

Office Demand and Remote Work: Analysis and Projection

April, 2020

Summary

Almost everyone in the real estate world is considering the long-term ramifications of COVID-19. One topic under discussion is the current shift to work from home (WFH) or remote work. Will this change how people work after the crisis abates? How will an increase in the amount of WFH change the way organizations consume office space? In a recent article in Forbes--quoting a Gartner Group survey of CFO's--there were some dramatic aspirations put forward: those surveyed saw great opportunities for cost savings by making the temporary status permanent for some of their workforce.¹

It is undoubtedly the case that work will change after COVID, and highly likely that workers who become accustomed to the flexibility of working from home will wish to maintain that flexibility. It is also highly likely that CFO's around the country will want to continue to reduce costs! However it is the thesis of this paper that the translation of these two desires into a significant reduction in office demand is limited by the fundamental nature of employee demographics and the nature of office leasing. To summarize the points in the paper:

1. High-status employees (executives and senior managers) have already had flexibility to work from home, and have been doing so since the 1990s. Their WFH will only change demand *going forward* when these employees **give up their workspace permanently**, which executives are unlikely to do for a variety of reasons.
2. Administrative and clerical employees, particularly those that are *database connected*, **have already been consigned to WFH** in large measure for cost avoidance and productivity reasons, a change again that happened in the late 90s and early 2000s. These employees also, in general, take up the smallest amount of space in the organization and therefore have the smallest impact on demand when shifted.
3. This leaves "professional staff" as the greatest opportunity for demand reduction. These creative professionals, staff attorneys, programmers, and scientists are the group that stands to gain flexibility in where they work. However, this will *only* result in a significant reduction in demand if these employees either (as above) give up their workplaces permanently, or if they **adopt hot-desking or hoteling arrangements for their space**. While this is possible, many countervailing forces will work against chang-

1. Ezequiel Minaya, "Cfos Plan to Permanently Shift Significant Numbers of Employees to Work Remotely — Survey." *Forbes* April (2020): <https://www.forbes.com/sites/ezequielminaya/2020/04/03/cfos-plan-to-permanently-shift-significant-numbers-of-employees-to-work-remotely---survey/#463e7441575b>.

ing the fundamental interaction between these (extremely mission-critical) employees and their workspace.

4. Even if the major shifts described in 1. or 3. occur, these changes can only affect office demand if organizations a) wait until **lease expiration** or b) **sublease** their space and relocate to smaller space. The decision to sublease is heavily influenced by **transaction costs**, which impose a lower bound on the decision. Both of these choices will be **phased** over a significant time horizon, thereby lessening any impact on demand in the immediate aftermath of the crisis.
5. Finally, there are emerging countervailing trends that must be considered post-COVID. These include an **increase in space standards** that might follow from social distancing (and a possible health concern around hot-desked space) as well as a possible **reduction in demand for co-working spaces**, which have the highest density of any office use.

This paper acknowledges the fundamental nature of the shift likely to be seen in workplace behavior post-COVID, but describes the mis-match between an future increase in the percentage of days working from home and the percentage of demand reduction that results. This projection is made with one important caveat, which is that a fundamental shift to hoteling ("no fixed address") would change the game dramatically, since a workforce without a designated space could compress more completely than one in which employees retain some fixed accommodation. In the author's opinion, such a shift is extremely unlikely given human nature and the many unsuccessful attempts to make hoteling work. This paper sub-divides the workforce into categories based on Bureau of Labor Statistics, and attempts to make assumptions about how much space each group occupies, and what are the likely consequences on space use of increased working from home. The approach is probabilistic, with distributions estimated around key parameters, and the model employs Monte Carlo methods to evaluate probable outcomes. The models' output suggest that reasonable expectations in increased working from home might result in demand reduction of 4-6%, which although extremely significant is far below some of the apocalyptic predictions being made by academics and the business press.

Introduction

As we all think about the implications of COVID-19 and the term “social distancing” becomes a part of our everyday lexicon, we should consider how education, government, and work are likely to change. Many people have already begun to hypothesize a permanent increase in working from home, and have considered how this might effect office space demand over the long term.

This is the first part of a data-driven white paper on the impact of increased amounts of remote work on office demand. Our organization SquareFoot has its primary focus on the **demand side** of the office space equation, unlike the majority of office professionals who focus on the tangible product: office supply.

This paper will *not* concentrate on many of the potential benefits of remote work which have been researched, such as increased productivity, lower absenteeism and turnover, improved employee morale, reduced travel, and lowered environmental and infrastructure impacts. It will instead focus on the *narrow topic of real estate cost savings*, which has long been a “given” in descriptions of remote work, and the effect of those savings on demand.

Savings factor (based on half-time telecommuting)	Assumed decrease with half-time telecommuting	Savings estimate for 3.9 million existing half-time telecommuters	Savings estimate for 62 million potential telecommuters
Productivity	15%	\$27.5 billion	\$436 billion
Real estate	25%	\$7.6 billion	\$121 billion
Absenteeism	31%	\$5.1 billion	\$81 billion
Voluntary turnover	10%	\$1.5 billion	\$24 billion
Continuity of operations	1 day/year	\$1.7 billion	\$27 billion
Total employer savings		\$43.6 billion	\$689 billion

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BLE 1: SAVINGS THROUGH WFH

The real estate savings number most found in the blogosphere attributed to converting to remote work is **\$10,000 per employee**; a material amount. However, like most numbers out on the inter-webs, this is one of those “off-repeated, must be true” numbers that is seldom examined.²

Above is a provocative chart from Global Workplace Analytics³ that shows savings

2. remoters, “Remote Work Trends for 2020: The Present & Future of Remote Work.” (2020): [:/remoters.net/remote-work-trends-future-insights/](https://remoters.net/remote-work-trends-future-insights/).
3. Kate Lister and Tom Harnish, “2017 State of Telecommuting in the Us,” *Global Workplace*

from 3.9 million existing, half-time “telecommuters” of \$43.6 billion. This number is dwarfed however, by the savings estimate of **\$689 billion** for the **62 million** potential telecommuters. Can this be real? And if it is, should we all be selling our REIT shares and buying lakefront property for our startup?

