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THE COVID-19 PANDEMIC AND OFFICE SPACE DEMAND DYNAMICS

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Abstract. The COVID-19 pandemic led to the mass adoption of remote working and other office market dynamics. As firms continue to adapt to the changes caused by the pandemic through various work patterns, the potential implications for the office market are unclear. Using data from Knight Frank's (Y)OUR SPACE (2021) survey, this paper employs probit and multinomial models to examine the relationship between COVID-19 related remote working and changes to firms' office space strategies. The study confirms that the pandemic has significantly influenced firms' medium-term office space use strategies, and the results show that firms' perception of their employees' work-from-home experience has influenced their strategy review. The results specifically show that a positive WFH experience increases the likelihood that firms will reduce their total space quantity, reduce their density of occupation, and negotiate shorter leases in the medium term. We further observe that the pandemic is likely to have weaker effects on space quality than on space quantity, implying that economic factors remain core priorities in future office space use strategies, while social and environmental factors may remain secondary. These insights extend the literature beyond the economic determinants of office space demand to other social factors.

Keywords: office, COVID-19, remote working, work from home (WFH), workspace, corporate real estate, ergonomics.

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Introduction

Following the outbreak of the COVID-19 pandemic across the world, the World Health Organisation (WHO) Emergency Committee declared a global health emergency on 30 January 2020. The highly infectious nature of the virus, high mortality rate and the inability of global and national health systems to contain its spread (among other factors) led the WHO to declare a global pandemic on 11 March 2020. This further led to a shutdown of national economies and severe restrictions on the movement of people[1]. As an adaptation strategy, many businesses and organisations mandated their personnel to work remotely, and this led to the conversion of erstwhile residential spaces to workspaces, commonly referred to as working from home (WFH).

According to the Office for National Statistics (ONS, 2020a) report, 46% of the UK labour force worked from home by April 2020 and 86% of those that worked from home attributed it to the COVID-19 pandemic. The universal adaptation of the work from home (WFH) practice during the lockdown has generated a plethora of debates relating to the future of office spaces. Corporate firms and organisations are actively engaging in conversations about their business operation strategy, particularly the utilisation of real estate, going forward. Kalyan et al. (2020) reveals that CEOs of global organisations with large space usage (such as Barclays, Google and Facebook) are considering structural changes to office space use, and a KPMG CEO Outlook Pulse Survey conducted in 2021 also reflects the same sentiment. According to the KPMG (2021) report, 24% of the CEOs surveyed admitted that their business models will change "forever"; the world's most influential companies are therefore developing strategies for the post-COVID-19 world. Kalyan et al. (2020) further suggest that organisations now favour a reduction in the number of staff working from the office and are developing strategies to strengthen the remote working practice. However, the specific ways in which these changes will affect office space use in the short, medium, and long term are still unclear. Furthermore, previous studies that examined the effects of the pandemic on the user segment

[1] Popularly referred to as "lockdown".

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of the office market have been based on descriptive analysis, which makes it difficult to establish the relationship between the factors being analysed.

This paper analyses the key areas of expected changes to office space use going forward and explores key factors that may be influencing these changes. The paper particularly examines the relationship between the COVID-19 pandemic and firms' strategies for office space quantity and quality. This study probes the following: (1) what key changes are firms likely to make to their office space use strategies in terms of quality and quantity going forward? (2) what are some of the factors that can influence the potential changes to firms' office space use strategies and to what extent will COVID-19-related factors affect these changes?

The study addresses the aforementioned questions using data from Knight Frank's (Y)OUR SPACE (2021) survey administered to office space occupiers (organisations) across over 15 industry sectors with business presence in the UK. Probit and multinomial models are used to examine the key factors that can influence changes to firms' office space strategy with a primary focus on factors relating to the COVID-19 pandemic. The results confirm that indeed, firms are developing plans to make medium-term changes to their office space use strategy and the COVID-19 pandemic has significantly influenced the review of their strategies. The results show that a positive WFH experience increases the likelihood that firms will reduce their total space quantity, reduce their density of occupation, and negotiate shorter leases in the medium term. The results however suggest that the effects of the pandemic and the WFH experience on space quality are likely to be weaker than the effects on space quantity.

This paper provides novel insight into office demand dynamics and associated COVID-19-related factors that are essential for future office space use planning, management and forecasting. The study makes important contributions to the ongoing conversations on the impact of the COVID-19 pandemic on the commercial real estate market. It particularly provides useful insight on the influence of the pandemic on the changes to the user market segment of the office market following rigorous empirical analysis. Furthermore, our study also makes an important contribution to the broader literature on the office market by analysing the social elements of the market (space users) and the economics of space use through an estimation of the influence of employees' experiences and employers' perception on potential space demand regarding space size, lease terms, office space densities and office space quality. These insights extend the literature and provide novel knowledge beyond the erstwhile analysis of office space demand from an economic angle (Miller, 2014; Rabianski & Gibler, 2007). These insights are also particularly important considering the growing conversations around ergonomics[2].

The paper continues with a brief overview of the influence of COVID-19 on changes to work culture and office space utility, followed by a review of relevant literature and the conceptual framework. The third section covers the data and methods, while the fourth and fifth sections present the results and further discussion respectively. The final section provides a summary and conclusion to the paper.

