

MOODY'S CRE INSIGHTScre.moodyanalytics.com/insights-and-research/**AUTHORS**

Todd Metcalfe
Associate Director, Moody's CRE

Anthony Spinelli
Analyst, Moody's CRE

Thomas LaSalvia
Senior Director, Moody's CRE

CONTACT US

Client Services
+1.212.553.1658

CREClientService@moodys.com
cre.moodyanalytics.com/request-demo

What will be the impact on office demand from WFH?

The demand for office space has experienced a significant decline. Yet, the precise extent of this downturn remains unclear. How many employees will return to the office? What days will they be in? Will employees share offices or have common space? Will firms need more collaborative space and fewer individual desks? The answers to these questions - and many others regarding return to office - are crucial for accurately forecasting the office sector's performance.

Various studies and surveys have attempted to gauge the proportion of workers that are unlikely to return to the office. However, each of these efforts has its limitations, complicating the task of predicting the ultimate impact on the sector. This article reviews some of the more notable studies and surveys on the persistence of remote work among office employees. Combining these insights, with our more than 40 years of historic office performance data, as well as future employment projections, our model indicates that the impact on office demand from work from home will be around 14% on average across a 63-month period, resulting in vacancy rates that peak in early 2026 at approximately 24% nationally

WILL WORK FROM HOME PERSIST?

Studies on the impact of work from home (WFH) on productivity have produced mixed results, but for many industries, it appears that productivity has not been significantly affected.¹ This observation suggests that without a noticeable decrease in output, businesses may lack a strong

¹ Fernald, John, Ethan Goode, Huiyu Li, and Brigid Meisenbacher. January 16, 2024. FRBSR Economic Letter. "Does Working from Home Boost Productivity Growth?" Available at: <https://www.frbsf.org/wp-content/uploads/el2024-02.pdf>

incentive to revert to traditional office settings, especially considering the potential cost savings from reducing physical office space.²

Moreover, the preference of many employees to work from home cannot be overlooked. According to the Report on Economic Well-Being of U.S. Households, a significant portion of workers equate the prospect of being mandated to return to the office with receiving a pay cut. Further, 28% of respondents indicated they would be highly likely to seek new employment if required to return to the office, underscoring the strong preference for remote work among a substantial segment of the workforce.³

The discourse around the purported benefits of in-office work, emphasized by some CEOs, has been prominent in the media.^{4,5} Nevertheless, the argument for maintaining or even increasing remote work practices remains compelling for many businesses. If productivity remains stable and costs can be reduced by forgoing physical office spaces, the rationale for mandating in-office attendance diminishes.

Despite the debate between many employees and employers, employees are and will continue to spend more time outside of the office working. Research conducted using the Survey of Working Attitudes and Arrangements suggests that nearly 20% of full working days will be done from home post 2021, compared to 5% pre pandemic. This increased stickiness of WFH is supported by large investments made into physical and human capital that enable WFH, technological advancements that make us work from home better, the reduced stigma of WFH, and a pandemic led concern about crowds and contagion risk⁶. Consequently, it is likely that WFH arrangements will continue to be more common than they were before the pandemic.

WHAT WILL BE THE NEW LEVEL OF DEMAND FOR OFFICE SPACE?

There has been a sizeable shift to working from home across all industries. However, there are three primary industries that make up the majority of office demand.⁷ These groups are Information, Finance and Insurance, and Real Estate, and Rental and Leasing (FIRE), Professional, Scientific, and Management, and Administrative, and Waste Management Services. Not surprisingly these industries also have higher work from

² While the true long-term costs of WFH remain unknown, and a return to office in greater numbers may occur as we better understand these costs, such as reductions in effectiveness of training junior employees, over the next few years WFH levels seem likely to be remain elevated.

³ <https://www.federalreserve.gov/publications/2023-economic-well-being-of-us-households-in-2022-employment.htm>

⁴ Goswami, Rohan. May 16, 2023. "Elon Musk: Working from home is 'morally wrong' when service workers still have to show up." Available at: <https://www.cnbc.com/2023/05/16/elon-musk-work-from-home-morally-wrong-when-some-have-to-show-up.html>

⁵ Campbell, Todd. September 6, 2023. "JPMorgan's Jamie Dimon delivers a stern warning to remote workers." Available at: <https://www.thestreet.com/personal-finance/jpmorgans-jamie-dimon-delivers-a-stern-warning-to-remote-workers>

⁶ Barrero, Jose Maria, Nicholas Bloom, and Steven J. Davis, 2021. "Why working from home will stick," National Bureau of Economic Research Working Paper 28731

⁷ We considered including Public Administration but ultimately left it out because their WFH rates have had little to no impact on the greater percentage of the population working remote.

home rates than other industries. For this study we restrict our analysis to these major industry groupings due to a lack of robust survey data for more granular industries.

There are a few considerations that need to be made when determining what the demand for office space will be. First, many employees worked full time from home before the Pandemic. These employees should not be included in calculations for diminished office space demand. Second, there has been a general decline in the space per office using employee.⁸ Due to the number of hybrid workers that are only in the office 1 or 2 days a week, this trend is likely to continue.

There are several surveys and studies conducted on this matter. We will focus on three for the purposes of this analysis:

1. U.S. Census Survey of Income and Program Participation (SIPP)
2. U.S. Census American Community Survey (ACS)
3. Survey of Workplace Arrangements & Attitudes (SWAA)

We focus on these three sources because they have larger survey samples, and - in the case of the first two sources - have data available from before the Pandemic to compare overall shifts in WFH too. The SIPP, ACS, and SWAA surveys have methodological differences that produce different estimates on the level of work from home. However, they are informative to this work.

ACS and SIPP Estimation Methodology

Two important factors affecting office demand are the amount of office space needed per worker and the total number of office using workers. First, we estimate the relative level of demand per worker by comparing baseline (2019) levels of full time WFH with 2021 levels. Then using 2023 employment numbers by sector from the BLS, we estimate the overall impact on office demand from additional levels of work from home arrangements. Second, we utilize the Moody's U.S. monthly forecasts to estimate the total employment in the United States for each quarter.

