



WORKING PAPER

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The Impact that COVID-19 and working from home has had on the amount of main location office space retained and the future use of rented satellite offices

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ABSTRACT: Despite the extensive amount of research on the impact that the COVID-19 pandemic has had on significant changes in the location at which work takes place, especially working from home (WFH), there is very little systematic consideration given to the relationship between the substantial increase in WFH and the responses taken by organisations in reviewing their office (work space) capacity needs in the future, including a switch of the mix of utilising work space in the main office(s) and satellite office locations. Using data from 459 businesses for three periods for pre-COVID-19, April 2022 (25 months after the outbreak of the pandemic) and stated intentions for 2023, we develop a random effects regression model for the Greater Sydney Metropolitan Area in which we identify some of the influences on the downsizing or not of the main office(s) work space, and comment on what we see as the most likely scenario for WFH and work space in the main office and rented satellite office space under the ‘next normal’. The findings can be used to inform future commuting travel as well as changes in land use activity at specific locations, including possible reallocation of existing office space to other activity uses.

KEY WORDS: *COVID-19; work space downsizing; working from home; satellite offices; elasticities, random effects regression*

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1. Introduction

After two years of the COVID-19 pandemic, we are beginning to see a growing number of structural changes in the workplace that look like becoming key features of a 'next normal'. While we will live with a quantum of uncertainty on what is increasingly referred to as 'a return to the office', the evidence is mounting almost daily to suggest that the pre-COVID-19 work environment has changed forever, and for many good reasons supported by a significant number of employers and employees (Barrero et al. 2021, Beck and Hensher 2021, 2021a, Beck and Hensher 2022, Hensher et al. 2022a).

Hensher et al. (2022), in analysing data collected in Australia at four points in time between March 2020 and July 2021, offer signals as to what are important drivers of the main influences on structural change that occurred during the ongoing pandemic which is crystallised in a desire to work from home. As long as unchanged (or even increased) productivity is seen as a positive outcome of working from home, especially by employers, who also recognise the lifestyle and wellbeing benefits to their employees (something that will inevitably be built into employments contracts going forward), and that a preference of workers to continue to work from home remains, given the many benefits on balance that have been recognised, the 'next normal' will almost certainly be linked to the delivery of structural change centred around WFH.

At the same time, we are seeing businesses review their workspace requirements at their main office location (linked in part to WFH), with some being closed temporarily, while other organisations have downsized their space or planning on doing so when leases are renewed. Complementing this space review is a consideration of the role that other office space associated with renting at a satellite office (by the hour or day, for example) might play, which is likely to be closer to where employees live, enabling some amount of working from home and/or return to the main office to be transferred to this alternative location, which we refer to increasingly as working near home (WNH). The satellite office offers a respite to both the long commute and being at home for extended periods, especially where work-related facilities at home are somewhat limited.

There is very little published research, despite extensive media commentary, on the relationship between working from home and changes that are occurring in the amount of office space that will be needed in the 'next normal', and how much of this space will be obtained through renting of space in satellite offices in contrast to the main office location. The question we are interested in is the extent to which levels of working from home and increased use of rented satellite office space will be linked to changes in the amount of workspace required at the main office that was used pre-COVID-19. We collected data in April 2022 from a sample of organisations in the Greater Sydney Metropolitan Area (GSMA) to enable us to estimate a random effects regression model on data from the pre-COVID-19 period, April 2022 and looking ahead to 2023, that can shine a light on the links between working from home and changes in workspace requirements today and in the future compared to pre-COVID-19.

The paper is structured as follows. We begin with a review of the evidence, largely from media and consultancy reports, on what changes are occurring and anticipated in the property market associated with office downsizing and /or relocation. We then provide a descriptive overview of the new survey data, collected as an online panel from a sample of organisations in the GSMA, distinguishing the Sydney Central Business District from other locations. A random effects regression model is estimated to account for the three periods, where the dependent variable is the percentage change in workspace at the main office location compared to the level (set at 100%) pre-COVID-19. The findings are discussed, including elasticity estimates associated with each of the three periods. The concluding

section discusses what the evidence suggests for policy settings associated with transport, land use, property development and leasing.

2. Key Insights from the Literature

The Reserve Bank of Australia (RBA) in August 2021 indicated that from 2020 to 2021, the commercial property market in Australia has declined in terms of the demand for office and retail space due to staff shifting to working from home and an increase in online shopping. Except for industrial properties such as warehouse space, other commercial properties have increased vacancy rates since the pandemic. The demand for office space, especially in large cities like Sydney and Melbourne, has declined since 2020. The occupancy rates of office space have varied between 10% and 30% below the pre-COVID-19 levels in all cities.

Recent data released by the Property Council of Australia (PCA) show that the overall Australian office vacancy rate in January 2022 is 12.1%, compared to about 8% in January 2020¹. However, the demand for the premium end of the office leases, like quality towers, is still strong, with the vacancy rate reduced from 5.5% to 4.9% (Cummins 2022 and also Figure 2 and Table 2 below). The PCA data for early 2022 also show that for the first time in two years, the demand for offices has started to increase instead of decrease, indicating the beginning of a possible recovery². There are growing office leasing enquires in capital cities, led by Sydney³. From March 2022 or over the peak of the outbreak of the Omicron variant, workers started to spend some time in the office while remaining working remotely on other days (Beck and Hensher 2022a). In the three CBDs of Sydney, Melbourne and Canberra, workers only occupy 32% to 45% of the workspace, with others working remotely (Williams 2022). A USA survey by PwC suggests that some businesses have already cut back on their real estate needs, as WFH re-imagines how they get work done, and where that work takes place (PwC, 2021).

The challenges facing the commercial property industry are not just about recovery but also accommodating the evolving requirements of a hybrid work pattern, which is unlikely to change soon. For example, office spaces have been reconfigured to have more room for in-person collaboration, compensating for the lack of this function while working from home (Williams 2021). Some commercial property owners have set up new divisions to focus on these tasks, offering tenants new amenities such as wellness centres. Despite the higher vacancy rate during the pandemic, the commercial real estate sector has not seen a decline in investment, exacerbating the potential oversupply of office space, although this is expected to result in lower rents in the short to medium term at least. A recent market figure suggests that over AUD\$70 billion in investment has entered this sector, with \$21 billion in office properties (Cummins 2022).

For employers, the decisions for workers and workspace are related. On the one hand, they need to work out the ongoing work arrangements and the support plan for working from home. On the other hand, they need to decide whether to maintain, increase or decrease, the existing workspace, or decentralise the workspace. Because of the length of many current office leases, these changes may take some time to resolve (Lenaghan 2021).