1. Remote working and the modifying effect of the COVID-19 pandemic

Remote working is one of the outcomes of contemporary flexible workspace strategies. Evidence suggests that remote working was already a well-established practice before the COVID-19 pandemic. Data from the ONS (2020b) shows that 5% of the UK workforce (approximately 1.7 million people) worked from home in 2019, and Hess (2019) further reveals that 5.2% of the US workforce completely worked from home in 2017 while 43% worked from home occasionally. Workplace apps and other digital tools were therefore already being used to improve online teams' collaboration and to facilitate flexible and remote working before the pandemic (Jones Lang LaSalle [JLL], 2019). Although the remote working culture before the pandemic was most common in service occupations such as programming, design, marketing, media, and customer services (Saiz, 2020), the COVID-19 pandemic permeated occupational barriers[3]. Firms have therefore had to review their office space strategies to align with the current realities. Data from Knight Frank (2021) shows that 27% of space users aim to make long-term/permanent strategic changes to their office space use following the pandemic, while another 48% aim to make medium-term changes to their office space use strategy. It will therefore be valuable to delve deeper into these dynamics to broaden the insight on some of the potential changes to future office space use and its concomitant factors.

2. Relevant literature and conceptual framework

Office market asymmetric adjustments have been shown to combine demand and supply dynamics (Hendershott et al., 2010). Hendershott et al. (1999) provide an equilibrium-based dynamic adjustment model of the office market that highlights the role of demand factors in determining vacancy rates adjustments and rents. Demand and pricing in the office market are fundamentally driven by a plethora of factors that theoretically relate to the optimal utilisation or underutilisation of workspaces. Traditional models generally account for office-related macro-level factors such as GDP, population growth, employment, the industrial and occupational composition of the economy and market competition, in addition to other micro-level factors such as changes in technology, work practices, corporate management and environmental pressures

[2] Ergonomics is a science concerned with the fit between people and their work. It puts people first and aims to ensure that equipment, task and the environment are compatible.

[3] According to ONS (2020b), professional occupations were still most likely to be adaptable to home working.

(Wheaton et al., 1997; Tsolacos et al., 1998; Colwell et al., 1998; Rabianski & Gibler, 2007).

Occupiers' activities have also been found to influence office space demand (Guy & Harris, 1997). According to Detoy and Rabin (1972) (cited in Rabianski & Gibler, 2007), office space demand is channeled through existing tenants expanding their space requirement, relocating firms with new tenants moving into the community, new tenants emerging from start-up businesses, existing tenants upgrading their space requirements, and existing tenants in a building being forced to relocate due to office space being removed from the inventory. Rabianski and Gibler (2007) further suggest that the occupation sector and the location of an organisation are important factors in space demand analysis; these factors are particularly important in empirical analysis because they control for the potential occupational sector and sub-market unobserved heterogeneity. The demand factors highlighted generally interplay with supply dynamics to create office market adjustments. Da Silva et al. (2022) also highlights the role of workspace providers in determining office market adjustments, showing specifically that flexible workspace providers contribute to rent adjustment, albeit negatively in comparison to core tenants. This may be the result of the uncertainty and higher risk associated with flexible workspaces.

Other important aspects of office space use that have been explored in literature are the density of workspaces and lease terms. Miller (2014) argues that the overall density of space that a firm requires will increase as the number of employees in the firm increases; this follows the assumption that firms will first seek to maximise their available space before demanding more. In order to maximise space while ensuring reasonable densities, innovations such as shared spaces, hot desking, co-working, and remote working have emerged, leveraging shared digital cloud-style storage systems (Miller, 2013). These new models, by implication, should further lead to a decrease in space quantity requirement (theoretically), and this can serve as an adaptation strategy in the event of business and economic shocks. Miller (2014) further suggests that flexible leases are potential channels through which firms can modify their office space strategies. Some of the key areas of flexibility include shorter lease lengths to accommodate potential economic changes, more regular break options and incentives such as rent-free periods or capital contributions. However, the changes to the densities referenced in these studies may reflect organisations' post-GFC cost-reduction adaptation, in contrast to the current drive to maximise utility.

Studies on office space demand are typically premised on the implicit assumption that demand evolves over a long period of time. While this may be true in most cases, this line of reasoning fails to account for institutional, economic, and political shocks which can cause sudden changes to work culture and requirements. The COVID-19-induced WFH, for instance, revealed that changes to office space use and by extension, space demand, may not necessarily operate within defined theoretical constructs. The literature on the black swan theory provides insight into the impact of shocks on economic systems[4]. This theory has been applied to the energy market (Krupa & Jones, 2013), risk management (Aven, 2013), the stock market (Bekiros et al., 2017) and construction (Nafday, 2011). The black swan event theory has also been applied to real estate (Higgins, 2015, 2013, 2014), although the focus of these studies has been on real estate pricing and capital markets. The COVID-19 pandemic has been classified as a black swan event (Antipova, 2021); our study, therefore, makes a unique contribution to the broader black swan event and the office real estate market literature. More broadly, the study effectively provides novel insight into one of the channels through which office space demand could be altered in atypical theoretical constructs.