We utilized employment data by industry from the BLS to estimate weighted averages for each industry (See Figure 1). Using the weighted averages indicates that 19.5% and 24.06% more office workers no longer use the office compared to 2019, for the SIPP and ACS surveys respectively. Using these numbers implies that office workers today only need between 75.9% and 80.50% of the office space that workers needed before the pandemic.

⁸ Calanog, Victor, Jun Chen, and Todd Metcalfe. August 19, 2021. "Full Speed Ahead (Maybe): The Outlook for the Economy, Multifamily and Commercial Real Estate." Available at: <https://cre.moodyanalytics.com/insights/research/full-speed-ahead-maybe-the-outlook-for-the-economy-multifamily-and-commercial-real-estate/>

Figure 1: WFH Demand Change^{9,10,11}

Industry	SIPP 2019	SIPP 2021	Difference	BLS 2023 Employment by sector	Weight of Industry	Weighted difference
Information	16.94%	46.14%	29.20%	2971	6.96%	2.50%
FIRE	22.01%	44.95%	22.94%	11018	25.80%	7.28%
Professional Services	24.20%	41.63%	17.43%	20735	48.55%	10.41%
			Simple Average	Employment in selected industries		Weighted Average (WFH due to Pandemic)
			21.53%	42708		20.19%
						Demand level due to WFH
						79.81

Industry	ACS 2019	ACS 2021	Difference	BLS 2023 Employment by sector	Weight of Industry	Weighted difference
Information	10%	42%	32%	2971	6.96%	2.70%
FIRE	11%	38%	28%	11018	25.80%	8.76%
Professional Services	13%	37%	24%	20735	48.55%	14.27%
			Simple Average	Employment in selected industries		Weighted Average (WFH due to Pandemic)
			24.98%	42708		26.73%
						Demand level due to WFH
						74.27%

Sources: U.S. Census Bureau, BLS

The ACS and SIPP methodologies can provide guidance on what the true level of office demand per worker should be. While these surveys have large sample sizes and a long history, they ask about commuting patterns and may lack the subtlety necessary to fully understand the extent of WFH. Further, due to their lag in reporting we cannot directly account for employment growth or WFH changes since 2021. Employment growth is however captured by our weighting process above and by using the Moody’s forecast series for office-using employment, which includes both history and forecast. To get a slightly better sense of growth in these variables, we turn to the SWAA which reports more frequent estimates.

SWAA Estimation Methodology

Using the SWAA’s monthly series of industry specific percentage of fully remote workers from November 2021 to March 2024, we first compare the level of WFH that occurred¹², similar to the above methodology. We then apply each industry's adjusted fully remote rate to its BLS industry employment equivalent and aggregate to create a weighted and adjusted office using employment series. Taking the average difference between the adjusted series and the unadjusted series from Q1 2022 to Q1 2024, we get an average difference of 12.15%; This implies that when accounting for the increase in fully remote work, office workers today on average use 88% of the office space used pre pandemic.

⁹ Gumber, Clatyon and Michael Burrows, June 27, 2023. “Sharp Drop in On-site/In-Person Work Since 2019.” Available at: <https://www.census.gov/library/stories/2023/06/sharp-drop-in-on-site-in-person-work-since-2019.html>

¹⁰ Labor Force Statistics from the Current Population Survey, January 26, 2024. Available at: <https://www.bls.gov/cps/cpsaat18.htm>

¹¹ Burrows, Michael, Charlynn Burd, and Brian McKenzie. April 2023, “Home-Based Workers and the COVID-19 Pandemic.” Available at: <https://www.census.gov/content/dam/Census/library/publications/2023/acs/acs-52.pdf>.

¹² We use the ACS 2019 estimates because they are more consistent with the total aggregate levels estimated in the SWAA.

This 12% estimate is a fine benchmark but says nothing about the reduction in office demand due to hybrid work. However, even if a firm is 100% remote, they still may require some level of physical space, making this estimate a bit biased towards greater vacancy rates.

Wanting to consider the amount of hybrid work that affects the demand for office space, we applied the same methodology to the percentage of workers who work fully remote, and who work in an office one day a week using the distribution of current WFH days reported by the SWAA, which increases the baseline of 12% to an average of 14%¹³.

Pushing this logic a bit further, we can include workers who work one or two days in the office, but since two days in the office is much less likely to lead to office space declines than one day per week, we reduce the final addition by 25%, using the Berkley Division of Academic Plannings¹⁴ staffing guide as a rough measure of how much hybrid work will affect the office space needed per worker.¹⁵ This brings us to an estimated average gap of 16.10%.

Table 1: Estimated Reductions in Office Demand due to WFH Employment

Survey	Method	Effect of WFH
SIPP	2019 – 2021 weighted	20.19%
ACS	2019 – 2021 weighted	25.73%
SWAA	Fully remote and hybrid 1 or 2 days in the office, adjusting by 75%	16.10%
SWAA	Fully remote and hybrid 1 day a week	13.99%
SWAA	Fully remote	12.15%