Naor et al. (2022) study the effects of the pandemic in Israel, with evidence indicating a decline both in procuring office space and its price per square metre. Employee productivity while WFH remains

¹ <https://research.propertycouncil.com.au/data-room/office>

² Vij et al. (2022) report that 5.2% of sampled individuals who are managers (807) work for a company that would consider reducing its office space,

³ <https://www.commo.com.au/news/2022/02/03/pca-office-vacancy-statistics-cbre/1643850982>

relatively high despite home distractions, with a forecast of a continuous shift to hybrid work mode after the pandemic.

There are clear advantages of the hybrid work form such as time saving and work/life balance (Bloom et al. 2009, Hensher and Beck 2022). It has been widely acknowledged that supporting the hybrid work form is important for staff retention in the new “normal” workplace. For workers, after two years of working from home most of the time, some may never return to the past routine of working five days in an office. Not only do employees support it, but business leaders such as the CEO of Telstra have publicly endorsed it as the new way going forward. Flexibility is here to stay’ and ‘employers who offer a balance of WFH and in office will attract more high quality employees’ (The Future of Office Space Summit, 17 Feb 2021)⁴. According to the Productivity Commission, the types of work that can be done at home are about 35%, and the other 65% must be done on site, but this may change over time (Ziffer 2022). The Chair of the Productivity Commission’s in Australia has stated that ‘the five-day office week is dead, long live the hybrid model’⁵.

In the long term, it is still unclear whether and to what extent office space requirements at the firm level will decline due to the hybrid work arrangement, with many industry experts being cautious in referencing a permanent decline in office space. First, there are signs that the demand is increasing for Central Business District (CBD) offices. Second, many businesses are expanding post-COVID-19 and may need more space to accommodate more employees (although see Table 1). Third, larger organisations, including government departments and banks, have not yet decided to reduce office space; however in contrast, many small to medium businesses have decided to reduce office space since the pandemic (Harley 2022 and Table 2 below). Ramani and Bloom (2021) conclude that within large US cities, households, businesses, and real estate demand have moved from dense central business districts (CBDs) towards lower density suburban zip-codes. They label this the “Donut Effect” reflecting the movement of activity out of city centres to the suburban ring. This aligns with a growing interest in satellite office use.

By contrast, Delventhal et al. (2020) have argued that increased adoption of remote working arrangements is likely to lead to a further centralisation of employment. They base this position on three main factors driving this reallocation. First, employers can access the labour of telecommuters even if they are located far from where they live; hence employment shifts from locations which are less productive but closer to workers’ home location, toward locations closer to the core which have higher exogenous productivity and benefit from greater productivity spillovers. Second, the reallocation of residents increases demand for floorspace in peripheral locations and reduces it in the core, creating a cost incentive for jobs to move in the opposite direction. Third, the fact that telecommuters require less on-site office space further increases the cost-efficiency of firms in core locations with high productivity but high real estate prices. The hybrid WFH model can accommodate a mix on increased centralisation and decentralisation with a metropolitan area, in recognising this broader benefits from an employer’s perspective, where physical connectivity (the commonly cited agglomeration benefit) is important despite digital agglomeration satisfying a growing number of connectivity needs in the business supply chain.

Regardless of whether the demand for commercial properties is increasing, the impact of the pandemic on commercial properties cannot be ignored. KPMG surveyed decision-makers of the twelve largest commercial property tenants, and the findings revealed some critical insights to guide how commercial properties might have to change in the future, including dropping the one-size-fits-

⁴ <https://futureplace.tech/future-of-office-space-summit-post-event-session-recordings/>

⁵ <https://www.smh.com.au/business/companies/the-five-day-office-week-is-dead-long-live-the-hybrid-model-says-productivity-boss-20210706-p587d4.html>

all workplace, allowing hybrid workplaces and employee working flexibility, enhancing data and technology, and changing traditional offices to collaboration hubs⁶.

This brief overview of how office space downsizing, growth and potential repositioning is occurring since the beginning of the pandemic illustrates the need to establish the extent to which there is a systematic relationship between three key elements of the structural change associated with a 'next normal', namely how the incidence of working from home and interest in substituting satellite office use may provide informative signals on the expected demand for work space in the future at the office location(s) associated with the pre-COVID-19 period. This evidence has important implications on the movement of employees as commuters and users of the many services associated with the living supply chain (e.g., morning coffee, lunches etc.), which are suffering at present, especially in CBDs. Anecdotally, as of April 2022 we are seeing a significant return of people traffic to the CBD of Sydney, but not as workers, rather to enjoy the interactions associated with shopping, restaurants and associated activities. Meanwhile the office blocks remain very empty.

3. Descriptive Overview of the Data

We drew a random sample of 500 organisations in the GSMA with a quota sample of 100 businesses in the Sydney CBD. A screening question was used to ensure that whoever we spoke to was working in the same organisation pre-COVID-19 and today, and that they had awareness (and ideally decision making capacity) in sharing with us information on the organisation's workspace plans, actual and anticipated, as well as the WFH and WNH activity. The survey took around 10 mins to complete. The final useable sample was 459, with the balance of data deemed unreliable for a number of key reasons including outlier responses to key questions.

A descriptive profile of the data over the three periods is summarised in Table 1 with accompanying graphs (Figures 1, 3 to 7) showing the distribution of the main variables in the sample. We see a drop in the number of employees during the pandemic compared to pre-COVID-19 with evidence (Figure 1) of some small recovery starting to occur. The percentage of working days that are worked from home (Figure 5) has significantly increased, as expected, during the pandemic, with evidence, on average, suggesting little change between April 2022 and the expected level in 2023. Employer support for WFH has more than doubled compared to pre-COVID-19 which, as we know, is crucial to the continuing support and success of a hybrid working model (Beck and Hensher 2022). The percentage of workspace has declined (Figure 3) to an estimate that aligns well with the broader findings in the literature of around 70-80% of pre-COVID-19 levels. Interestingly, cost savings were only seen as a definite consideration by 26% of the organisations, with 11% indicating a definite no, and the balance (63%) not having sufficiently considered it to date.