Firms and organisations have reported negative and positive experiences concerning the COVID-19-induced WFH. CBI (2020) reveals that some of the positive effects include increased flexibility in working patterns, time saved on commuting and travelling, maintained/improved productivity and a more structured/disciplined approach to communication; while negative effects include mental health problems, isolation, lack of informal collaboration/interaction with colleagues, difficulties in training and development, and difficulty in building relationships, particularly for less experienced and new members of staff. Firms that can maximise the positive aspects of the WFH experience and address some of the negative areas may therefore be more likely to promote the remote working practice within their organisation. By extension, these firms are also likely to demand less space and seek shorter lease terms. It is therefore valuable to examine the WFH experience and analyse the extent to which it can influence firms' post-COVID-19 office space use plans.

It is typical of space users to regularly review their overall property strategy to ensure that the space occupied is still appropriate to support their core business operations (Scarrett & Wilcox, 2018). With the pandemic leading to major changes in the real estate market, it is valuable to analyse key areas of firms' space use strategies to gain further insight into the expected changes in the office market, particularly in the user segment of the market. The quadrilateral-dimensional elements of space quantity, leases, space densities, and space quality are key areas of interest. The first and second elements relate to the economics of space with direct financial implications, while the third and fourth relate to physical space and ergonomics. A CBRE (2021) report predicts a circa 9% reduction in underlying demand for office space over the next three years as more organisations move towards a more hybrid form of working. Data from the (Y)OUR SPACE (2020)

[4] The theory of black swan events describes rare, unpredictable, surprising and outlier events which leave clear footprints and, in most cases, significantly change sector systems and operations (Runde, 2009).

survey further reveals that companies and organisations aim to reduce the quantity of space in use, decrease average lease length and density of occupation, and increase desk-to-person ratio, desk sharing and collaborative spaces. The data further shows that firms are likely to improve the quality of amenities provided in their workspaces going forward. However, the data, in a descriptive form does not shed enough light on the extent to which the COVID-19 pandemic has contributed to these planned changes. The empirical exercises in our study, therefore, provide insight into the relationship between the COVID-19 pandemic and the expected changes, particularly considering that remote working was already a relatively common practice before the pandemic.

The foregoing theoretical constructs align to three core propositions: the first proposition is that the significant increase in the WFH practice during the pandemic led to fewer employees working in the office at the same time. This may therefore lead to a decrease in firms' space quantity requirements, particularly in the short and the medium term (as highlighted in Section 1). The second proposition relates to the uncertainty in business operations as firms continue to promote the WFH practice. Tenants (firms) may consider shorter and more flexible lease options as an adaptation strategy, and the increase in vacancy rates following less space demand can also position tenants to be able to negotiate more favourable lease terms (including shorter leases). The third element relates to space management, ergonomics and the general experience of workers in the office, which specifically address changes to the use of traditional office spaces. The increased awareness and exposure of the workforce to flexible working and other innovations during the pandemic may lead employees to demand better and more flexible working conditions if they chose to work from the office; organisations may, therefore, need to improve their physical work environment and general conditions, facilities, and amenities. These propositions are examined in the empirical section.

3. Data and methods

3.1. Data and summary statistics

Following the outbreak of the COVID-19 pandemic, several real estate service firms conducted surveys to gain deeper insight into the potential impact of the pandemic on the real estate market. (Y)OUR SPACE is one of the major surveys that focused on the changing nature of workspaces. The empirical analysis in this study, therefore, utilises secondary data from Knight Frank's (Y) OUR SPACE (2021) survey. This survey was conducted in a two-month period between 1 December 2020 and 31 January 2021[5]. The data was primarily collected, managed, and verified by Knight Frank's Occupier Research team, and access to the raw-anonymised dataset has been provided to the authors for use in this study[6].

The survey targeted global companies occupying real estate across multiple international markets. These companies were drawn from 15 industry sectors to provide a broad spectrum of occupier types. The sample was also balanced in terms of the size of the responding companies, ranging from companies with a total headcount of more than 50 to global multi-national corporations with a headcount of more than 100,00. The data was collected through online questionnaires with the links sent directly to key corporate real estate leaders in the client network base of Knight Frank[7]. All respondents were senior corporate real estate professionals with multi-market responsibility for the management of real estate portfolios and the delivery of the workplace. Those responsible for the delivery of day-to-day facilities management were excluded from the survey, given the focus was on the strategic use rather than tactical delivery of real estate. Only one response was permitted from a single company and where multiple responses were provided from the same organisation the response from the most senior respondent operating with the broadest geographical remit was used. Respondents were asked to respond from the perspective of their role in delivering real estate and workplace within their organisation, rather than from a personal perspective. This, therefore, implies that the responses in the survey represent corporate rather than individual perspectives.

The link was made private, and the survey was not open to public platforms to ensure that the responses were limited to the core corporate targeted respondents. A total of 650 questionnaires were administered, with a response rate of approximately 56%. Due to the missing information on some observations within the dataset, a total of 361 firms have been used for the empirical exercises.

The primary outcome variable in our empirical analysis is a binary variable that captures firms' plans to reduce the size of their office spaces within the next three years (1) relative to firms' plans to increase the size of their office spaces or keep the space the same (0). In addition to this, we explore three other (secondary) outcome variables (also in binary form): decrease in lease length, decrease in space density, and improvement to space quality. The decrease in lease length variable captures firms' plans to have shorter lease lengths within the next three years (1) relative to firms' plans to have longer lease lengths or to leave the lease length the same (0); while the decrease in space density variable captures firms' plans to reduce the number of workers per space relative to increasing this number or keeping it the

[5] The survey questions and structure can be found in Online supplementary material Table S1.