Space Savings

Remote work can reduce office demand in two basic ways, both of which involve saving space. The first involves a fundamental change: **permanently giving up your dedicated space at work**. No office, no assigned cube, no defined place at the bench. The second involves a number of employees rotating through workspace⁴ in some form of **hot-desking** or **hoteling**. Here is a good description of hoteling from a 1998 *Harvard Business Review* article by forward-thinking industry expert Sandy Apgar⁵:

...“hotel” work spaces are furnished, equipped, and supported with typical office services. Employees may have mobile cubbies, file cabinets, or lockers for personal storage; and a computer system routes phone calls and E-mail as necessary. But “hotel” work spaces are reserved by the hour, by the day, or by the week instead of being permanently assigned. In addition, a “conciierge” may provide employees with travel and logistical support. At its most advanced, “hotel” work space is customized with individuals’ personal photos and memorabilia, which are stored electronically, retrieved, and “placed” on occupants’ desktops just before they arrive, and then removed as soon as they leave.

Quoting this article serves to make the point that this vision has been around for more than two decades. Despite that, these concepts have been far less impactful than—for example—open plan office, which has dramatically altered how space looks and functions.

Hot-desking can come in an infinite variety of permutations, so for the purposes of this paper, we will focus on one simplifying example: the **4->3**. This means that four employees rotate, and occupy three workspaces. Why choose this rather than some other metric? It makes the numbers easy and illustrates the fundamental point. When this occurs, demand along those employees goes down by 25%, all other things equal.

The third issue we should mention is the effect of countervailing real-estate-related costs, including increases in space for meetings or training, and other corollary costs. We won't be examining the last in detail, but it's a factor to include in our mental

Analytics (2017).

4. This is our generic term for offices and positions in open plan space, which includes cubicles and benches.
5. Mahlon Apgar, “The Alternative Workplace: Changing Where and How People Work.,” *Harvard Business Review* 76, no. 3 (1998).

map of remote work.

How and when do people permanently give up dedicated space? And when do they not? To understand this, we need to consider the relationship between remote work and **status**.

Status

Executives and Managers

Many of the first adopters of remote work were executives and senior managers who valued the flexibility and reduction in commute time. Since—to a significant degree—those people set institutional direction, their organizations responded in the second half of the 1990's by providing the ability to “work from home” for some number of days during the week (for example Fridays in the summer). This “bias” in favor of executives has persisted, as illustrated in the following table⁶ which pulls out just the occupations most likely to consume office space:

Percent of Workers Who Work At Least Some Full Days From Home, by Occupation	
Management, business, and financial operations	30.9
Professional and related	23.6
Sales and related	15.9
Office and administrative support	9.7

Source: Bureau of Labor Statistics

TABLE 2: WFH PERCENTAGES

About a third of all executives and managers have the ability to work from home for some portion of their month. This is in part a hangover from the origins of remote work in the beginning of the 1990's.

In the earliest stages of remote working, there were significant IT costs associated with setting someone up for remote working, including a second computer at home, upgrades to the telecommunications infrastructure—in both the home of the employee and in the office—and changed IT procedures, policies, and software tools. It should not come as a surprise that the first adopters were also the most highly compensated employees. Stanford Professor Nicholas Bloom includes this chart in his

6. Bureau of Labor Statistics, “Job Flexibilities and Work Schedules Summary,” (2019).

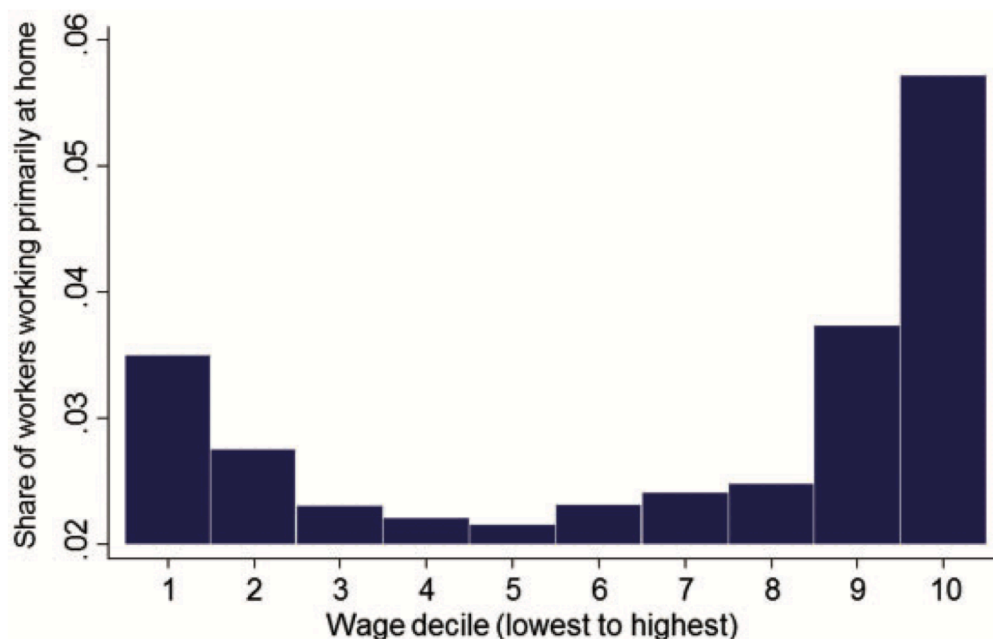


FIGURE I

In the United States Working Primarily from Home is Relatively More Common for the Highest and Lowest Wage Deciles

FIGURE 1: WAGES AND WFH

It is an almost universal constant that managers have larger space standards than lower-titled staff. (We here at SquareFoot are an exception to this rule: everybody's equal!) One would therefore expect that the impact on office demand would be out of proportion to the percentage of employees doing remote work. However, both logic and data contradict this idea, because:

Demand changes when someone permanently gives up their space.

Executives, despite their desire for *flexibility* and *balance*, are also in general unwilling to relinquish their space on a permanent basis. Of course, there are exceptions to this since some companies are completely virtual and some executives feel an imperative to lead by example. However, the number of these companies (at scale) is relatively small. FlexJobs, a web-based employment agency publishes data on **170** fully virtual companies in the US⁸. An impressive number, on some level, but when considered relative to the number of US companies, tiny.

Without *full* virtualization, it is hard to imagine that a large percentage of organiza-

7. Nicholas Bloom et al., "Does Working From Home Work? Evidence From a Chinese Experiment *," *The Quarterly Journal of Economics* 130, no. 1 (2014):.

8. Susan Caminiti, "The Dream Job That's All the Rage Across America." (2018): <https://www.cnbc.com/2018/04/03/virtual-companies-answer-demand-for-better-quality-of-life.html>.

tions would feature some employees possessing permanent space while at the same time CEO or their manager drifts between locations with no “there, there.”