Table 1. Descriptive profile of key data items across three periods

<i>Before COVID-19</i>	Mean	STD	Min	Max
Number of working days	4.4	1.3	0	7
Percentage of days WFH	20.5	32.5	0	100
Employer supported WFH days	1.3	1.7	0	5
Employee Numbers	847	4081	0	50000
Commuting time in minutes	35	25	0	180

⁶ <https://home.kpmg/au/en/home/insights/2021/05/commercial-real-estate-future-of-work.html>

<i>April 2022</i>	Mean	STD	Min	Max
Number of working days	4.1	1.4	0	7
Percentage of days WFH	35.5	37.5	0	100
Employer supported WFH days	2.8	1.4	0	5
Employee Numbers	711	3654	0	45000
Workspace change at main office location(s) (% compared to 100% Pre-COVID-19)	72	36	0	150
Commuting time in minutes	31	23	0	150
<i>In 2023</i>	Mean	STD	Min	Max
Number of working days	4.1	1.4	0	7
Percentage of days WFH	35.2	35.7	0	100
Employer supported WFH days	2.5	1.5	0	5
Employee Numbers	728	3643	0	45000
Workspace change at main office location(s) (% compared to 100% Pre-COVID-19)	80	32	0	200
Percent of employees will start working at satellite offices if satellite office will be used (160 of 459 orgs)	41.8	25.3	1	100
Commuting time in minutes	31	23	0	150
<i>Other Contextual Data</i>	Mean	STD	Min	Max
Accommodation & food services	0.031	-	0	1
Administrative & support services	0.037	-	0	1
Arts & recreation services	0.026	-	0	1
Construction	0.057	-	0	1
Education & training	0.153	-	0	1
Electricity, gas, water & waste services	0.017	-	0	1
Financial & insurance services	0.052	-	0	1
Health care & social assistance	0.107	-	0	1
Information media & telecommunications	0.031	-	0	1
Manufacturing	0.033	-	0	1
Professional, scientific & technical services	0.137	-	0	1
Public administration & safety	0.037	-	0	1
Rental, hiring & real estate services	0.015	-	0	1
Retail trade	0.107	-	0	1
Transport, postal & warehousing	0.048	-	0	1
Wholesale	0.022	-	0	1
Main work office - Sydney CBD %	26.6		0	1
Well informed about business work space plans *	72	-	0	0

The distribution of the size of the sampled businesses, defined by the number of employees, is given in Figures 1 and 2, and Table 2 where the latter is presented by five firm sizes. Relative to 100% pre-

COVID-19, very large firms with 1,000 plus employees have reduced workspace much less than firms with less than five employees, which aligns well with what is suggested in Section 2 (Harley 2022) where larger organisations have not yet decided to reduce office space since the pandemic in contrast to many small to medium businesses. In aggregate, the average number of employees per firm has declined in April 2022 compared to pre-COVID-19 and is 83.9% of pre-COVID-19 levels; however we are starting to see a small increase to 85.9% in 2023. It is also likely that larger firms have been able to better weather the financial impacts of COVID-19 as compared to smaller businesses, who may also rent office space over shorter leases.

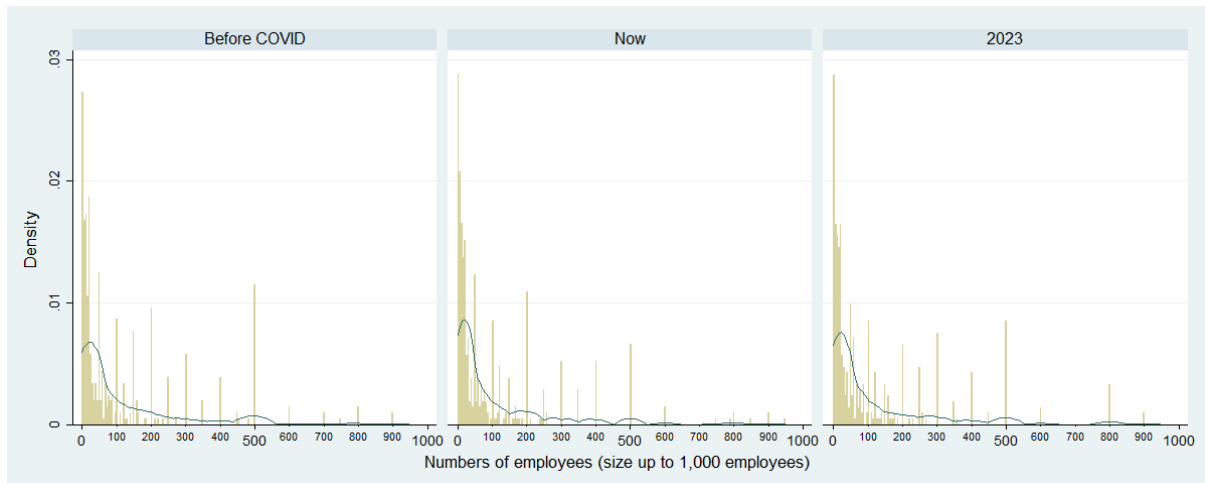


Figure 1. The distribution, by period, of the number of employees in each organisation in the GSMA

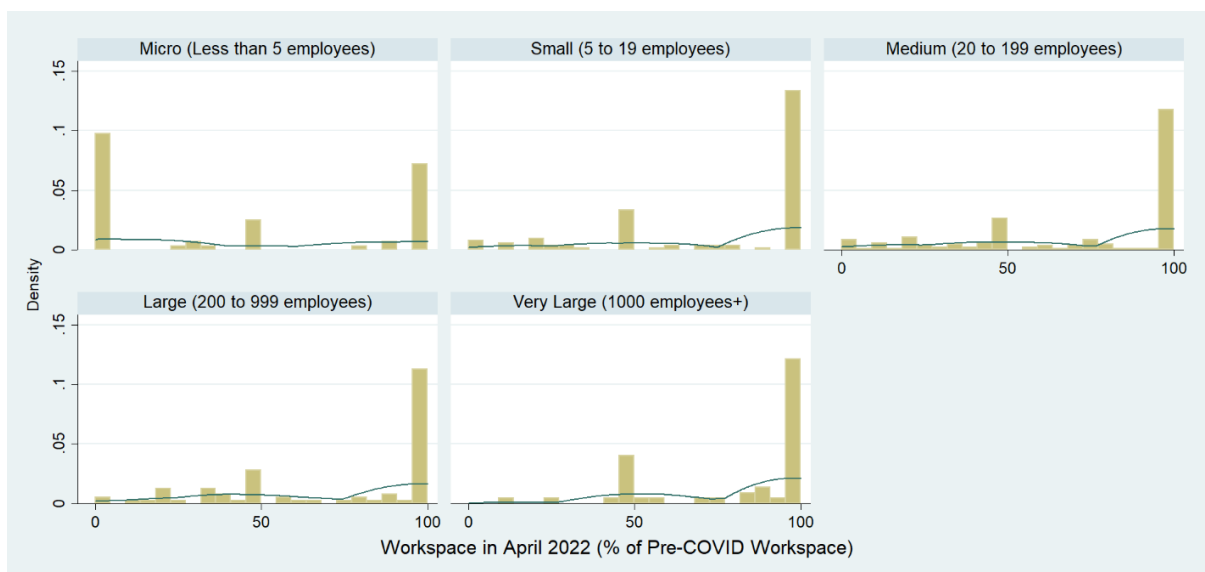


Figure 2. The distribution of main location office space in 2022 compared to Pre-COVID-19 by organisation size

Table 2. Workspace in April 2022 (% of Pre-COVID-19 workspace) by organisation size