[6] The data from the survey was originally used to produce Knight Frank's proprietary (Y)OUR SPACE (2021) report.

[7] These corporate real estate leaders confirmed that they had either regional or global responsibilities for their organisations/firms, suggesting that they were influential in the decision-making process in their organisations.

same (0); the fourth outcome variable captures firms' plans to improve their space quality (1) relative to having no plans to make improvements (0).

For the explanatory variables, we focus on two key variables. The first explanatory variable is the firms' general WFH experience during the pandemic. This enables us to analyse the role of the WFH experience during the pandemic on firms' office space strategies. The second key explanatory variable is the firms' acknowledgement of the role of the COVID-19 pandemic in influencing their office space strategy[8]. While the latter captures the COVID-19 effect on office space demand in general, the former captures the WFH experience effect more specifically. The variation in the WFH variable is represented at the firm level. It should be noted that during the survey, each respondent, representing the firm, provided a response based on his/her perception of the WFH experience of the generality of the employees within the firm they represented. The WFH experience variable is therefore interpreted as employees' satisfaction with the WFH in their firm rather than as the firm's productivity or business performance.

To minimise the potential bias caused by omitted variables, other binary and categorical variables are introduced into the model in alignment with the key factors discussed in the relevant literature and conceptual framework section. One of the control variables is the industry or occupational sector in which the firms operate. This captures the potential unobserved heterogeneity associated with the operational requirements and realities of the occupational sectors. For instance, while those in tertiary occupation (services) can commit to WFH more easily due to the nature of their task and responsibility, those in the primary occupation sector may find WFH more challenging. The dataset in its raw form indicates the specific business/industry sector for each firm; due to small cell sizes within these sectors, however, the occupational sectors have been re-classified into the three main occupational categories: tertiary, secondary and others[9]. We also introduce a variable to indicate the location of the headquarters of the firms to capture potential effects relating to the continental location of the firms' headquarters[10]. In addition to these, we include other control variables as listed in the variable description and summary table in Appendix Table A1[11]. Although some of the control variables such as sustainability and the size of the global workforce are not conventional, they can capture contemporary demand dynamics and are thus valuable in our study.

3.2. Data analysis and methods

We first use probability models to estimate the conditional probabilities for each of the outcome variables (a decrease in space quantity, a decrease in lease terms, a decrease in occupancy ratio, and an improvement in space quality). The models measure the probabilities that the changes in these outcomes are likely to be caused by the COVID-19 pandemic, WFH experience more specifically, and other factors (controls), conditioned on a set of vectors of unobserved characteristics, based on the assumption that the zero conditional mean assumption holds:

$$\mathrm{P}(y = 1|x) = \mathrm{E}(y|x). \quad (1)$$

The outcomes are in binary form, hence the suitability of a probit model. The models are defined in terms of latent variables thus:

$$y_i^* = x_i'\beta + e_i. \quad (2)$$

For the primary outcome variable, for instance (the probability of a decrease in a firm's office space size/quantity vs the probability of the firm's total space increasing or remaining the same), y_i* enables us to observe if the decrease in space quantity over the next three years (1) or otherwise (0) is determined by whether the outcome variable (y_i*) crosses a threshold or not. The coefficients from the marginal effect (Equation (3)) are reported in the results section because they show the impact of the explanatory and control variables on the likelihood that a firm will take a specific decision relative to another alternative, thus making it possible to estimate the effects of the predictor variables on firms' future office space plans and strategies.

$$g(\overline{x}(k)\hat{\beta}(k) + \hat{\beta}_k) - g(\overline{x}\ (k)\hat{\beta}(k). \quad (3)$$

We further adopt multinomial probit models (MNP) for the outcome variables to capture broader dimensions in the analysis. For the MNP, we use outcome variables containing discrete multiple alternatives with no natural ordering or sequence (for instance, decreasing space size = 1, keeping space the same = 2, and increasing the space size = 3). The modelling of these outcomes is premised on the assumption that there are a series of latent propensities y^*_{im} for each discrete state (m representing the values of the dependent variable y_i), each of which is

[8] Firms acknowledging that the pandemic has affected their space strategy is expected to capture COVID-19 effects.

[9] The "others" category includes primary occupations and unclassified categories. The few firms within the primary occupation sector led to small cells within this category; we thus had to merge the primary occupation with the "others" category and the "unclassified" category which refers to respondents that did not indicate their occupational sector.

[10] Due to the small sample sizes for some of the continents, we use four continental categories: America, Europe, Asia/Middle East/Africa and others (for Australia and all other responses where the continents were not listed).

[11] We explored the use of several other control variables, but they generally were statistically insignificant and did not improve the model fit. In addition to these, some variables were also dropped due to multicollinearity and in other cases, due to insufficient observations which would have further reduced the sample size. Some of these variables are analysed as outcome variables in the further analysis and robustness test (in Section 4.3).

assumed to depend on a series of exogenous characteristics. It is assumed that the probabilities linearly depend on common factors x_i thus:

$$y^*_{im} = x^{l}_{i}\beta_m + u_{im} \text{ for } m = 1, 2, 3, \quad (4)$$

where β_m represents the vectors of parameters specific to each firm's decision (for instance, to reduce the space, keep the space the same or increase the space over the next three years) and u_{im} represents random disturbances with some potentially joint distribution.