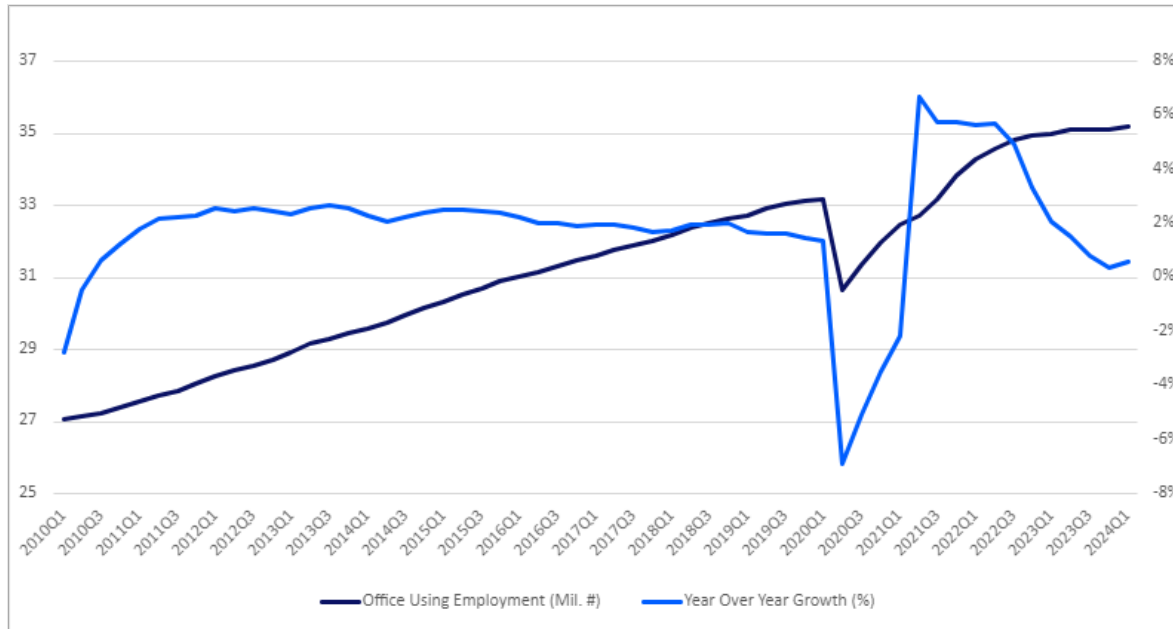
While increasing levels of WFH reduces the demand for office space, office using employment has still been growing, as can be seen in Figure 2. Initially, office using employment cratered at the beginning of the pandemic, the predicted “V” shape recovery did manifest for these types of jobs. Further, on a year-over-year basis these jobs have grown continuously since the recovery, but at a declining rate. We expect that growth in these jobs will continue, but at a much slower rate over the next 10 years. The increase in office-using workers will partially offset reductions in demand due to WFH.

¹³ Distribution of current 2024 WFH days reports 5.6% of workers are in an office one day a week, while 11.4% are in two days a week: Barrero, Jose Maria, Nicholas Bloom, and Steven J. Davis, 2021. “Why working from home will stick,” National Bureau of Economic Research Working Paper 28731.

¹⁴ <https://vpap.berkeley.edu/space-planning/policies-and-guidelines/guidelines-office-space>

¹⁵ For how we arrive at this number see the “Appendix: How much office space is needed per (hybrid) worker?”

Figure 2: Office Using Employment - Level and YoY Growth



Source: BLS, Moody's

WHEN DID REDUCED DEMAND FROM THE PANDEMIC START?

Having estimated the impact on office demand from the percentage of the workforce frequently using office space, our next step is to determine the timing of these changes. Even if an employer believed that remote work could replace in person work completely from day one of a lockdown and deemed office space redundant, they would still be bound by legal obligations to fulfill their existing lease agreements. This diminishes the incentive to quickly decide on dropping office space.

In many states the lockdowns were lifted by the end of August 2020, and some companies started to resume at least limited return to office policies. Some companies may have felt able to make an informed decision at this point, and that they could do without office space. However, this seems unlikely to be a significant number. There are anecdotes of large companies taking significant time to study their office needs, and even different parts of the same company coming to greatly different conclusions for similar job functions. Further, many larger companies would be less likely to make a decision to cancel significant office space without more study. In fact, a large number of companies seemed to hedge their bets by signing short term leases. While 2019 only had a very short lease rate of 14.8%, this rate rose to 25.9% in 2020 and to 32.2% in 2021.¹⁶

¹⁶ Fagan, Kevin and Victor Calanog. January 19, 2022. "The 'Big Short' of Office Leases: What Do Shorter Terms Really Mean, and Will they Last?" Available at: <https://cre.moodyanalytics.com/insights/cre-news/the-big-short-of-office-leases-what-do-shorter-terms-really-mean-and-will-they-last/>

Due to the number of companies that signed short term leases in 2021, and the fact that most of 2020 can be considered non-representative of normal times, and that many companies would want to carefully analyze their office needs before acting, this analysis will assume that office cancelations due to changes in WFH following the Pandemic would start hitting the market in 2022 Q1.

HOW LONG WILL IT TAKE TO SEE REDUCED DEMAND?

To estimate how many companies would drop their office space in each quarter we make a couple of simplifying assumptions. First, we assume that companies reduce their office space at the same levels as employees are working from home, i.e. if 20% of employees now work from home, then companies will reduce their demand by 20% when their lease is renewed. This is a strong assumption used to simplify our calculations and does not necessarily reflect the office demand of even full-time remote employees. In fact, researchers recently estimated that pre 2020 a decrease in office space per teleworker of 44% compared to in-office workers.¹⁷ The decreased demand is likely higher in 2024 as investments in technology and capital have been made to increase the efficiency and cost savings of WFH. Once we have a longer a time sample on this side of the pandemic we will be able to test to see if this relationship has changed. Further, the relationship may be nonlinear as a firm approaches 100% remote employment and will likely vary by industry given varying needs to have a physical presence.

Next, we assume that companies, collectively, will reduce their demand at a constant rate over the length of the average contract.¹⁸ In 2022, Moody's CRE found the average length of an office lease was about 63-months (just over 5-years), or 21 quarters.¹⁹ Hence, we assume that each quarter, 4.76% of office space is up for renewal. Of that space, the renewal rate will depend on the WFH ratios that we calculated above. So we would expect to see 4.76% of the overall demand reduction to occur each quarter. If we assume that 20% more workers are no longer going into the office, we should see those reductions in demand each quarter from 2022 on.

There were a number of technology companies that ramped up hiring during the Pandemic to meet new demand that these companies experienced. If these companies signed lease agreements to accommodate these employees immediately, it is possible that they could skew the distribution. However, it is not clear if a significant proportion of these companies expanded their physical footprints, and even if they did they are a

¹⁷ Liu, Kun, Subhrajit Guhathakurta, Chaeyeon Han, Eric Hittinger, Sinoun Phoung, and Eric Williams. 2024. "How Much Is US Office Building Space Reduced per Teleworker?" *Findings*, April. <https://doi.org/10.32866/O01c.115400>.