Organisation size	% of sample	Mean	STD	25th percentile	median	75th percentile
Micro (less than 5 employees)	12.4%	44.9	44.9	0	35	100
Small (5 to 19 employees)	22.7%	77.2	32.1	50	100	100
Medium (20 to 199 employees)	37.5%	74.7	33.8	50	100	100
Large (200 employees)	17.6%	74.9	32.5	50	100	100

Very large (1000 employees+)	9.9%	82.0	24.9	52.5		100	100
Total	100.0%	72.3	35.5	50		100	100

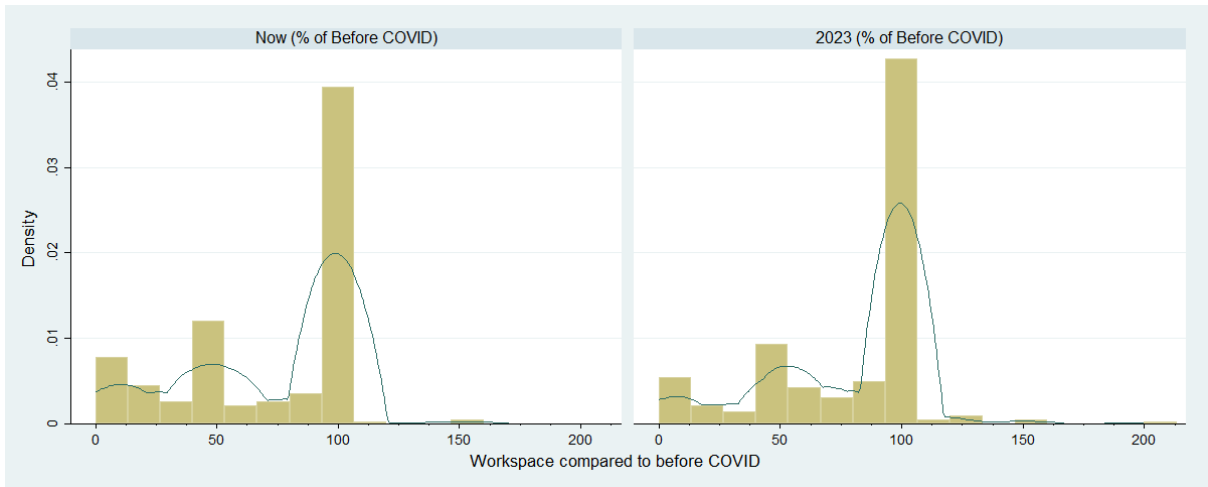


Figure 3. The distribution, by period, of the percentage of work space change in April 2022 and 2023 compared to pre-COVID-19 in the GSMA



Figure 4. The distribution, by period, of the number of working days in the GSMA

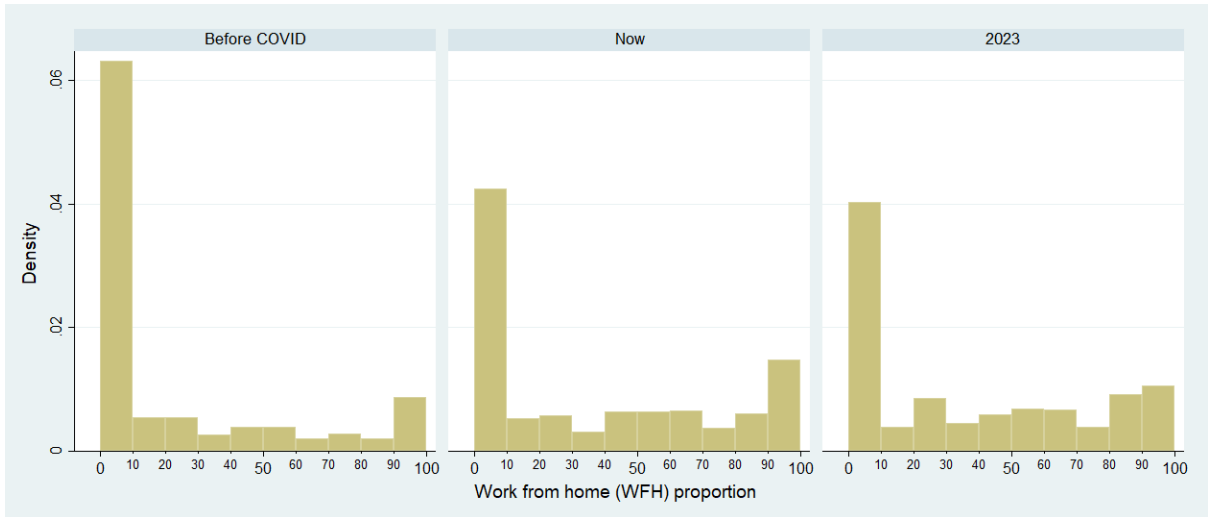


Figure 5. The distribution, by period, of the percentage of working days that are worked from home in the GSMA

We investigated the prospect of more employees starting to work at satellite offices (in space which is shared with others or rented for your organisation only) instead of the main office they went to before COVID-19. In 2023, it is anticipated that some amount of work will occur at a satellite location which we suggest is relatively closer to an employee’s home than the Pre-COVID-19 office location; we call this ‘Working near Home’. 34.72% of the sampled organisations (Figure 6) indicated that they will use satellite offices which represents an average 14.34% of staff in the future working in a satellite office or, on average one in 6.7.