The raw coefficients of the MNP are not directly interpretable; however, it is possible to obtain probabilities for each choice by integrating the probability density function. Marginal effects (average marginal effects) on the probability of being in a category can give better insight into the overall effect of a change in the predictor variables on the different options for the outcome variables, and this can be calculated by evaluating the derivatives of each propensity relative to each regressor.

Although the discussion on the empirical framework has been mainly applied to the primary outcome variable, an identical approach is adopted for the other outcome variables. The models for the various outcome variables are shown below (Equations (5)–(8)):

$$\begin{aligned} &Pr\left(Space\,quantity\,decrease\right) = \\ &\beta_0 + \beta_1 Work\ from\ home\ experience + \\ &\beta_2 COVID-19\,effect\,on\,space\,use\,strategy + \\ &\beta_3 Sector\ FE + \beta_4 Location\ FE + \beta_5 x + u; \end{aligned} \quad (5)$$

$$\begin{aligned} &Pr\left(Lease\,length\,decrease\right) = \\ &\beta_0 + \beta_1 Work\ from\ home\ experience + \\ &\beta_2 COVID-19\,effect\,on\,space\,use\,strategy + \\ &\beta_3 Sector\ FE + \beta_4 Location\ FE + \beta_5 x + u; \end{aligned} \quad (6)$$

$$\begin{aligned} &Pr\left(Space\,density\,decrease\right) = \\ &\beta_0 + \beta_1 Work\ from\ home\ experience + \\ &\beta_2 COVID-19\,effect\,on\,space\,use\,strategy + \\ &\beta_3 Sector\ FE + \beta_4 Location\ FE + \beta_5 x + u; \end{aligned} \quad (7)$$

$$\begin{aligned} &Pr\left(Space\,quality\,improvemnt\right) = \\ &\beta_0 + \beta_1 Work\ from\ home\ experience + \\ &\beta_2 COVID-19\,effect\,on\,space\,use\,strategy + \\ &\beta_3 Sector\ FE + \beta_4 Location\ FE + \beta_5 x + u. \end{aligned} \quad (8)$$

4. Results

This section presents the results from the empirical analysis in three sub-sections: the first sub-section shows the results from the base models with the primary outcome variable, the second presents the results with the four outcome variables, and the third sub-section presents further analysis, robustness tests and the limitations of the study. The results are discussed further in Section 5.

4.1. COVID-19 and firms' office space quantity/size expectations

Table 1 reports the marginal effects of probit models where we regress a dummy for the decrease in office space size against the main explanatory and control variables. Although the full set of coefficients is reported, the discussion and analysis focus on the key explanatory variables (WFH experience and COVID-19 effects) and other variables with note-worthy coefficients. Column 1 presents the regression with the variable on the WFH experience during the pandemic, and this is used to establish the baseline for the analysis. The negative WFH experience serves as the reference category. The baseline results show that as expected, firms that had positive and neutral WFH experiences are more likely to demand less space over the next three years compared to firms with negative WFH experiences. To further establish the relationship between the pandemic and expected changes to office space quantity demanded, we introduce the variable that captures firms' acknowledgement that the COVID-19 pandemic has affected their office space use strategy, and this is reported in column 2.

The results reveal that firms that reported that the pandemic has influenced their office space strategy in the medium and long term are more likely to reduce their space sizes over the next three years in comparison to firms that reported that the pandemic has not affected their office space strategy. Furthermore, the probability that a non-negative WFH experience will reduce the space quantity demanded remains significant in the new model. The introduction of the COVID-19 effect variable causes a 300% increase in the model fit (column 2 in comparison to column 1), suggesting that firms' plans to adapt to the pandemic will likely drive their office space demand over the next three years.

To minimise the effects of omitted variable bias, we introduce the control variables for the full-spec model (Equation (5)); this becomes the base model, and the results, which are presented in column 3 are generally consistent with the results in column 1 and 2. The results from the full-spec model (column 3) specifically show that firms reporting a positive WFH experience have a higher probability (35%) of reducing their office space size and those with a neutral experience have a 29% higher probability of reducing their space sizes over the next three years. This further implies that firms that reported a negative WFH experience are unlikely to reduce the sizes of their office spaces, suggesting that they will either maintain or increase the space sizes. The results also show that firms whose long-term and medium-term office space strategies have been influenced by the pandemic are 47% and 22% more likely to reduce their office space sizes respectively (in comparison to those that reported that the pandemic did not affect their office space use strategy).