¹⁸ The short term "bridge" leases could indicate that many companies pushed their decision out a year. Hence, it is possible that more companies would have reduced their demand earlier in the analysis period. However, since 63 months is the average length of office usage, there are likely companies that reduced their office demand but will still pay beyond the analysis period due to the length of their leases. For simplicity we assume these will roughly cancel each other out.

¹⁹ Fagan, Kevin and Victor Calanog. January 19, 2022. "The 'Big Short' of Office Leases: What Do Shorter Terms Really Mean, and Will they Last?" Available at: <https://cre.moodyanalytics.com/insights/cre-news/the-big-short-of-office-leases-what-do-shorter-terms-really-mean-and-will-they-last/>

relatively small proportion of office demand. There are three industry groupings in the office using employment that technology companies would likely fit into:

1. Software Publishing (NAICS 5112)
2. ISP, Web Sear Portals, and Data Processing Services (NAICS 518)
3. Computer Systems Design and Related Services (NAICS 5415)

Employment grew in each of these industry groups between 2020 and 2021, going from approximately 500k to just under 555k, 360k to 388k, and 2.2 to 2.3 million for NAICS 5112, 518, and 5415 respectively. For a total growth of approximately 185k jobs. However, there were approximately 32 mil office using employment jobs in 2021. Hence, increased office leasing from Tech companies would likely have a minimal impact on our assumptions.

Now that we have set about these assumptions there are a few different ways that we can estimate what vacancy rates should be. The first we will call the naïve approach, where we simply add in the WFH rate to our historic vacancy rate. The second is by using recent history to project forward vacancy rates. Finally, we also statistically model the vacancy rates and forecast them.

Naïve Vacancy Estimations

Naively we could argue that a 20% reduction in demand, ceterus parabus, would result in a 20% increase in vacancy. That would imply an approximately 36% vacancy rate nationally in 2026, based on the Census SIPP survey numbers. Moreover, we should have already recognized almost half of that increase and should have recognized about 26 or 27% vacancy rates in 2024 Q1.²⁰ The “Naïve” estimates using this logic can be seen in Table 2, and with the exception of the lowest scenario, produce currently expected rates much higher than we saw in 2024 Q1.

Table 2: Naively Estimated Vacancy Rates

Survey	Approximate WFH Rate	Expected Current Vacancy	Estimated Final Vacancy
ACS	25.00%	33.50%	42.00%
SIPP	20.00%	28.50%	37.00%
SWAA + 1 & 2 day hybrid	16.00%	24.50%	34.00%
SWAA + 1 day hybrid	14.00%	22.50%	31.00%
SWAA fully remote only	12.00%	20.50%	29.00%

²⁰ 27% would be 10% added to the approximate vacancy rate of 17% at the beginning of the Pandemic.

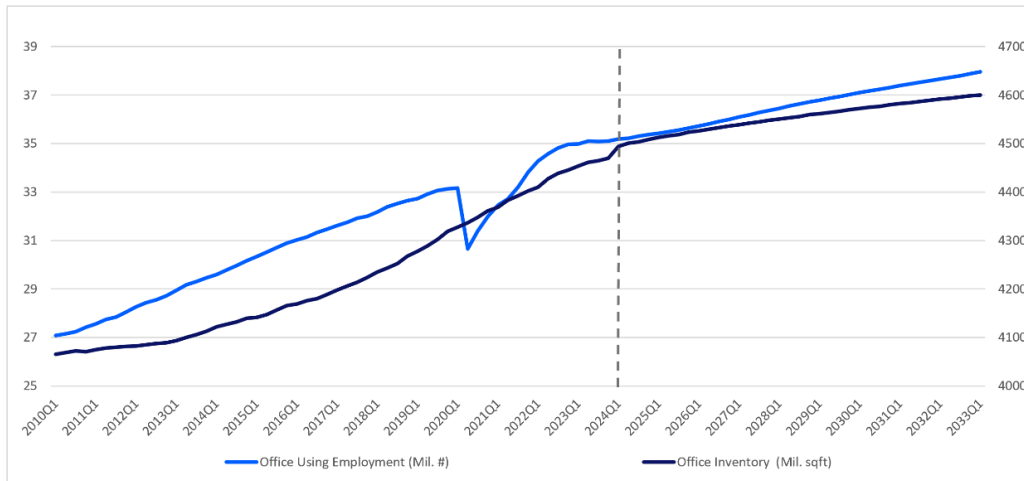
However, there is not likely to be a 1 to 1 relationship, even a fully remote company will likely need some office and meeting space.

Recent History Estimation

If we assume the relationship between WFH and vacancy rates can be estimated based on the difference between vacancy rates today and a “baseline” vacancy rate, using the timing logic above we can estimate that vacancy rates will peak in early 2026. If we assume the Q4 2021 vacancy - 18.1% - is the baseline rate, and that we are about halfway through the adjustment period, then the difference between 2024 Q1’s 19.8% rate and the baseline rate would be roughly half of the expected change. Hence, the peak rate in early 2026 would be approximately 21.5%. Of course, assuming different baseline rates will increase this calculation. If we instead assume the vacancy rate in Q1 2020 of 17.0% was the baseline and keep the assumption that we are about halfway through the adjustment period, we will instead get a predicted peak vacancy rate of approximately 22.6%.

For this approach we do not get a range of vacancy estimates depending on the WFH rates, like in the naïve approach, or the statistical approach below, because we assume that the next 10 to 11 quarters will be like the last 10 to 11 quarters.