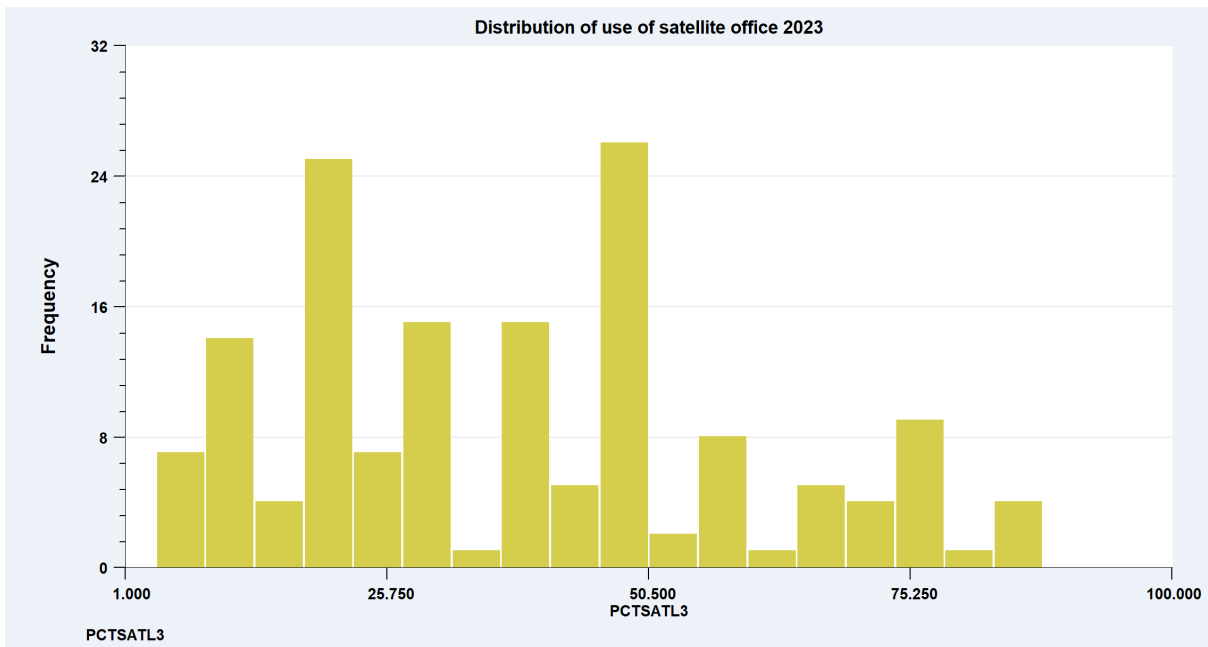


Figure 6. The distribution, by period, of the percentage of employees in 2023 who will start working at satellite offices if satellite office will be used (160 of 459 organisations)

3.1. Distinguishing the Sydney Central Business District and Other Locations

There has been a lot of interest in how the Central Business Districts of major cities have been impacted by the pandemic during lockdowns and periods of relaxation and removal of restrictions. It

is well known that the decline in office workers, many of whom are in occupations that are more amenable to working from home (Hensher et al. 2022, 2022a), has been tumultuous in the CBDs compared to other locations, and this is indeed shown by the findings of our survey. In April 2022, at the time of the survey, noting that in Sydney at this point in time, vaccination rates including booster shots, sits at around 90% of the eligible population and there are no restrictions at all on the movement or gathering of people other than compulsory masks on public transport, the percentage of days WFH was 50% (2.5 days a week) in the CBD and 28.5% (1.4) in other locations (Figure 7). The percentage of employees WFH on any one day in 2023 is expected to be 46.4% for the CBD (i.e., 2.3 days per week) and 29.8% at other locations (i.e., 1.5 days per week), suggesting a slightly lower incidence of WFH in the Sydney CBD in the next year.

This mirrors the relative difference in the percentage of workspace change compared to pre-COVID-19 (100%) of 67% in the Sydney CBD and 73.4% in other locations, with this becoming in 2023, an estimated 72.4% and 81.7% respectively (Figure 8). We see some anticipated recovery towards pre-COVID-19 levels, however even the higher average estimate of 81.7% aligns well with what many pundits are suggesting for the number of workers in the CBD at any one time, namely 80%.

One of the most interesting new measures of influence on the main office work space is the growing interest in utilising space in satellite office locations, on a pay for usage basis (Figure 9). Surprisingly, the finding is very similar for both businesses located pre-COVID-19 in the Sydney CBD and at other locations, at around the 14.3%, which tends to suggest that the interest in using satellite office space is very generic by location and is linked to what we call working near home in contrast to working at home, reducing the frequency, distance and stress associated with daily commuting.

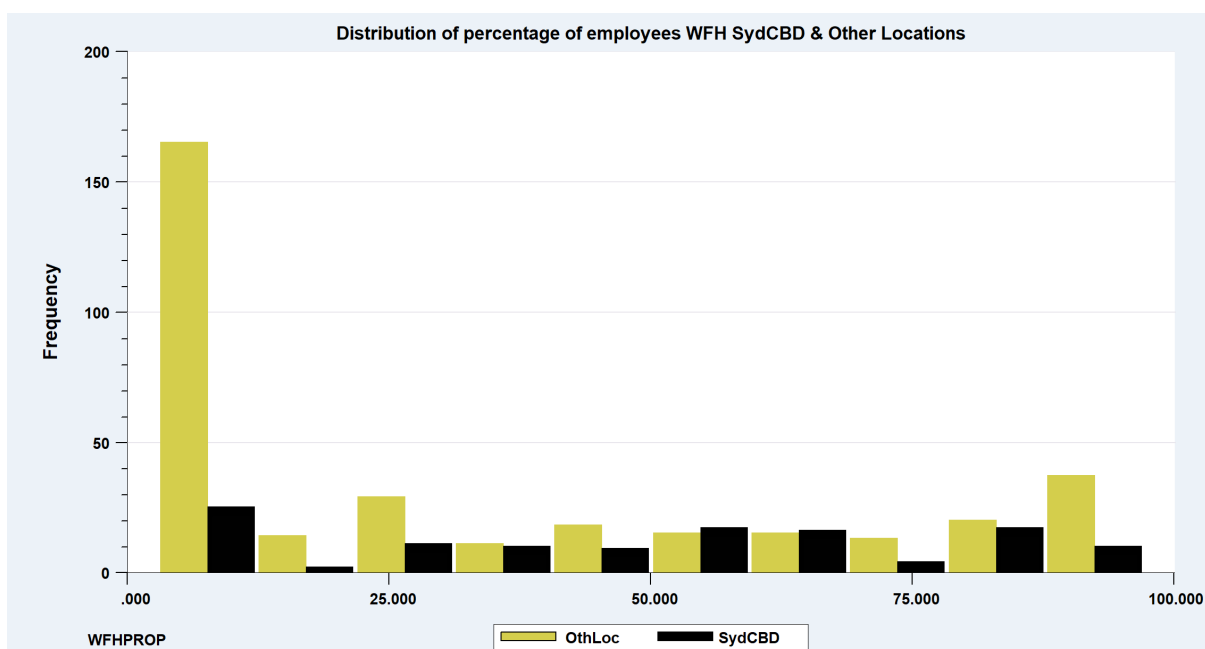


Figure 7. The distribution of percentage of employees working from home in 2023 for two locations