Table 1. Probit showing office space quantity (decrease) expectation within the next three years

Variables		(1) Baseline	(2) COVID effect	(3) All controls (Base model)
WFH experience during the pandemic	Negative	–	–	–
	Neutral	0.127*	0.158**	0.295***
	Positive	0.302***	0.229***	0.345***
Effect of COVID-19 on organisation's office space strategy	No effect	NO	–	–
	Medium term (3 years)	NO	0.206***	0.223***
	Long term	NO	0.495***	0.473***
Occupation sector	Tertiary	NO	NO	–
	Secondary	NO	NO	0.125**
	Other sectors/unclassified	NO	NO	–0.053
World region/continent location of company HQ	Asia, ME and Africa	NO	NO	–
	North America	NO	NO	0.107
	Europe	NO	NO	0.112*
	Australia/classified/missing	NO	NO	0.114
Organisation's general plans for quality of space in the next 3 years	To decrease	NO	NO	–
	To increase	NO	NO	0.200***
	To remain the same	NO	NO	0.291***
Proportion of portfolio that is in serviced/ co-working space	Less than 5%	NO	NO	–
	5–20%	NO	NO	0.063
	21–50%	NO	NO	0.053
	More than 50%	NO	NO	–0.001
Expected average lease length	To decrease	NO	NO	
	To increase	NO	NO	–0.124
	To remain the same	NO	NO	–0.114**
Expected density of occupation	To decrease	NO	NO	–
	To increase	NO	NO	0.062
	To remain the same	NO	NO	0.007
Influence of sustainability consideration on office space use strategy	No influence	NO	NO	–
	Some influence	NO	NO	0.002
	Major	NO	NO	–0.008
Probability of moving to a new space in the next three years		NO	NO	0.082*
Global workforce	Less than 1,000	NO	NO	–
	1,000 to 9,999	NO	NO	0.128*
	10,000 to 99,999	NO	NO	0.261***
	100,000 and more	NO	NO	0.247**
	Unclassified	NO	NO	0.185*
	pseudo r^2	0.0439	0.156	0.327
	Observations	361	360	317

Notes: Standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4.2. COVID-19 and firms' office space use expectations

Table 2 reports the results for the marginal effects of the probit models in Equations (6)–(8). The results in column 1, Table 2 are the direct replica of the full-spec model (base model in column 3, Table 1), while columns 2, 3 and 4 of Table 2 are also full-spec models albeit with the secondary outcome variables: lease length, space density and space quality[12].

[12] The outcome variables – lease length, space density and space quality are also predictor variables in the base model; therefore, in models where the outcome variable corresponds with one of the predictor variables, the predictor variable is omitted in the estimation.

Table 2. Probit showing office space quantity and quality expectation within the next three years

Variables		(1) Space size decrease	(2) Lease length decrease	(3) Decrease in space density	(4) Space quality improvement
WFH experience during the pandemic	Negative	–	–	–	–
	Neutral	0.295***	0.056	–0.084	0.054
	Positive	0.345***	0.160**	–0.011	0.088
Effect of COVID-19 on organisation's office space strategy	No effect	–	–	–	–
	Medium term (3 years)	0.223***	0.132**	0.128*	-0.012
	Long term	0.473***	0.381***	0.055	–0.014
Occupation sector	Tertiary	–	–	–	–
	Secondary	0.125**	0.054	0.042	–0.071
	Other sectors/unclassified	–0.053	0.115	0.132	0.013
World region/continent location of company HQ	Asia, ME and Africa	–	–	–	–
	North America	0.107	0.125	–0.002	0.131
	Europe	0.112*	0.097	–0.025	0.063
	Australia/classified/missing	0.114	–0.066	–0.224	–0.079
Organisation's general plans for quality of space in the next 3 years	To decrease	–	–	–	NO
	To increase	0.200***	–0.384***	–0.034	NO
	To remain the same	0.291***	–0.393***	–0.175	NO
Proportion of portfolio that is in serviced/co-working space	Less than 5%	–	–	–	–
	5–20%	0.063	0.028	0.150**	0.151**
	21–50%	0.053	0.129	0.070	0.068
	More than 50%	–0.001	–0.054	0.214**	0.291***
Expected average lease length	To decrease	–	NO	–	–
	To increase	–0.124	NO	–0.282***	0.367***
	To remain the same	–0.114**	NO	–0.216***	0.000
Expected density of occupation	To decrease	–	–	NO	–
	To increase	0.062	–0.236***	NO	–0.063
	To remain the same	0.007	–0.137**	NO	–0.181***
Influence of sustainability consideration on office space use strategy	No influence	–	–	–	–
	Some influence	0.002	0.027	–0.097	–0.275***
	Major	–0.008	0.058	–0.206***	–0.033
Probability of moving to a new space in the next three years		0.082*	–0.025	–0.053	–0.046
Global workforce	Less than 1,000	–	–	–	–
	1,000 to 9,999	0.128*	–0.076	0.016	–0.047
	10,000 to 99,999	0.261***	0.108	0.033	–0.106
	100,000 and more	0.247**	–0.162*	0.075	–0.041
	Unclassified	0.185*	0.087	0.082	–0.008
	pseudo r^2	0.327	0.263	0.157	0.132
	Observations	317	317	317	317

Notes: Standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. The models are the exact specification in Table 1, column 3 (now reported in Table 2, column 1), although different outcome variables are reported in columns 2, 3 and 4.

The results in Table 2 show that firms are likely to reduce their lease lengths if they have reported a positive WFH experience and if they have acknowledged that the pandemic has influenced their office space strategy.