Figure 3: Office Using Employment and Office Inventory Forecasts



Statistical Approach

Vacancy rates can be statistically modeled depending on the natural vacancy rate, the ratio of occupied inventory to office using employment, and an auto-regressive term for the previous period’s vacancy. We used these variables to model the magnitude of

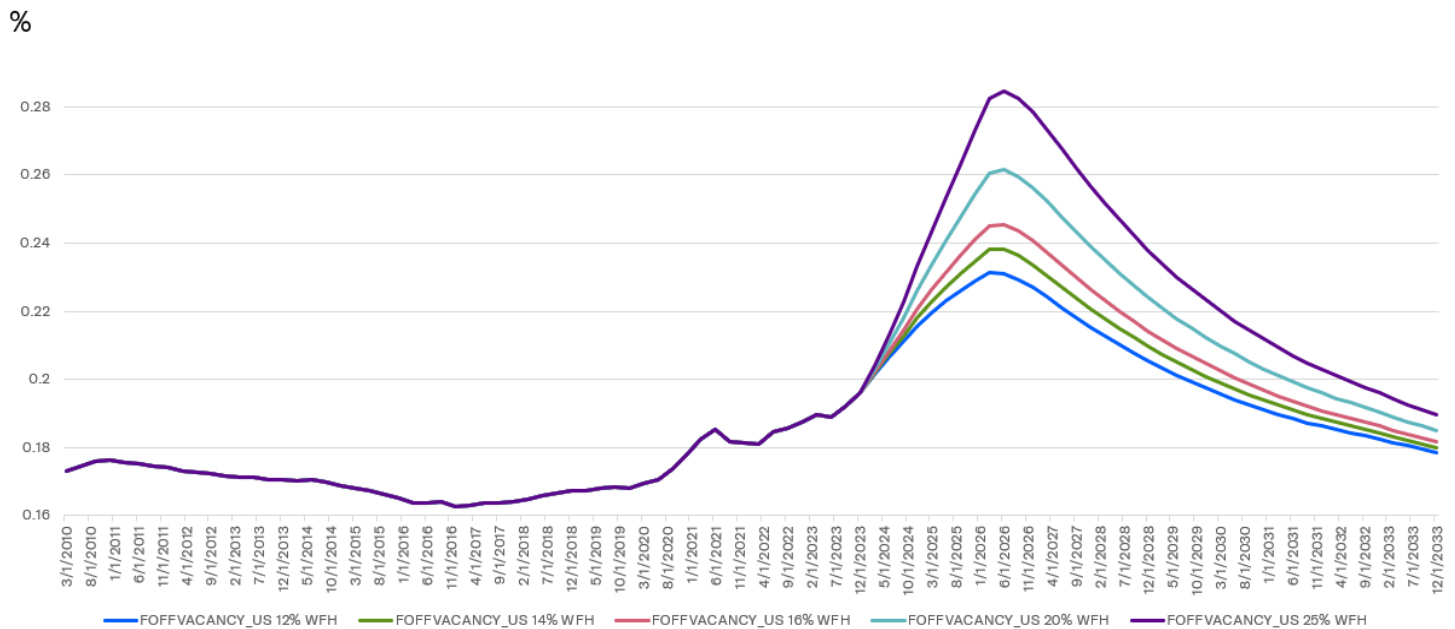
effects of the level of office using employment on vacancy rates.²¹ We would expect to see office demand increase as there are more office using employees needing office space. We use the ratio of the occupied inventory to office using employment, because there has been a general decline in space per employee in office settings over the last few decades.²²

Using the Moody's forecasted inventory and the U.S. Macro Model's forecasted office using employment (Figure 3) we constructed a range of scenarios to test the project vacancy rate under the different WFH calculations presented above.²³

To construct these forecasts, we adjust the office using employment scenarios based on the WFH rates given in Table 1 above. We do so by assuming that reduced demand per worker would be reduced evenly across the 63-month time span as described above to produce a range of estimates on peak vacancy rates.

For the lowest case of WFH demand reduction, 12% less demand, vacancy peaks at approximately 22.5% in 2026. The larger demand reductions of course produced more dire estimates coming in at 26.2% and 28.4% for the 20% WFH and 25% WFH rates (see Figure 4).

Figure 4: Forecasted Vacancy Rate Under Different WFH Scenarios



Sources: Moody's Analytics

²¹ See the "Appendix: Statistical Vacancy Model"

²² See the "Appendix: How much office space is needed per (hybrid) worker?"

²³ Moody's Analytics, September 2019, "Moody's Analytics U.S. Macro Model Methodology."

WHICH WFH OFFICE SCENARIO IS MOST LIKELY TO BE CORRECT?

We are now approximately 2 to 3 years into the WFH trend. We should already be able to see the first part of this trend in the vacancy rates, and this implies that the 20 and 25% WFH vacancy forecasts are too high. The lowest two scenarios, 12% and 14%, are most in line with the trends that we are currently seeing and the Naïve vacancy estimate.

Further, employees working from home still need some office space. While the 44% figure cited above may be too high, under today's WFH conditions, it does imply that the most dire scenarios are unlikely to unfold.

There are still many companies planning to return to the office at greater levels in 2024.²⁴ This implies that currently higher WFH full time and one or two day a week counts may also be short lived. A recent McKinsey study found that there will be 13% less demand for office space in the median city of their study by 2030.²⁵ This also argues that the ultimate reduction in demand will be one of the two lower scenarios.

As for the return to an office vacancy equilibrium, "Right Sizing" will continue over the next decade as the market shakes out less efficient space for flexible floorplans that support our relatively new working habits. Office conversion to multifamily will remain rare as it is an expensive, albeit efficient, solution for high vacancies. Only a small fraction of offices would be feasible for a conversion.²⁶ However, offices are also being torn down to be converted to other uses, such as warehousing.²⁷ As office valuation declines are realized, conversions and teardowns will make more sense, which will act as a tailwind and put downward pressure on vacancy rates.

For these reasons we think that the 14% and therefore roughly 24% peak vacancy forecast appears to be most likely scenario to unfold over the next few years.