This is confirmed by analyzing the BLS data:

Percent of Workers Who Work Five Days per Week From Home, by Occupation	
Management, business, and financial operations	12.8
Professional and related	14.3
Sales and related	16.0
Office and administrative support	15.6

Source: Bureau of Labor Statistics

TABLE 3: WFH FIVE DAYS PER WEEK

While almost a third of executives/managers work at home some of the time, only around 12.8% of those work at home five days a week. This means that only 3.9% of this occupational grouping work from home full time. It is possible that these jobs cluster in **financial operations** rather than general management.

This data does not state *explicitly* that these jobs don't retain workspaces, nor does the data indicate whether those functions work remotely five days per week, but still get into the office **occasionally**. That occasional time in the office, not tracked by BLS, might require a ongoing (albeit mostly empty) dedicated workspace. Who is going to tell the CEO or the CFO that she has to give up her office to save expense?⁹

Database-connected Workers

At the other end of the compensation and title spectrum are “database-connected” workers, a term that loosely describes employees whose job (in significant measure) is to update or interact with databases. This includes contact/call center staff, travel agents, and sales support people (these categories all overlap and the term is somewhat ill-defined). There are several thoughts to consider about these employees. (All of these points are generalizations with exceptions, but perhaps accurate overall):

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9. One interesting observation about this data is that the numbers for all occupations seem roughly similar. This might be because some organizations have become completely virtual, which within the reduced universe of employees that work from home (still only 14.7% of total workers) these completely virtual companies have a disproportionate effect on the data (since within that set everyone would be 100% in the above chart).

- ◆ Their positions **don't** require frequent staff meetings and internal discussions.
- ◆ They interact with **customers** through the phone or online, and don't need places for F-T-F interaction.
- ◆ Their **productivity** is easy to measure, which makes remote management easier.
- ◆ Their **schedules** are flexible in the sense that their workload can be reallocated readily to others, meaning that a combination of remote work and in-office work (say onboarding and training) can be optimally arranged.

Professor Bloom and his team conducted research on this group, and described their conclusions in *Does Working From Home Work? Evidence From a Chinese Experiment*. This remarkable two-year study is often cited in research and posting on remote work.

One of the key problems with assessing any aspect of productivity in the built environment is the difficulty of creating a controlled experiment. Many research studies therefore concentrate on things like self-reported satisfaction or use inferential measures such as absenteeism to determine the impact of workplace design.

Bloom, on the other hand, was presented with a unique opportunity to create a rigorous controlled test of the effect of remote work in a Chinese travel company called Ctrip.

Bloom and his team began the study by soliciting 996 employees who would be willing to work from home; of those 503 agreed to participate and they were split randomly into two groups. The travel agency call center being studied was database-connected, allowing a remarkable amount of data on work activities to be extracted and analyzed *post hoc*.

In summary, Bloom found a sizable increase in productivity: 13% among the remote workers relative to the control group. After the experiment concluded, the CEO of the firm allowed all of their 16,000 employees to choose their work environment. When the experimental group was allowed this choice, approximately half of the 503 employees reselected the opposite choice, resulting in an even more remarkable 22% increase in productivity from the (now) self-selected group of at-home workers.

While this research is a ground-breaking piece of work, its conclusions on the question of reduced *office demand* are not as convincing as the productivity data analyzed. Here is the section (from the Online Appendix) on real estate:

Capital costs: The head office property is valued at approximately \$100m and houses 4000 employees, yielding an office cost of about \$25,000 per employee. While call center workers might be expected to use less space than the average employee, they do make up almost half the workforce. In any case, the firm used this figure in its estimates and budgeting. Assuming the capital cost for property is equal to the rental value – typically 5% of the property value in

Shanghai – this yields an annual employee property cost of \$1250. This will be reduced in two ways by WFH. First, office space per employee is reduced pro-rata to the number of days spent at home (4 out of 5 days per week) since the day WFH employees spend in the office is evenly distributed through the week and employees can hot-desk. Second, since for employees working at home, their output is 13% higher, the firm requires 13% fewer employees. Collectively this reduces office space requirements for WFH employees by 83%, saving a total of around \$1020 per year. Since Ctrip was actively expanding and hiring more employees and renting out additional office space, this saving from space was quickly realized¹⁰.

The calculation of total real estate cost seems very understated, since it derives directly from the value of Ctrip's building (hard to assess where this fits into the property value continuum). The use of a **5% yield** to compute costs also seems overly simplistic, since commercial landlords and financing institutions demand return on their time and money. The study also avoids addressing specifics of square footage per employee, only noting "they do make up half the workforce."

The second assumption in their analysis is much more suspect. They presume that the employees converted to at home work for four out of five days will yield a pro-rata reduction in office space utilization of 80%.

The boldness of this assertion is damped by the unrealistically low estimate of occupancy costs. If rents were, say \$100 per foot (nominal for Shanghai) and employees occupied 100 square feet per employee, the work from home savings projected would jump from \$1,250 to \$8,000, which exceeds even the most enthusiastic research estimates.

This ratio would be hard to achieve in real world settings for at least three reasons. (While these reasons are focussed on Bloom's study, they also apply more generally to problems of going "partial" to other firms trying to assess the implications of remote work on office space utilization).

First, it is scheduling impossibility to get a "20% segment" to show up on the exactly the same day each week, week after week. Breaking up the in-office time in that way would require, for example, that the organization repeat training several (5?) times rather than once or twice, presuming that the training required some in-person venue¹¹. For any practical level of scheduling, there will be more than 20% of the workforce showing up at one time, making that 80% reduction impossible to achieve.

The **second** reason is that any of these solutions require *hot-desking* or *hoteling* procedures in order to be successfully implemented because even 1-out-of-5-day work-

10. Bloom et al., "Does Working From Home Work? Evidence From a Chinese Experiment *."

11. If *all* activities such as training could be virtualized then the 1 out of 5 days in the office probably isn't needed.

ers cannot share workspaces easily without these procedures. Files, personal artifacts, and clutter all make undesirable to have “semi-dedicated” workspace. Hot-desking means that **nobody** has a fixed position, and in all likelihood some reservation system would be necessary to avoid chaos that would result if there were 120 employees in an office with 100 positions. By implementing hot-desking some percentage of space could undoubtedly be saved, but the threshold would be the **largest** percentage of the workforce that shows up on any given day, plus some safety factor. This post from *Management Today* illustrates some of the challenges with this kind of work¹². No matter how much effort (and cost) is expended, there is going to be much less than a 100% efficiency, which is generally managed by the simple expedient of having more positions. For example, if once a week (or one a month) 50% of the remote workers have to come into the office to work, space savings might be that minus 10-20% for contingency.