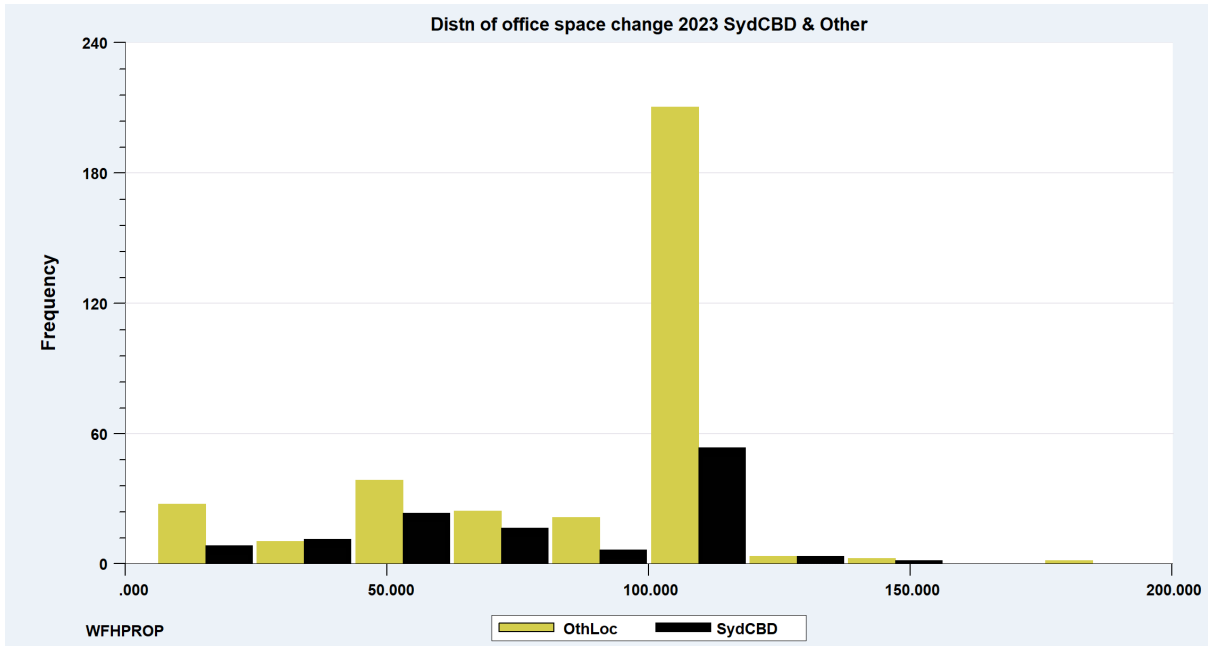


Figure 8. The distribution of percentage of main location office space change in 2023 compared to Pre-COVID-19 for two locations

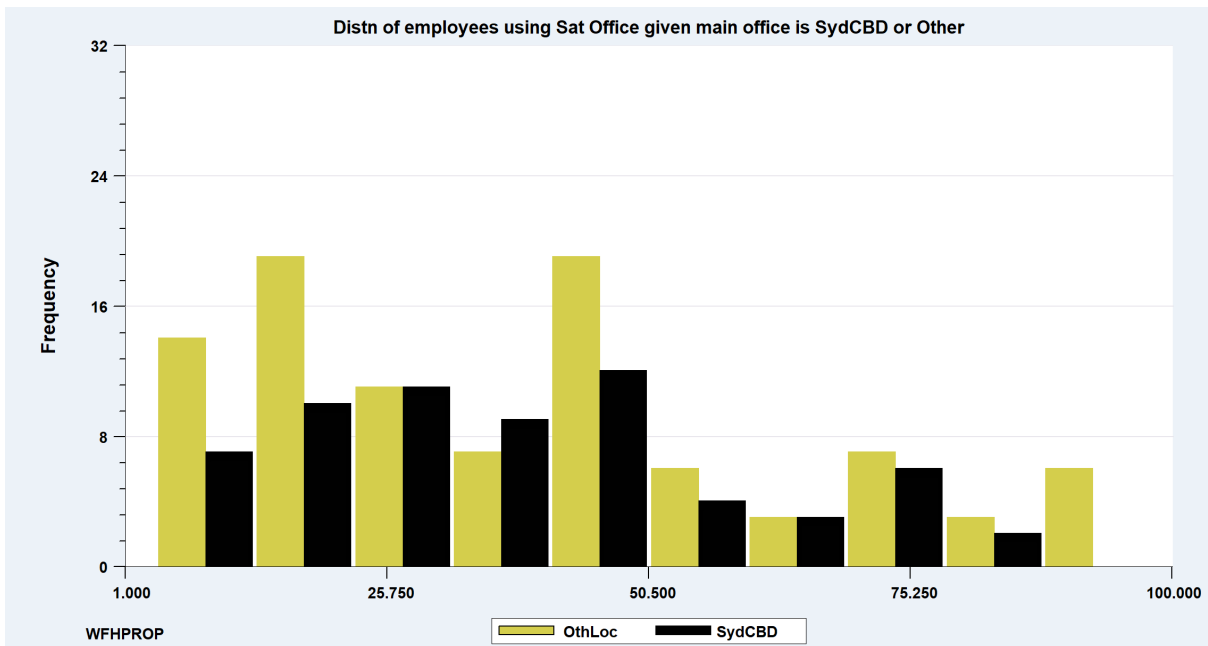


Figure 9. The distribution of the percentage of employees in 2023 who will start working at a satellite office if a satellite office will be used whose current main office is the Sydney CBD or another location

4. Model of Work Space Capacity

4.1 The Random Effects Regression Model

In exploring changes in the workspace capacity pre-COVID-19, in April 2022 and in 2023, we use a random effects regression model to account for data obtained from three periods, assumed to be

random in order to account for random effects. We also have a set of candidate explanatory variables which we are interested in seeing what role they might play in influencing the workspace capacity in each of the three periods. To have the parameter estimates associated with these explanatory variables vary across periods, we interact them with period-specific dummy variables. The standard one-way random effects model (REM) is given in equation (1).

$$y_{it} = \alpha + \beta'x_{it} + \varepsilon_{it} + u_i + w_t \quad (1)$$

The variation across groups (organisations) or time (i.e., periods) is captured in simple shifts of the regression function. These models are the random effects models characterised by μ and w being uncorrelated with x . Under this assumption, the model can be estimated consistently by ordinary least squares. The fundamental part of the random effects model is a one-way common effects specification, given as equation (2).

$$y_{it} = \alpha + \beta'x_{it} + \varepsilon_{it} + u_i \quad (2)$$

$Cov(u_i, x_{it}) = 0$ for all t , and $E[u_i | x_{it}] = 0$, $Var[u_i | x_{it}] = \sigma_\mu^2$, $Cov(\varepsilon_{it}, u_i | x_{it}) = 0$. The random effects model is a generalised regression model. It is homoscedastic, as all disturbances have variance $Var[\varepsilon_{it} + u_i] = \sigma^2 = \sigma_\varepsilon^2 + \sigma_\mu^2$. But, for a given i , the disturbances in different periods are correlated because of their common component, u_i , and $Corr[\varepsilon_{it} + u_i, \varepsilon_{is} + u_i] = \rho = \sigma_\mu^2 / \sigma^2$. The efficient estimator is generalised least squares.

4.2 Results of Random Effects Model

The final model developed for the GSMA (459 organisations) is summarised in Table 3, where the dependent variable is the percentage change in the workspace of the main office in April 2022 and 2023 relative to 100% for Pre-COVID-19. Direct average elasticities are given in Table 4. This model was selected after an extensive assessment of numerous socioeconomic, attitudinal and travel-related candidate variables.