²⁴ Resume Builder, August 22, 2023. "90% of Companies Will Return to Office By the End of 2024." <https://www.resumebuilder.com/90-of-companies-will-return-to-office-by-the-end-of-2024/>

²⁵ Mischke, Jan, Ryan Luby, Brian Vickery, Lola Woetzel, Olivia White, Aditya Sanghvi, Jinnie Rhee, Anna Fu, Rob Palter, Andre Dua, and Sven Smit. July 13, 2023. "Empty spaces and hybrid places: The Pandemic's lasting impact on real estate." Available at: <https://www.mckinsey.com/mgi/our-research/empty-spaces-and-hybrid-places>

²⁶ Spinelli, Anthony & Lu Chen. April 11, 2024. "14% of Seattle's Office Properties are Suitable for Multifamily Conversion." <https://cre.moodyanalytics.com/insights/cre-news/14-of-seattles-office-properties-are-suitable-for-multifamily-conversion/>

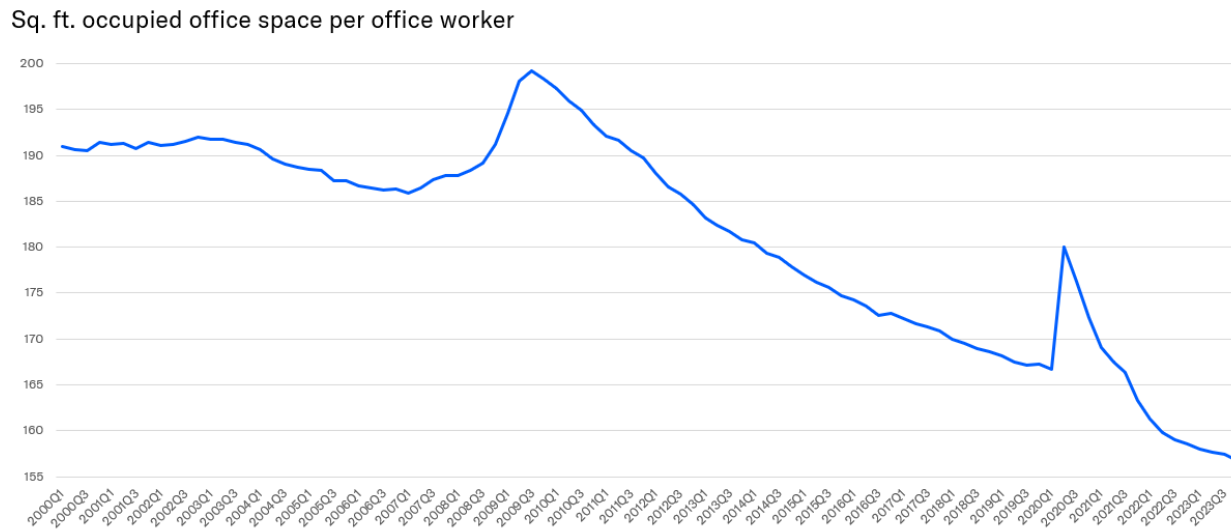
²⁷ Vincent, Roger, March 18, 2024. "A Sign of the times: Tearing down an emptying O.C. office complex to build a warehouse." <https://www.latimes.com/business/story/2024-03-18/office-demolished-to-make-way-for-warehouse-distribution-center>

APPENDIX

How Much Office Space is Needed Per (Hybrid) Worker?

The amount of office space per worker has been on a general downward trend for decades. In 2000, the average space per office using employee was over 190 sq ft of occupied space per worker, compared to only about 155 sqft at the end of 2023 (see Figure 5).²⁸ Part of this trend is due to the increase in remote work, which stood somewhere between approximately 10 and 20% in 2019 of the main office using industries.²⁹

Figure 5: Office Space per Worker has Been Declining



Sources: Moody's, BLS

Since the pandemic, remote work has increased significantly lowering the space needed per worker. It is difficult to say how much further this trend will increase. There are still underutilized office spaces that are technically “fully” occupied, as leases on these properties expire that will likely further decrease the occupied space per worker. However, it is unclear how low this space will go for employees that work in the office.

A minimum amount of space is required per employee. The amount of space needed for an employee is often based on their role. A manager that needs to host confidential meetings with direct reports is going to require more space than a lower level worker

²⁸ This trend goes back at least until 1980. See Calanog, Victor, Jun Chen, and Todd Metcalfe. August 19, 2021. “Full Speed Ahead (Maybe): The Outlook for the Economy, Multifamily and Commercial Real Estate.” Available at: <https://cre.moodyanalytics.com/insights/research/full-speed-ahead-maybe-the-outlook-for-the-economy-multifamily-and-commercial-real-estate/>

²⁹ Depending on the survey.

who can be get by with a shared worked space. There are office space calculators that calculate minimum amount of space per workers.

Using an academic office setting produces a low end of space needed for temporary or student staff at 36 sq ft per worker.³⁰ Part time workers (less than .5 FTE) require less space than full time workers, but still a significant share (.77). When conference rooms, and other utility spaces are included, even the absolute minimum space requirements per worker will rise.

Office planning needs to be done for peak demand, not a “typical” day. While desk space demand may fall, when full time remote and hybrid employees are in the office, they will need both space to work, and meeting space. As such reducing demand for “part time in the office” workers by approximately 25% compared to their full time in the office (3+ days) seems reasonable.

Statistical Vacancy Model

We forecast key CRE concepts quarterly. As part of this process we produce a series of models and challenger models for these concepts which include vacancy rates. For this paper we use a simple OLS regression done in line with the Moody's Analytics Global Macroeconomic Model Methodology.³¹

We use the OLS regression in a dlog specification to model the U.S. vacancy rate for the aggregate industrial series (see Table 3). For this model we used the natural vacancy rate, the ratio of occupied inventory to office using employment, and an auto-regressive term for the previous period's vacancy as the regressors. Specifically, we model the vacancy rate as:

$$\text{dlog}(\text{Vacancy}_t) = \alpha + \beta_1 \log(\text{Natural Vacancy Rate}) + \beta_2 \text{dlog}(\text{Inventory} / \text{Office Using Employment}) + \beta_3 \text{dlog}(\text{Vacancy}_{t-1}) + \varepsilon$$

Natural vacancy rate is assumed to be the four quarter moving average for the office sector. This relatively short period is adopted because of the extreme movement that has been seen in the sector. The selected time period provides stability to the model and acts as a long-term anchor, while also not creating too much of a mean reversion in the model.

The adjusted office using scenario forecasts using the methodology described above were inserted into this model to produce our final vacancy forecasts for each scenario. In the short run inventory is relatively fixed, hence the vacancy rate is driven by the scenarios we tested for the percentages of employees that work from home. Conversions and destruction of inventory will have the effect of lowering the realized vacancy rate. This would imply that our calculations are conservative.

