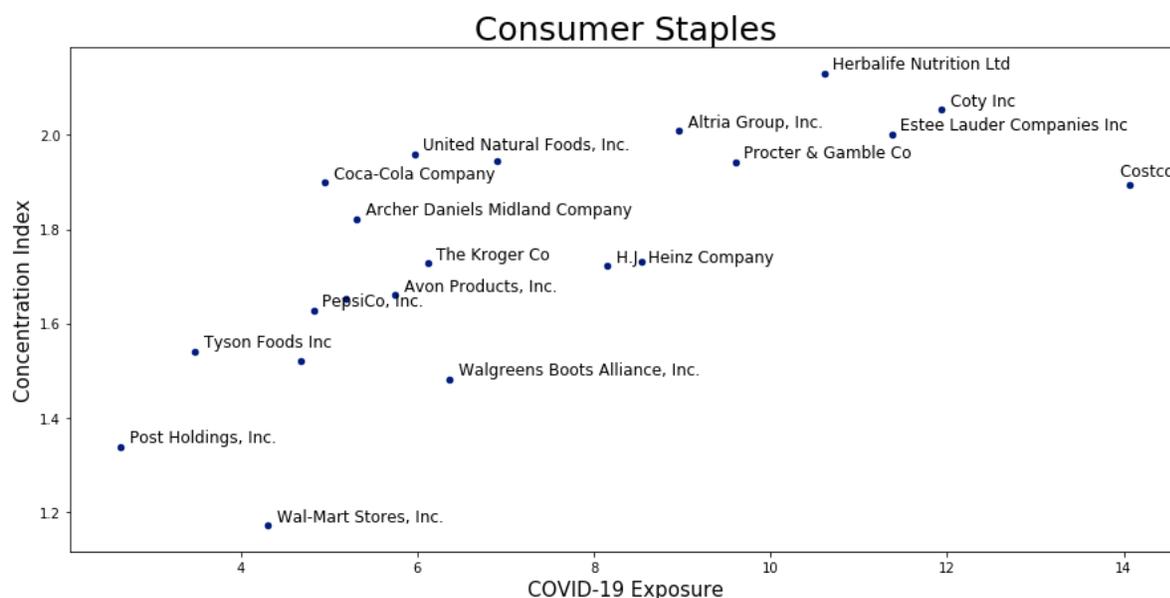
Although KKR has the greatest exposure to COVID-19, there is more cause for concern for Morgan Stanley and Goldman Sachs because KKR is organized around a distributed workforce.



Bristol-Myers Squibb is the most exposed of the healthcare companies, but none of them particularly stand out as both exposed and concentrated. If the virus continues to spread to new locations, Eli Lilly could move more to the right, putting it at greater risk than Bristol-Myers Squibb.



Although communication is a broad industry, there are useful subgroups within the industry that reveal significant distance. AT&T and Verizon, for example, have markedly different exposures. The same can be said for News Corp and CBS, or for Facebook and Twitter.



Consumer Staples companies reveal an interesting positive correlation between exposure and concentration. Although this is likely coincidental, it provides a clear signal for where to be optimistic and pessimistic. Costco is much more at risk, whereas Walmart appears to be far more protected, despite the companies having the outward appearance of being similar.

As the crisis continues to unfold, it will be interesting to track how these vulnerabilities will evolve. Beyond the impact on specific companies, there could be enormous transformations to the broader economy and business practices.

The COVID-19 pandemic could be an impetus that forces companies to reconfigure how they are organized. It will not be an easy transition and we should expect massive adjustment costs in the short term. In the long term, a decrease in the friction of remote work will increase the returns to offshoring and cross-border interaction.

These changes will also decrease the returns to agglomeration, which could slow the rate of global urbanization. However, a slowing rate of global urbanization should be cause for concern.

Urbanization led to unparalleled investment in human capital, fewer carbon emissions per person,

and significant improvements in governance. While the positive externalities of cities should not be overlooked, we have yet to experience broad-based growth in secondary and tertiary labor markets in recent times.

In these times of fear and apprehension, we hope to learn more about how businesses adapt to shocks. We hope that, despite the tragic circumstances, businesses will take the opportunity to become more resilient to withstand what is sure to be a turbulent economic future.