4.3. Further analysis, robustness tests and limitations

To gain deeper insight into the various office space use strategies examined in the previous sub-sections, we conduct further analysis using the MNP approach discussed in Section 3. In their raw form, the outcome variables

Table 3. MPM showing office space quantity and quality expectation within the next three years for space quantity demanded and space quality

Variables		Space size/quantity			Space quality		
		(1) Decrease	(2) No change	(3) Increase	(4) Increase	(5) No change	(6) Decrease
WFH experience during the pandemic	Negative	–	–	–	–	–	–
	Neutral	0.299***	–0.215**	–0.083	0.088	–0.006	–0.081
	Positive	0.343***	–0.232**	–0.111	0.131	0.014	–0.145**
Effect of COVID-19 on organisation's office space strategy	No effect	–	–	–	–	–	–
	Medium term (3 years)	0.224***	–0.123*	–0.100	–0.023	–0.039	0.061**
	Long term	0.469***	–0.177**	–0.291***	–0.026	0.018	0.008
Other controls		YES	YES	YES	YES	YES	YES
Observations		317	317	317	317	317	317

Notes: Standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; Full model specification- exact model specification in Table 2 in multinomial probits. After 300 iterations, convergence was not achieved for the lease length and density, so models are not reported. This may be because one of the categories has only 35 observations which is small.

used in the analysis are unordered categorical variables; we, therefore, attempt to estimate the same models reported in Table 2 with the outcome variables now taking the raw unordered categorical form. The MNP models with lease length and space density as outcome variables did not converge; Table 3 therefore only presents the marginal effects of the MPN models for the space size/quantity (columns 1–3) and space quality (columns 4–6). This approach enables us to observe one probability (e.g., space decrease) as a discrete option of 3 alternatives (space decrease = 1, no change to space quantity demanded = 2, and space increase = 3) rather than the two options that we observe in the binary probit models (where space decrease = 1; no change and space increase = 0). All models are full spec with all control variables included.

The results in Table 3 show that respondents that reported both positive and neutral WFH experiences are less likely to increase their firms' office space sizes or retain the same space sizes. The statistical insignificance in the WFH coefficients in column 3 further suggests that firms that have reported positive or neutral WFH experience are not likely to increase their workspace sizes. It can, therefore, be inferred that of the three outcomes, an increase in space size is the most unlikely outcome for companies where the WFH experience has been positive or neutral. We also observe that firms that reported that the pandemic has influenced their real estate strategy are less likely to increase their space sizes or retain the same spaces. This implies that the expected changes to space quantity captured in the study have been largely influenced by the COVID-19 pandemic. The results from the MNP model for space quality (columns 4–6, Table 3) generally show that the WFH experience or the COVID-19 pandemic, in general, have not significantly influenced changes relating to space quality strategies. These results are generally consistent with the previous section which indicate that the pandemic is likely to influence firms' space quantity strategies more significantly than they would influence space quality.

We further explore a wider range of office space quality-related factors and examine how the WFH and COVID-19, more specifically, may influence other strategies. The models are estimated using the default probit model in the full specification in Table 2. All the outcome variables are in binary form, and they capture the key facilities and amenities that firms perceive that their staff would request for going forward through the regression against the full range of explanatory variables. Using this approach, we can examine the underlying influence of the WFH experience and COVID-19 more specifically on these firms' expectations[13]. The results (Appendix Table A2) indicate that the WFH experience has no significant effect on the probability that staff will demand the facilities and amenities listed. We however find that the COVID-19 variables are statistically significant for health care facilities, desk-to-person ratio, collaborative spaces, mental health support facilities such as sanctuary spaces, and paid food and beverage provision, suggesting that the pandemic may have influenced some of the employees' expectations regarding these elements.

We carry out empirical analysis to further examine the robustness of the results. First, we examine the probability that the results are driven by a concentration of the sample within categories, particularly the occupation sector, world region/continent of the company's headquarters and the size of the firm's workforce. As highlighted in the data section, firms in particular sub-categories may show specific patterns, and if our results are driven by sample concentration by occupation, the results obtained from

[13] It should be noted that these outcome variables are the facilities and amenities that firms think their staff will request, rather than what firms are willing to provide; the results, therefore, cannot be interpreted to mean that the firms are committing to provide these facilities or amenities.

the models in these sub-categories should be inconsistent with the results from the base models. This empirical exercise, therefore, enables us to examine potential variations in the trends across sub-categories. The models are full specification models similar to columns 1 (space quantity demand) and 4 (space quality) in Table 2 and the results (not reported) are generally consistent in terms of the signs and the statistical significance of the coefficients, although the magnitude of coefficients varies in some cases. Due to cases of missing observations for some variables in some categories, some of the models failed to converge and some others had missing coefficients.

We also examine the potential relationship between the WFH experience and the COVID-19 effects, and how these two factors affect the estimates of the other variable. We, therefore, estimate two models: the first model omits the COVID-19 variable from a full-spec model, while the second model omits the WFH variable from a full-spec model. We observe that the coefficients of the key explanatory variables are generally consistent in terms of sign and statistical significance, suggesting that both the WFH and COVID-19 variables are not spurious with either the presence or absence of the other.