³⁰ Berkeley Division of Academic Planning. “Guidelines for Office Space.” Available at: <https://vpap.berkeley.edu/space-planning/policies-and-guidelines/guidelines-office-space>

³¹ Hopkins, Mark. July 2020. “Moody's Analytics Global Macroeconomic Model Methodology.”

Table 3: Office Vacancy Regression

Method: Pooled Lease Squares

Sample: 2000Q1 to 2019Q4

Included observations: 79

R-squared: 0.759

Adj. R-Squared: 0.749

Variable	Coefficient	Std. error	t-statistic	Prob.
Constant	-0.0339	0.024	-1.419	0.160
Log Natural Vacancy Rate _{t-1}	-0.0199	0.013	-1.588	0.116
dlog Inventory/Office Using Employment	1.7265	0.411	4.201	0.000
dlog Vacancy _{t-1}	0.5258	0.076	6.939	0.000

© 2024 Moody's Corporation, Moody's Investors Service, Inc., Moody's Analytics, Inc. and/or their licensors and affiliates (collectively, "MOODY'S"). All rights reserved.

CREDIT RATINGS ISSUED BY MOODY'S CREDIT RATINGS AFFILIATES ARE THEIR CURRENT OPINIONS OF THE RELATIVE FUTURE CREDIT RISK OF ENTITIES, CREDIT COMMITMENTS, OR DEBT OR DEBT-LIKE SECURITIES, AND MATERIALS, PRODUCTS, SERVICES AND INFORMATION PUBLISHED OR OTHERWISE MADE AVAILABLE BY MOODY'S (COLLECTIVELY, "MATERIALS") MAY INCLUDE SUCH CURRENT OPINIONS. MOODY'S DEFINES CREDIT RISK AS THE RISK THAT AN ENTITY MAY NOT MEET ITS CONTRACTUAL FINANCIAL OBLIGATIONS AS THEY COME DUE AND ANY ESTIMATED FINANCIAL LOSS IN THE EVENT OF DEFAULT OR IMPAIRMENT. SEE APPLICABLE MOODY'S RATING SYMBOLS AND DEFINITIONS PUBLICATION FOR INFORMATION ON THE TYPES OF CONTRACTUAL FINANCIAL OBLIGATIONS ADDRESSED BY MOODY'S CREDIT RATINGS. CREDIT RATINGS DO NOT ADDRESS ANY OTHER RISK, INCLUDING BUT NOT LIMITED TO: LIQUIDITY RISK, MARKET VALUE RISK, OR PRICE VOLATILITY. CREDIT RATINGS, NON-CREDIT ASSESSMENTS ("ASSESSMENTS"), AND OTHER OPINIONS INCLUDED IN MOODY'S MATERIALS ARE NOT STATEMENTS OF CURRENT OR HISTORICAL FACT. MOODY'S MATERIALS MAY ALSO INCLUDE QUANTITATIVE MODEL-BASED ESTIMATES OF CREDIT RISK AND RELATED OPINIONS OR COMMENTARY PUBLISHED BY MOODY'S ANALYTICS, INC. AND/OR ITS AFFILIATES. MOODY'S CREDIT RATINGS, ASSESSMENTS, OTHER OPINIONS AND MATERIALS DO NOT CONSTITUTE OR PROVIDE INVESTMENT OR FINANCIAL ADVICE, AND MOODY'S CREDIT RATINGS, ASSESSMENTS, OTHER OPINIONS AND MATERIALS ARE NOT AND DO NOT PROVIDE RECOMMENDATIONS TO PURCHASE, SELL, OR HOLD PARTICULAR SECURITIES. MOODY'S CREDIT RATINGS, ASSESSMENTS, OTHER OPINIONS AND MATERIALS DO NOT COMMENT ON THE SUITABILITY OF AN INVESTMENT FOR ANY PARTICULAR INVESTOR. MOODY'S ISSUES ITS CREDIT RATINGS, ASSESSMENTS AND OTHER OPINIONS AND PUBLISHES OR OTHERWISE MAKES AVAILABLE ITS MATERIALS WITH THE EXPECTATION AND UNDERSTANDING THAT EACH INVESTOR WILL, WITH DUE CARE, MAKE ITS OWN STUDY AND EVALUATION OF EACH SECURITY THAT IS UNDER CONSIDERATION FOR PURCHASE, HOLDING, OR SALE.

MOODY'S CREDIT RATINGS, ASSESSMENTS, OTHER OPINIONS, AND MATERIALS ARE NOT INTENDED FOR USE BY RETAIL INVESTORS AND IT WOULD BE RECKLESS AND INAPPROPRIATE FOR RETAIL INVESTORS TO USE MOODY'S CREDIT RATINGS, ASSESSMENTS, OTHER OPINIONS OR MATERIALS WHEN MAKING AN INVESTMENT DECISION. IF IN DOUBT YOU SHOULD CONTACT YOUR FINANCIAL OR OTHER PROFESSIONAL ADVISER.

ALL INFORMATION CONTAINED HEREIN IS PROTECTED BY LAW, INCLUDING BUT NOT LIMITED TO, COPYRIGHT LAW, AND NONE OF SUCH INFORMATION MAY BE COPIED OR OTHERWISE REPRODUCED, REPACKAGED, FURTHER TRANSMITTED, TRANSFERRED, DISSEMINATED, REDISTRIBUTED OR RESOLD, OR STORED FOR SUBSEQUENT USE FOR ANY SUCH PURPOSE, IN WHOLE OR IN PART, IN ANY FORM OR MANNER OR BY ANY MEANS WHATSOEVER, BY ANY PERSON WITHOUT MOODY'S PRIOR WRITTEN CONSENT. FOR CLARITY, NO INFORMATION CONTAINED HEREIN MAY BE USED TO DEVELOP, IMPROVE, TRAIN OR RETRAIN ANY SOFTWARE PROGRAM OR DATABASE, INCLUDING, BUT NOT LIMITED TO, FOR ANY ARTIFICIAL INTELLIGENCE, MACHINE LEARNING OR NATURAL LANGUAGE PROCESSING SOFTWARE, ALGORITHM, METHODOLOGY AND/OR MODEL.