The total variance of error consists of the variance of error between the periods for all organisations, ε_{it} , and within organization, μ_i . The results show that the variance within a time period is the dominant variance. This implies that COVID-19 is the dominant force and cause for businesses changing workspace, and differences of workspaces are not due to differences among other factors. This will give confidence for recovery once the pandemic is 'over'. Eventually, the before COVID-19 workspaces may recover to some extent given that COVID-19 is the dominant reason. However, such recovery will take time, shown by the closeness of current workspace and expected 2023 workspace levels and the growing evidence that WFH to some extent is here to stay as a non-stigmatised model of hybrid working. The model findings align well with the general direction of the empirical evidence from market monitoring, set out in Section 2.

The findings from the workspace random effects regression model suggest that during the pandemic, as measured in April 2022 two years on from the beginning of the outbreak of COVID-19, the increased incidence of WFH has, *ceteris paribus*, resulted in a reduction in the amount of workspace in the main office location throughout the GSMA. Taking the 34% of working days as being WFH now compared to 20% pre-COVID-19 for the organisations in the sample, we have a 14% absolute greater incidence of WFH or a 70% increase, and given the direct point elasticity of 0.059 (Table 4), this equates to a 4.13% decrease in the average amount of office space at the main workplace location. In 2023 we see a similar anticipated further change in the incidence of WFH but a higher direct point elasticity of -

0.0676 resulting in a 4.72% decrease in the average amount of office space at the main workplace location. Hence there is close to a 5% reduction in leased or owned office space.

With many businesses supporting WFH on average one to three days a week and slowly introducing staggered (flexible) working hours, the reduction in office space is still much lower than the number of employees returning to the office and a continuing low occupancy rate, reported as 41% for Sydney⁷. Our survey suggests that the total drop in office workspace or office vacancies is close to an average of 28% in April 2022, and expected to be 21% in 2023, showing some recovery of space being leased or owned, and the full recovery to the pre-COVID-19 office occupancy level most likely taking much longer, and hence the decrease due to WFH is only one reason for the reduction of office capacity, representing 25% of the reason in 2023.

At the same time, in 2023 it is anticipated that some amount of work will occur at a satellite location (14.34%) which we suggest is relatively closer to an employee's home than the Pre-COVID-19 office location. The mean elasticity estimate of 0.0198 indicates that, *ceteris paribus*, a 10% increase in the employees using a satellite office results in a 0.198% reduction in the percentage change in the expected amount of workspace at the main office location in April 2022.

Table 3. Summary of GSMA random effects models for all three periods of data

Variable	Acronym	Units	95% confidence interval			
Pre-COVID-19:			Parameter estimate	t-value		
Number of employees	EMPNUM1	number	0.0187	2.80	0.0056	0.318
Percent of days working that are WFH	WFHP1	%	0.1384	2.73	0.039	0.238
April 2022:						
Percent of days working that are WFH	WFHP2	%	-0.3236	-7.91	-0.404	-0.243
2023:						
Percent of days working that are WFH	WFKP3	%	-0.3732	-8.92	-0.455	-0.291
Percentage of employees using a satellite office	PCTSATL3	%	-0.0089	-2.96	-0.147	-0.003
Context Variables:						
Industry = education and training	EDUC	1,0	-7.4322	-2.61	-13.01	-1.867
Industry = Real Estate	REALEST	1,0	-23.018	-2.76	-39.34	-6.69
Constant			88.871	53.2	-39.34	-6.691
Random effects*:						
Var (ϵ)			1427.57			
SD (ϵ)			37.78			
Var (μ)			0.2698			
SD (μ)			0.5195			
Corr [$v(i,t),v(i,s)$]			0.00019			
R-squared			0.13			

* Variances computed using ordinary least squares (OLS) and least squares dummy variable (LSDV)

Table 4. Summary of mean point and arc elasticity estimates

Computed by average over sample observations
(t-value in parenthesis)

Influence	Mean Elasticity
Percent of days working that are WFH (WFHP1)	0.0095 (2.97)
Percent of days working that are WFH (WFHP2)	-0.0590 (5.95)

⁷ <https://www.commercialrealestate.com.au/news/workers-trickle-back-to-offices-but-cbds-remain-critically-underpopulated-1130458/>

Influence	Mean Elasticity
Percent of days working that are WFH (WFHP3)	-0.0676 (6.45)
Percentage of employees using a satellite office	-0.0198 (3.16)
Number of employees	0.0098 (3.03)

5. Conclusions

There are many ongoing challenges to governments, to the broad base of employers, and even to households, as they work out how best to encapsulate the non-stigmatised WFH future (Beck and Hensher 2020). The implications for funding of infrastructure, re-prioritising land use plans, growing new office settings which include satellite offices, and what the future office environment might be are profound (Ramani and Bloom 2021).

This paper has identified how working from home and a growing interest in the use of satellite offices impacts on the amount of office space likely to be required (or preferred) in the near future as we seek out evidence on what the ‘next normal’ may look like in the office property market. The findings from our survey of 459 organisations and its reflection in a random effects regression model align extremely well with the reported changes occurring in the Sydney market. Given this alignment, it is plausible that the model will give good insight into what may happen to work space under different levels of working from home (measured as a proportion of days worked from home rather than a number of days measure).

We analyse the change in work space over a range of different WFH proportions, in respect of WFH (Figure 10) and use of satellite offices (Figure 11) on the quantum of main office space. The range of the percentage of days working that are WFH that we assessed suggests a potential drop in the amount of office space required at the main office of between 85.2% and 62.8%. If we work with what appears to be the most likely scenario of one to two days WFH per week for many occupations, our model predicts a reduction in the percentage of office space compared to pre-COVID-19 of 79.6% for an average of one day WFH and 72.1% for an average of two days WFH. The decline of 20% to 28% in 2023 relates reasonably well to an occupancy rate in February 2022 of 18% for the Sydney metropolitan area (Williams 2022).