Finally, let's presume that hoteling and hot-desking have been implemented, and the employee brings her laptop from home, connects to WiFi, and is working smoothly. Experience with these methods has shown that there are several *countervailing forces that drive space utilization up*.

Conference and meeting rooms, training centers, collaboration spaces and storage areas for personal files all increase. In many cases the change-management process that overcomes employee dissatisfaction with a nomadic work style involves “compensating” people with additional physical amenities such as kitchens/pantries, lounges, etc. This will certainly will be the case if one were to implement this concept with more highly compensated employees such as programmers, web designers, graphic artists, and digital marketing specialists.

As a final thought: since the remote work paradigm shift has been going on for more than two decades, many of these logical database-connected jobs have already been converted (and were in fact converted a decade or more ago).

Today's Professional Workforce

While the modern, millennial, highly-educated workforce values flexibility, reduced commute time, etc. in much the same way as their boomer-executive predecessors did in the the late 90's, they are probably not going to enjoy a regimented schedule for in-office work, the complete lack of “place” that comes from hot-desking, nor the necessity to have to “book” their space that comes from hoteling. Even in our millennial-intensive offices at SquareFoot, people have assigned places and customize them extensively to suit their personal style, as is human nature.

12. Peter Ames, “Hot-Desking: Hot or Not?” (2015): <https://www.managementtoday.co.uk/hot-desking-hot-not/article/1334680>.

Conclusions on Status

- ◆ Executives and managers enjoy the greatest flexibility in terms of at-home work, but they regard it as a perquisite *from*—and not a predicate *to*—their employment.
- ◆ Executives and managers will generally be the last ones to give up their offices or workstations fulltime and work entirely from home, for reasons having to do both with their job function and their status. This threshold probably gets passed when a very large percentage of the workforce has gone virtual, which for many organizations especially in major urban centers whose appeal is “bright lights, big city” is probably quite some distance in the future.
- ◆ The biggest opportunity for space savings might come from the “professional” class, which currently has a great deal of flexibility, occupies a large percentage of office space, and might not be able to insist on a fixed workspace.
- ◆ The database-connected employees who are the logical candidates for full time remote work occupy the smallest amount of square footage (and thereby effect demand the least by at least a factor of three relative to their managers).
- ◆ Many of those database-connected employees have already been moved to remote work.
- ◆ There are logistical challenges that make the idea of “pro rata” reductions in square footage unlikely, and might even support a lower ratio than the 25% frequently proposed as real estate demand reduction. A future paper will discuss a possible modeling exercise to help sharpen this number across a cross-section of employee types.
- ◆ Younger, highly-educated employees might not consider a private office as a benefit, and undoubtedly will enjoy the flexibility, reduced commute time, and agency that comes from working at home occasionally and on their schedule. They are likely **not** to enjoy having no “fixed address” or having to battle with a reservation system/protocol in order to find a place to work, and will respond to organizational attempts to reduce space by requesting “amenity space” that will offset some of the potential savings from the hot-desk or hoteling model.

There is another reason that office demand will not change as dramatically as one might suppose, and that is the nature of contracting and the negative consequences of transaction costs, the subject of the next section.

Contracting and Transaction Costs

Let's consider an organization that has decided for a variety of reasons and goals to change its remote work/WFH policies. What happens next?

In the most simple and probably most common case, the organization *waits for its lease to come to an end* and then relocates to smaller space reflecting the reduced need. Given that leases in NY have a term of 5-15 years typically (which is changing but has not completely changed), the average term remaining on a lease is 2.5 to 7 years. While these remote work transformations are most likely to be implemented on the shorter end of the scale (why consider them as a potential source of real estate savings with 10 years left on a lease?) there will still be a lag between decision and implementation of reduced space utilization.

How about *subleasing and relocating*? There are two considerations here, time and money.

After the strategic decision has been made to implement a broader remote work program, there are training and change-management problems that need to be solved. The Bloom study is instructive, since it was a two-year project from start to conclusion, including definition of the scope, selection of the participants, etc. Perhaps three to six months would be likely for a smaller project. The sublease process also takes time: to find an acceptable tenant and to find a space to move to. Both ends of the transaction require some search, some negotiation, and perhaps some construction. While a lot of this work will be concurrent, there will still be a material lag between when the project is commenced and when the move-in has been accomplished. A detailed model of this process will come in a later paper, however we can conclude even without a model that there will be a significant lag between “lightbulb” and move-in.

The second sublease consideration is the effect of transaction costs on the subleasing decision. As well as being a headache for management, subleasing space requires the payment of commissions, the provision of free rent or cash, and the likelihood that the short term available to the sub-tenant will result in a significant discount to market on the rent. Would a reduction of 10% in the space (post relocation) justify this? **Unlikely**. Perhaps **25% or more** would spur this decision. With less of a space saving opportunity that, an organization might wait until the lease expires, as described above.

It should be noted that SquareFoot has a product called PivotDesk which will simplify this process and improve the economics. <Insert Link>

The following diagram illustrates this system:

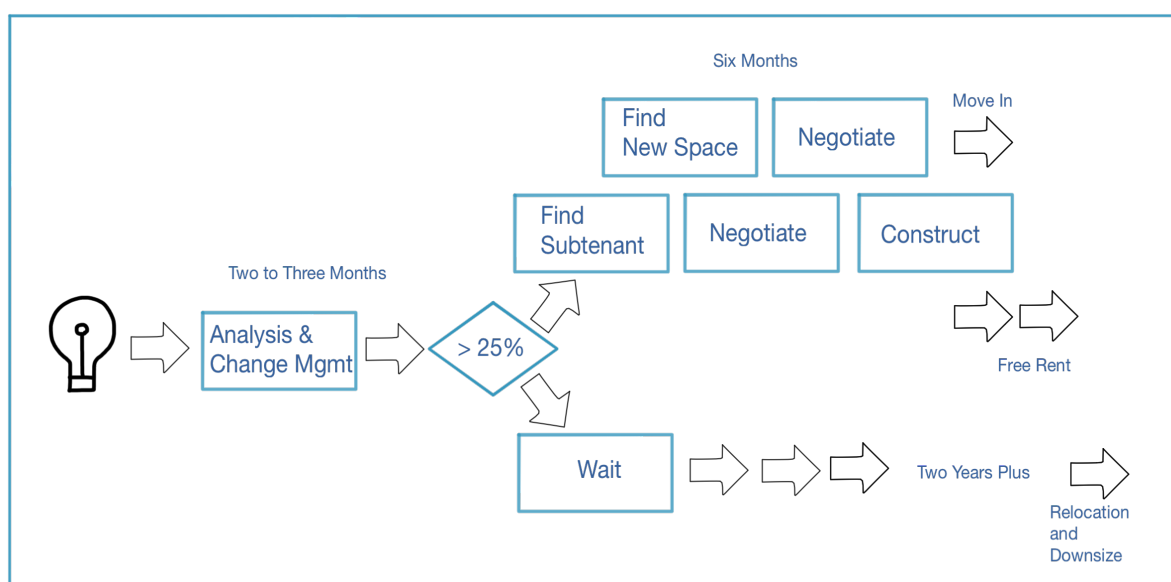


FIGURE 2: PROCESS TO DOWNSIZE

What the diagram implies is that the effect of any significant reduction in actual office demand (if it occurs) will be distributed over a period from somewhat less than a year to several years.

Contracting and Transaction Costs Conclusions

The office leasing market is a complex system. Unlike some other economic quantities--like equities--office space supply and demand reach equilibrium very slowly, either in macro or micro terms. Largely inflexible contracting terms and significant transaction costs create a significant lag in demand changes, despite the ability of a small to mid-size firm to pivot its worldview, and its strategy, in response to a crisis or dramatic change in employee preference.

The supply side responds slowly for some of the same reasons, since landlords are bound by contractual obligations and are reluctant to lead the market with price changes. While most writing on real estate supply focuses on new construction, a larger portion of the overall supply response is the increase or reduction in available sublease space, which can fluctuate over a (relatively) rapid six-month window.

From a tenant's perspective, however, an attempt to sublease space involves both a search for a new (presumably smaller or less expensive) space, as well as the search for a sub-tenant. Approval processes and negotiations are also slow. Even those the processes of disposition and acquisition can be run somewhat in parallel, there is still a significant lag between decision and demand reduction, and many transactions that might be executed in a world without transaction costs are stymied by their existence. A future article will examine the dynamics of the WFH, sublease, and relocate system.

Simulation Modeling of WFH and Office Demand

Model Description

To get a deeper understand of the potential impact of a significant increase in the availability and appeal of working from home, we have constructed a simulation model that can produce probability distributions for various scenarios. The model relies on the BLS data structure and begins with their data as a start point for the model.

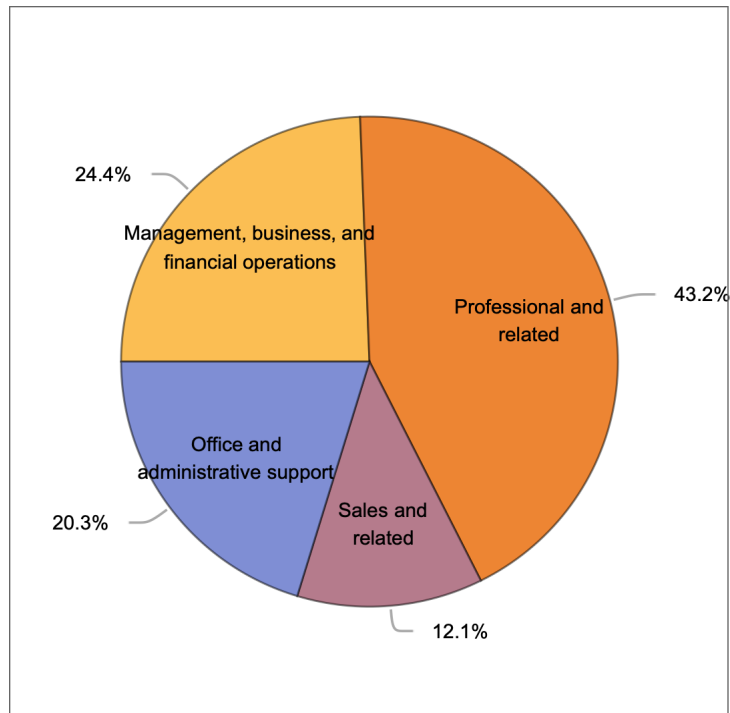
Data Description: Occupational Categories

The BLS provides many levels of occupational categories, but our concern is with the highest level, and with the categories most likely to reside in an office. These are:

- Management, business, and financial operations
- Professional and related @examples
- Services

- Sales and related
- Office and administrative support

These categories represent approximately 93 million jobs, which is around 81% of the total number of jobs in the BLS data. These "office using" jobs were then normalized to 100%, as seen in the following figure:



Percentage of Office Workers by Occupational Group

FIGURE 3: OFFICE WORKERS BY OCCUPATION

Data Description: Days WFH

The model compresses the BLS "work from home full time" into four categories:

- One or fewer
- One to two
- Three to four
- Five or more

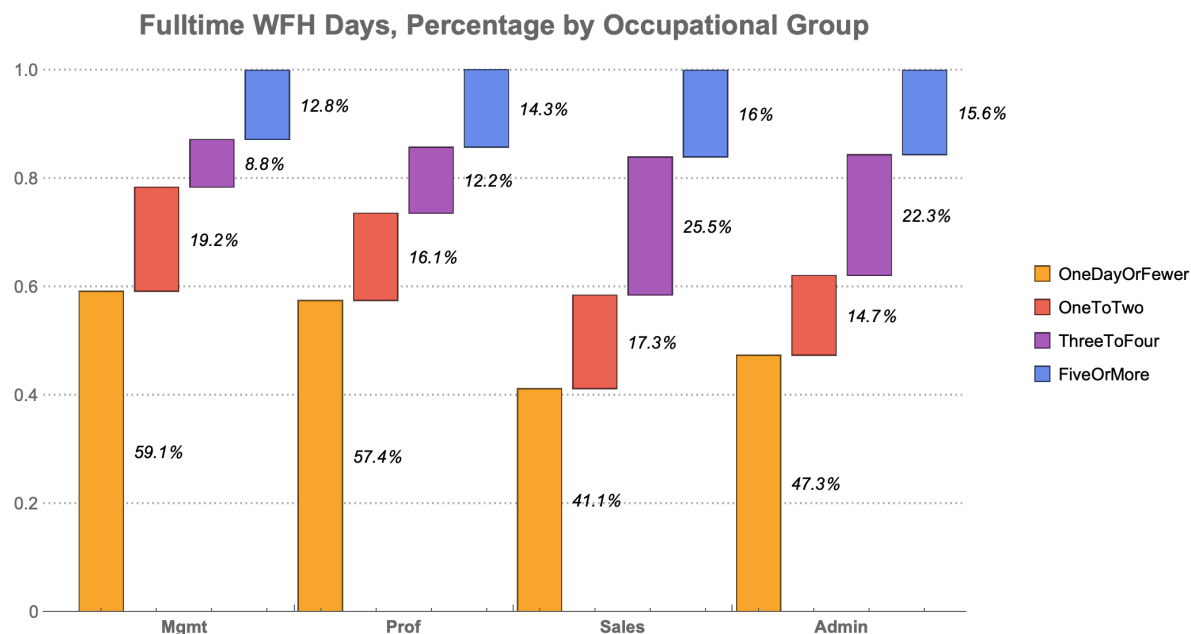


FIGURE 4: FULLTIME WFH BY OCC

The model uses these two sets of data to simulate 10,000 "employees" with occupations and days fully worked from home. These simulated employees are then assigned square footages based upon industry norms for their categories. These square footages are assumed to be normally distributed, as can be seen in this set of histograms:

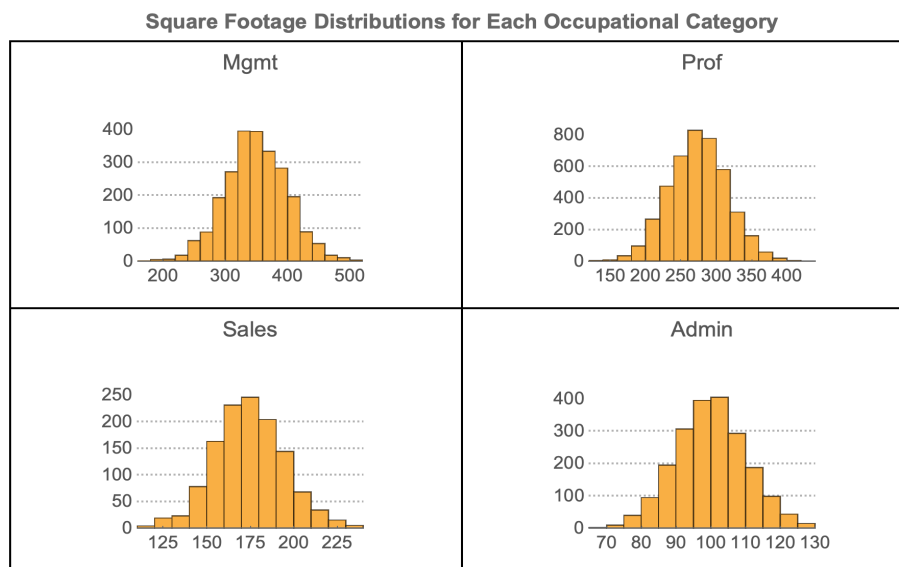


FIGURE 5: SQUARE FOOTAGE HISTOGRAMS

Next, these employees were grouped into "companies" of around 100 employees each, producing around 100 companies (the number of employees ranges uniformly between 80 and 120 in the simulation). The average square footage of these companies is around 23,000 sf.

Sensitivity Analysis

This analysis is solving for the effect of a significant change in WFH. In order to do this most effectively, the analysis looks at situations where "employees" are working from one ThreeOrFour days per week, because those working fewer days would have a harder time radically changing their work habits.

The analysis also leaves out those already working from home FiveOrMore days per week, on the logical assumption that those employees either: a) have already impacted the office demand, or b) have had a real reason for maintaining their office space despite already working from home five or more days per week.¹³ Only the final simulation considered the impact of executives working from home and dispensing (or radically downsizing) their office space.

The model was tested with two different sets of sensitivities. The first simulation examined three job categories being moved to a hot-desking environment: the Professionals, Sales, and Admin categories. This simulation used the industry-norm of 25% efficiency: in other words that each four employees would rotate through a set of three desks based upon a hoteling or hot-desking model.

13. Of these two assumptions, the former is more likely than the latter to apply, but in either event greater convenience or access to WFH probably has very little impact on office demand.

Sensitivity 1A Results:

The second sensitivity eliminated the Sales group, on the assumption that most sales-people who are working ThreeToFour days out of the office are likely to retain their office space despite an increase in WFH.

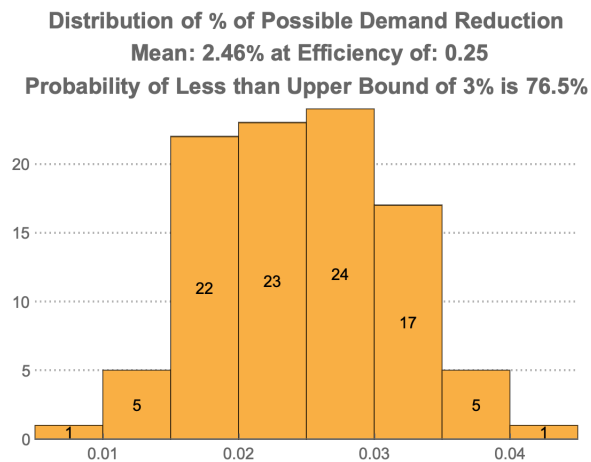


FIGURE 6: DEMAND REDUCTION: SCENARIO 1A

Sensitivity 1B Results:

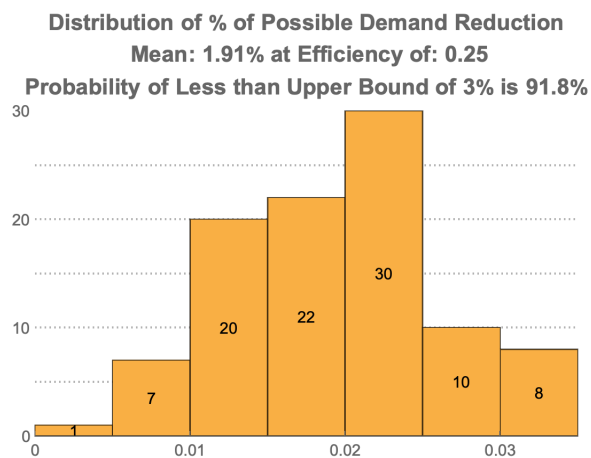


FIGURE 7: DEMAND REDUCTION: SCENARIO 1B

The second pair of sensitivities discards the 25% efficiency assumption and examines a range of values based upon a truncated normal distribution with a mean of 50% and a standard deviation of 75%. This produces a probability distribution function that looks like this:

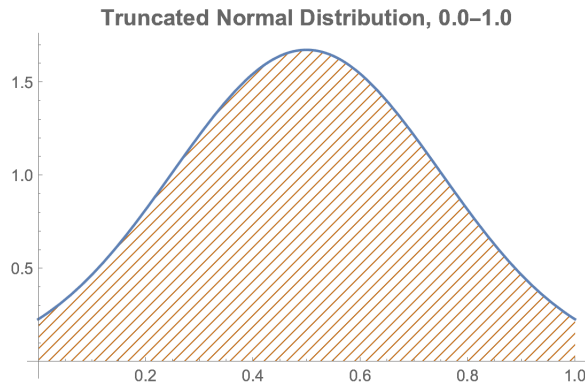


FIGURE 8: DISTRIBUTION OF SPACE SAVINGS

This truncated distribution puts around 71% of the "efficiency" between the 25% used above, and 75%, in which every four employees would share a single workplace.

In keeping with the first pair of sensitivities, the second pair begins with three non-executive categories (Professional and Admin). The subset of these two groups which currently works from home three or four days per week and in the simulation would (on average) cut their office demand by half would provide of stress test of what would be a significant shift in the work environment.

Sensitivity 2A Results:

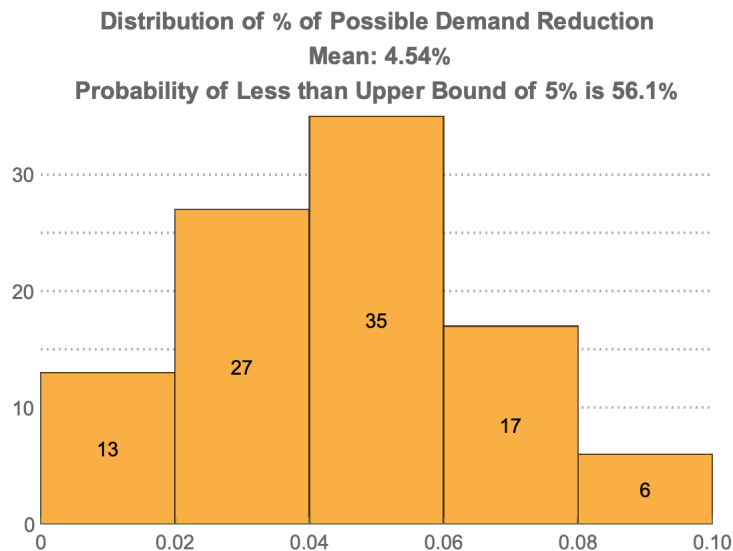


FIGURE 9: DEMAND REDUCTION: SCENARIO 2A

This run provides larger opportunity for space compression, with overall office demand reduced almost five percent: while this still seems relatively small in comparison with what might be dramatic reductions coming from WFH, it is important to note that a five percent reduction in demand would dramatically alter the land-

scope for office rents and office building values in any market.

The second sensitivity adds executives to the mix, again focusing on those currently working at home three or four days per week. This pushes the mean demand reduction in the simulation over six percent, the upper bound for the simulation; this would be a significant change in demand and might be a harbinger of significant structure changes

Sensitivity 2B Results:

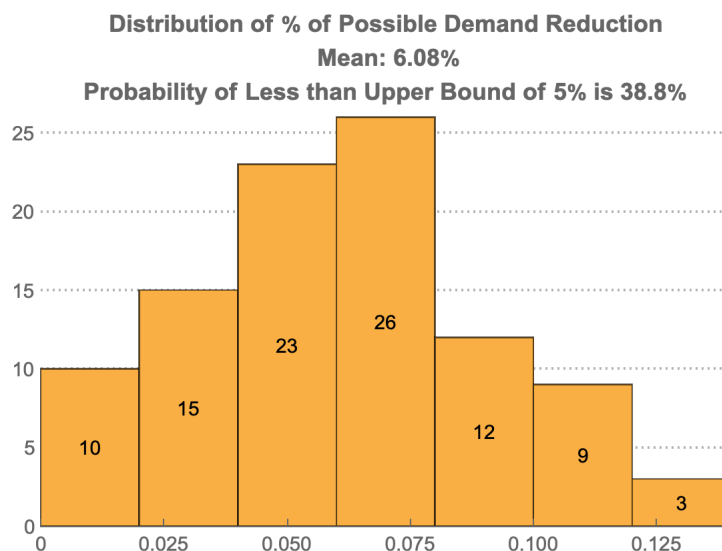


FIGURE 10: DEMAND REDUCTION: SCENARIO 2B

Conclusions and Considerations

Executives

What explains these results? First is the assumption that executives will probably retain their square footage despite a possible increase in access to, and preference for, working from home. The managerial responsibilities of this category mean that executives need to have confidential meetings and one-on-one conversations with the managers and middle managers that direct groups within the company. Even if an executive chooses to work exclusively from home, it is unlikely that such an executive would give up her office while other in the organization would continue to have theirs. The exception would be a purely virtual company; and while there are hundreds of these organizations--and perhaps more in future--they still represent a tiny fraction of the US total.

These executives represent just under 25% of the workforce, but approximately 35% of the total square footage, which in three of the four simulations remains as a con-

stant component of demand.

Professionals

While professionals who work from home one or two days a week might be converted to three or four days a week, this will only have an effect on demand when their office space is *surrendered*. What percentage of professionals will be willing to give up their permanent positions in favor of some sort of rotational office occupancy?

Even enthusiastic proponents of the "WFH future" acknowledge that this conversion will have a limited amount of impact on office demand, with a 25% reduction being a frequently-employed estimate. A simulation of this scenario (including other job categories) yielded office demand reductions of a few percent.