MOODY'S CREDIT RATINGS, ASSESSMENTS, OTHER OPINIONS AND MATERIALS ARE NOT INTENDED FOR USE BY ANY PERSON AS A BENCHMARK AS THAT TERM IS DEFINED FOR REGULATORY PURPOSES AND MUST NOT BE USED IN ANY WAY THAT COULD RESULT IN THEM BEING CONSIDERED A BENCHMARK.

All information contained herein is obtained by MOODY'S from sources believed by it to be accurate and reliable. Because of the possibility of human or mechanical error as well as other factors, however, all information contained herein is provided "AS IS" without warranty of any kind. MOODY'S adopts all necessary measures so that the information it uses in assigning a credit rating is of sufficient quality and from sources MOODY'S considers to be reliable including, when appropriate, independent third-party sources. However, MOODY'S is not an auditor and cannot in every instance independently verify or validate information received in the credit rating process or in preparing its Materials.

To the extent permitted by law, MOODY'S and its directors, officers, employees, agents, representatives, licensors and suppliers disclaim liability to any person or entity for any indirect, special, consequential, or incidental losses or damages whatsoever arising from or in connection with the information contained herein or the use of or inability to use any such information, even if MOODY'S or any of its directors, officers, employees, agents, representatives, licensors or suppliers is advised in advance of the possibility of such losses or damages, including but not limited to: (a) any loss of present or prospective profits or (b) any loss or damage arising where the relevant financial instrument is not the subject of a particular credit rating assigned by MOODY'S.

To the extent permitted by law, MOODY'S and its directors, officers, employees, agents, representatives, licensors and suppliers disclaim liability for any direct or compensatory losses or damages caused to any person or entity, including but not limited to by any negligence (but excluding fraud, willful misconduct or any other type of liability that, for the avoidance of doubt, by law cannot be excluded) on the part of, or any contingency within or beyond the control of, MOODY'S or any of its directors, officers, employees, agents, representatives, licensors or suppliers, arising from or in connection with the information contained herein or the use of or inability to use any such information.

NO WARRANTY, EXPRESS OR IMPLIED, AS TO THE ACCURACY, TIMELINESS, COMPLETENESS, MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE OF ANY CREDIT RATING, ASSESSMENT, OTHER OPINION OR INFORMATION IS GIVEN OR MADE BY MOODY'S IN ANY FORM OR MANNER WHATSOEVER.

Moody's Investors Service, Inc., a wholly-owned credit rating agency subsidiary of Moody's Corporation ("MCO"), hereby discloses that most issuers of debt securities (including corporate and municipal bonds, debentures, notes and commercial paper) and preferred stock rated by Moody's Investors Service, Inc. have, prior to assignment of any credit rating, agreed to pay to Moody's Investors Service, Inc. for credit ratings opinions and services rendered by it. MCO and Moody's Investors Service also maintain policies and procedures to address the independence of Moody's Investors Service credit ratings and credit rating processes. Information regarding certain affiliations that may exist between directors of MCO and rated entities, and between entities who hold credit ratings from Moody's Investors Service, Inc. and have also publicly reported to the SEC an ownership interest in MCO of more than 5%, is posted annually at www.moody.com under the heading "Investor Relations — Corporate Governance — Charter Documents - Director and Shareholder Affiliation Policy."

Moody's SF Japan K.K., Moody's Local AR Agente de Calificación de Riesgo S.A., Moody's Local BR Agência de Classificação de Risco LTDA, Moody's Local MX S.A. de C.V. I.C.V., Moody's Local PE Clasificadora de Riesgo S.A., and Moody's Local PA Clasificadora de Riesgo S.A. (collectively, the "Moody's Non-NRSRO CRAs") are all indirectly wholly-owned credit rating agency subsidiaries of MCO. None of the Moody's Non-NRSRO CRAs is a Nationally Recognized Statistical Rating Organization.

Additional terms for Australia only: Any publication into Australia of this document is pursuant to the Australian Financial Services License of MOODY'S affiliate, Moody's Investors Service Pty Limited ABN 61 003 399 657AFSL 336969 and/or Moody's Analytics Australia Pty Ltd ABN 94 105 136 972 AFSL 383569 (as applicable). This document is intended to be provided only to "wholesale clients" within the meaning of section 761G of the Corporations Act 2001. By continuing to access this document from within Australia, you represent to MOODY'S that you are, or are accessing the document as a representative of, a "wholesale client" and that neither you nor the entity you represent will directly or indirectly disseminate this document or its contents to "retail clients" within the meaning of section 761G of the Corporations Act 2001. MOODY'S credit rating is an opinion as to the creditworthiness of a debt obligation of the issuer, not on the equity securities of the issuer or any form of security that is available to retail investors.

Additional terms for India only: Moody's credit ratings, Assessments, other opinions and Materials are not intended to be and shall not be relied upon or used by any users located in India in relation to securities listed or proposed to be listed on Indian stock exchanges.

Additional terms with respect to Second Party Opinions (as defined in Moody's Investors Service Rating Symbols and Definitions): Please note that a Second Party Opinion ("SPO") is not a "credit rating". The issuance of SPOs is not a regulated activity in many jurisdictions, including Singapore. JAPAN: In Japan, development and provision of SPOs fall under the category of "Ancillary Businesses", not "Credit Rating Business", and are not subject to the regulations applicable to "Credit Rating Business" under the Financial Instruments and Exchange Act of Japan and its relevant regulation. PRC: Any SPO: (1) does not constitute a PRC Green Bond Assessment as defined under any relevant PRC laws or regulations; (2) cannot be included in any registration statement, offering circular, prospectus or any other documents submitted to the PRC regulatory authorities or otherwise used to satisfy any PRC regulatory disclosure requirement; and (3) cannot be used within the PRC for any regulatory purpose or for any other purpose which is not permitted under relevant PRC laws or regulations. For the purposes of this disclaimer, "PRC" refers to the mainland of the People's Republic of China, excluding Hong Kong, Macau and Taiwan.