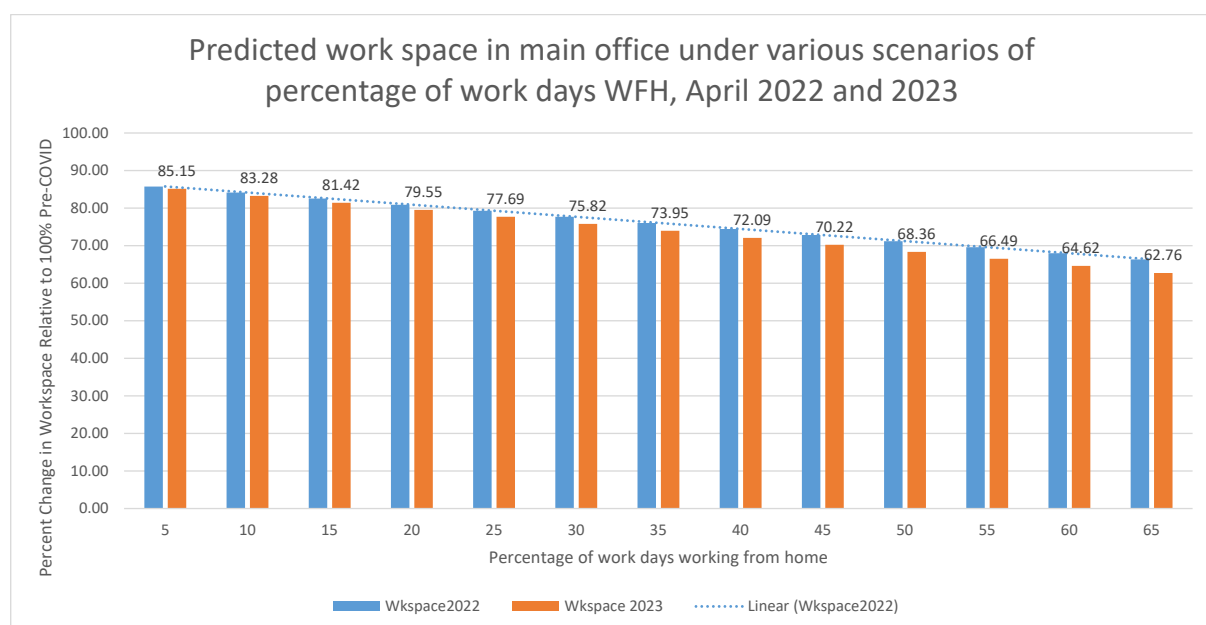


Figure 10. The expected influence of WFH levels on required office space in the main location in April 2022 and 2023

Figure 11 suggests that the growth in the use of satellite offices changes very little the quantum of main office space that is likely to be in place in 2023. The predicted impact at the mean of the likely use of satellite offices is close to 74%, which is the same range as the likely impact of WFH in Figure 10, reinforcing a view that the decrease in office space in the immediate future relative to the period just before the onset of COVID-19 is around 75%. We might speculate that some employees will use combinations of all three locations – the main office, the satellite office and WFH, adding some variety to their more flexible lifestyles. If true, to some degree, this may explain why we do not anticipate a significant change in the amount of main office workspace as satellite office use grows.

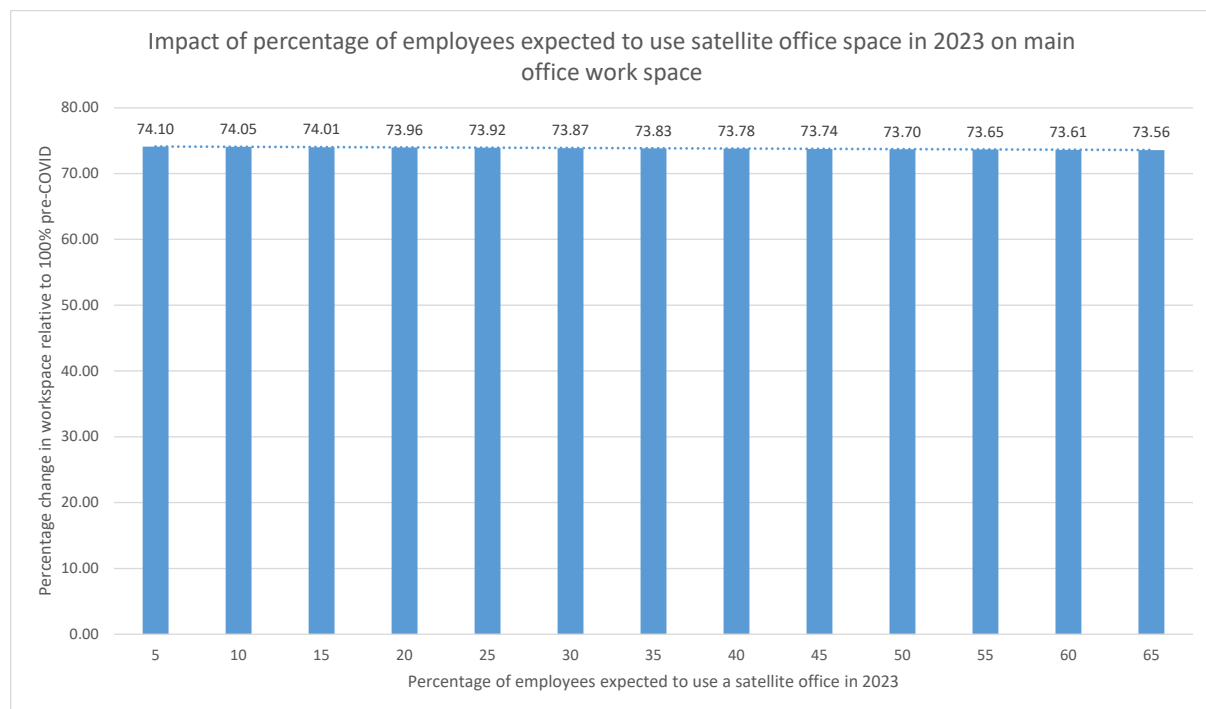


Figure 11. The expected influence of employees using a satellite office on required office space in the main location in 2023

These findings are significant in assessing policy settings that government needs to consider with respect to initiatives designed to manage changing demands on servicing various locations throughout the GSMA, especially infrastructure and ways to support businesses in delivering benefits to society as a whole. With WFH being seen as one of, if not the most, impactful transport policy instrument available for many years, the policy settings that flow from this WFH and WNH ‘next normal’ are expected to include infrastructure investments that align more with suburban investments to benefit walking and cycling and the broader agenda of the 20 minute city where reduced commuting distances become a greater priority. Importantly the changed profile of commuting may look more like reduced frequency over a week while preserving much of the longer distance commute over fewer days while either avoiding commuting at all on some days or commuting to a close by satellite office. These structural changes are evolving and look like becoming a permanent fixture of the mobility land use scape.

We recognise that this is a first attempt (indeed one of the first in the academic literature) to examine the impact of COVID-19 on work space volume decisions. It is likely that, after two years “experimentation” with working from home, and with businesses now seeing largely unchanged productivity despite the challenges of the pandemic, decision makers are likely beginning to think

more concretely about the size of main physical workplace that will be required in the future. As such, it is important that research in this area begin as it has been relatively overlooked, but will also be an important determinant into future travel patterns within urban areas and indeed the composition and reimagining of many office-dense city environments. In ongoing research, we are taking the evidence and model from this paper and building it into an integrated transport and land use model system for the GSMA, called MetroScan. We have already built WFH into MetroScan (Hensher, Wei and Liu 2022), but need to adjust the occupancy levels of employees in the office and workspace at each location in the GSMA.

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