The second pair of simulations encompassed two 50% *mean* WFH scenarios. The first included Professional Staff, Sales, and Admin all increasing their level of working from home and reducing their office demand, with most of the probability centered on 50% with almost three quarters of the simulation runs testing between 40% and 75%. The second (most radical) scenario combined these occupations with Executives. This begs the question as to whether a significant increase in executive WFH would get them to give up the office space they have retained throughout waves of space downsizing.

This diagram gives an overview of the analysis undertaken:

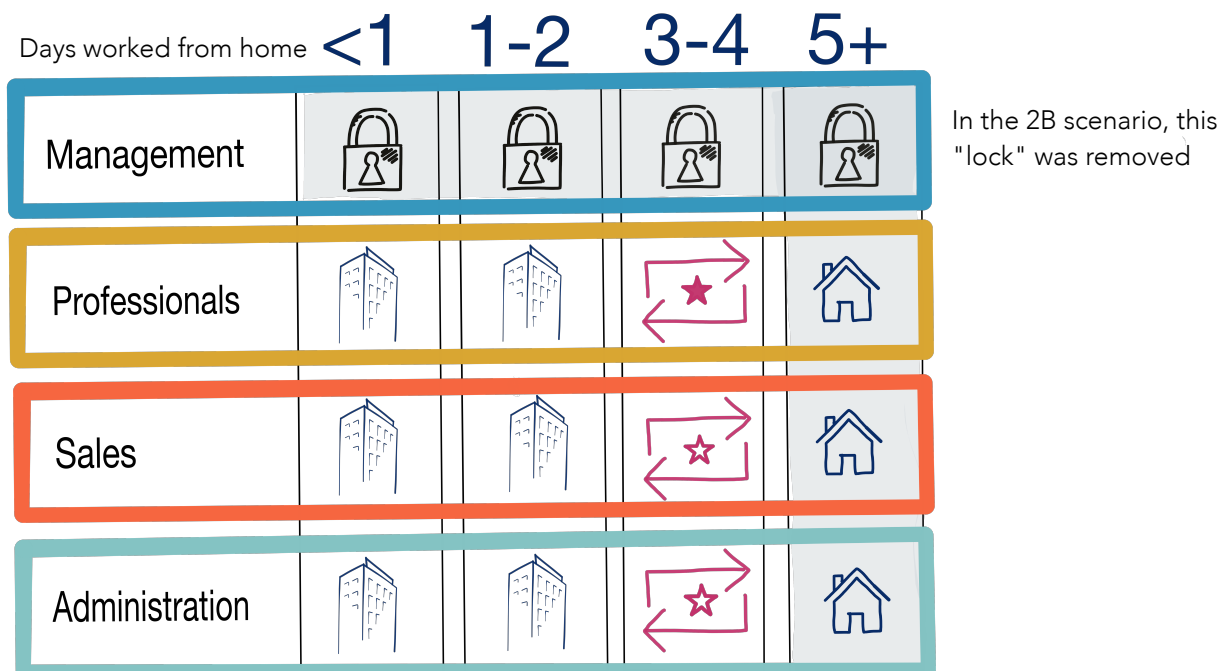


FIGURE 11: OVERVIEW OF THE STUDY

General Observations

Behaviors will undoubtedly change as a result of COVID and its aftermath. It is possible that the overall amount of working from home will increase substantially. Some workers who have not up to this point been allowed to work from home will be encouraged to do so, and their organizations will support through upgraded technology. Others who have worked from home a day or two per week will possibly find that it suits them, and will convert to three or four days from home, coming in for the Friday team gathering or training session.

There are also forces pushing in the opposite direction, including a possible move away from the "densification" trend that has been ongoing over the last decade. Janet Pogue-McLaurin, a principal and workplace leader at Gensler stated this very simply: "Densification will take a hiatus."¹⁴ Designers and architects are already re-thinking the appropriate dimensions for benched workspace and the shape of workstations. When that fellow on your left on the bench begins to sneeze, will you hand him a tissue or request re-assignment?

A second consideration involves co-working spaces. One of the fundamental economic drivers for co-working has been the higher density that their planning achieves. If an office floor that housed 100 people can be made to house 300, that increase provides a great margin for organizations such as WeWork. If co-working companies scale back, either reducing density or having fewer clients, either change will result in (effective) increases in the ratio between employees and office space. It's way too early to calibrate these effects, but they are likely to happen and will--to some degree--offset any WFH demand reduction.

While all of these changes would have knock-on effects, ranging from reduced traffic and emissions to increased requirements for bandwidth in cities and elsewhere, they are unlikely to change office demand significantly until either executives make the decision to give up their space permanently, or professionals are willing to shift from an assigned workspace to a shared position. While the current increase in working from home has happened with breathtaking swiftness, and will likely persist past the end of the COVID crisis, any change in office demand will have to wait on subleasing (in a market likely awash in sublease space) or lease expiration a process phasing in over several years.

14. Rani Molla, "This is the End of the Office as We Know it." (2020): <https://www.vox.com/recode/2020/4/14/21211789/coronavirus-office-space-work-from-home-design-architecture-real-estate>.

Peter Ames. "Hot-Desking: Hot or Not?" (2015): <https://www.managementtoday.co.uk/hot-desking-hot-not/article/1334680>.

Bloom, Nicholas, James Liang, John Roberts, and Zhichun Jenny Ying. "Does Working From Home Work? Evidence From a Chinese Experiment *." *The Quarterly Journal of Economics* 130, no. 1 (2014): 165–218.

Statistics, Bureau of Labor. "Job Flexibilities and Work Schedules Summary." (2019):

Susan Caminiti. "The Dream Job That's All the Rage Across America." (2018): <https://www.cnbc.com/2018/04/03/virtual-companies-answer-demand-for-better-quality-of-life.html>.

Lister, Kate and Tom Harnish. "2017 State of Telecommuting in the Us." *Global Workplace Analytics* (2017):

Apgar, Mahlon. "The Alternative Workplace: Changing Where and How People Work." *Harvard Business Review* 76, no. 3 (1998): 121–36.

Ezequiel Minaya. "Cfos Plan to Permanently Shift Significant Numbers of Employees to Work Remotely — Survey." *Forbes* April (2020): <https://www.forbes.com/sites/ezequielminaya/2020/04/03/cfos-plan-to-permanently-shift-significant-numbers-of-employees-to-work-remotely---survey/#463e7441575b>.

Rani Molla. "This is the End of the Office as We Know it." (2020): <https://www.vox.com/recode/2020/4/14/21211789/coronavirus-office-space-work-from-home-design-architecture-real-estate>.