Despite the rigorous empirical analysis and the robustness of the results, some limitations and potential issues are identified. First, our empirical models are discrete probability models; thus, the coefficients are estimates of probability rather than estimates of the volume of space, change in average lease length (in years), or the level of improvement in the quality of space. It would be useful to explore non-probability angles to office space demand in future studies. Second, the sample size made further empirical analysis challenging due to the resulting small cell sizes for some categories within the dataset. This created issues such as the non-convergence of some models, particularly in the further analysis and robustness tests. A third issue is potential omitted variable bias. It would have been useful to examine the effects of some other variables such as the number of years that the firm has been operating and other issues relating to the firm's future plans. The dataset, however, does not capture some of these factors. In addition to this, some variables that would have been included as controls had to be dropped to avoid multicollinearity. A fourth issue is the element of subjectivity in some of the variables, particularly the main explanatory variable- WFH experience. The fact that an individual responded on behalf of the firm may raise questions relating to the possible entanglement of the company's corporate/official position and the bias of the responding individual. Furthermore, a company's corporate perception of the staff's WFH experience may not necessarily align with the employees' actual WFH experience.

Another potential issue relates to the variation in employees' WFH experience and the company's plans and strategies at different stages of the COVID-19 pandemic. This may potentially have affected the responses during the survey; it is therefore possible that some firms may have made changes to their plans and strategies in line with the dynamics of the pandemic in the months after the survey was conducted. It should also be noted that the results in this study relate to potential changes to office space use rather than the actual changes. Because of the futuristic nature of some of the variables, particularly the outcome variable, the responses may not necessarily translate to actual changes in the future. The reported decline in the appetite of some global executives to downsizing their company's physical footprint after the pandemic (KPMG, 2021) is an indication that some of the firms may modify their strategies in line with their current realities. These issues notwithstanding, the results from our study provide valuable insight into some of the potential changes to office space demand and can therefore serve as the basis for further studies.

5. Discussion

The results in Section 4 have various implications; this section thus provides further analyses and discussion of the results, highlighting their links to previous literature and their implications.

COVID-19 and firms' office space quantity/size expectations

The results in Table 1 validate the proposition of Scarrett and Wilcox (2018) that firms will review their overall property strategy to ensure that the space use aligns with the current realities of their business operations. It also generally provides a basis for which the black swan effect of COVID-19 can be established in the office real estate market. Furthermore, the results support descriptive evidence (CBI, 2020; CBRE, 2021) that the pandemic is likely to lead to a reduction in underlying demand for office spaces over the next three years. The results also go beyond the scope of previous studies to provide insight on how the WFH experience is an important channel for the expected decrease in office space demand going forward, a line of reasoning that has not been previously established in the literature. A possible mechanism for the WFH effect is that firms that have recorded non-negative WFH experiences may be induced by the economic benefits of having their employees work remotely and thus aim to reduce the amount of office space occupied. Meanwhile their contemporaries, despite being interested in the economic benefits, may not be able to make the same decision due to their general perception of a negative WFH experience.

The results in Table 1, column 3 provide further insight into the influence of other factors on firms' plans regarding their office space sizes. We observe that firms operating in the secondary occupational sector (such as manufacturing and other related jobs) are more likely to reduce their spaces in comparison to those in tertiary occupations (such as banking, finance, IT etc.). This is interesting, as the expectation would have been that firms in tertiary occupations would be more inclined to reduce

their workspaces than those in secondary occupations, based on the expectations that jobs in the tertiary occupation sector may be more suitable for remote working. This result may be driven by the fact that firms in the tertiary occupational sector already had an established WFH culture before the pandemic (Saiz, 2020); thus, the changes associated with the pandemic may be minimal in comparison to those in the secondary sector that had previously not adopted remote working.

The results also show that firms with headquarters in Europe and North America are likely to demand less space going forward in comparison to companies with headquarters in Asia, Africa and the Middle East. A possible explanation for this is that the reference category consists of many developing countries[14]. The developing countries in this category may therefore lack the support infrastructure (such as power, stable internet connectivity, telecommunication, and other digital tools) that are required to support remote working. Studies (such as JLL, 2019) suggest that the companies that already practised remote working before the pandemic were supported by digital tools; thus, firms in countries without sufficient access to these tools or where these digital tools are expensive may prefer to maintain the traditional office working system and thus keep their spaces the same or possibly increase their space requirements[15]. These results generally support the assertion in JLL (2019) that future office space demand will be driven by a wide range of factors including costs, technology, innovation needs, company culture and space design trends, and global regions may adapt differently. In addition to these, we also observe that companies with a higher global workforce are likely to reduce their office space sizes which may reflect cost-saving strategies adopted by bigger firms. Interestingly, our results show that sustainability and ESG considerations do not have a significant influence on office space size reduction. It is surprising that despite the built environment accounting for 38% of total CO_2 emissions (Avison Young, 2021), and corporations increasingly claiming to be incorporating sustainability in their real estate strategies, ESG and sustainability issues do not appear to be strong considerations for office space size strategies.

The results (Table 2) further show that firms are likely to reduce their lease lengths if they have reported a positive WFH experience and if they have acknowledged that the pandemic has influenced their office space strategy. For the space density and space quality, the WFH experience and COVID-19 effects are generally weaker and statistically insignificant. The results indicate that the effects of the COVID-19 pandemic may be much stronger for the quantitative aspects of office space use. This is buttressed by the fact that the model fit (pseudo r^2) for the quantitative outcomes are stronger than the qualitative outcomes. In addition to firms having a higher probability to reduce their workspace size, the probability that they will negotiate shorter leases may reflect firms' desire for flexibility as a present and future adaptation strategy. For most tenants, a flexible model will mean shorter lease lengths or having more options and manoeuvrability with existing lease terms, providing a greater ability to navigate the uncertainty of hybrid working, business growth or recessions.

The result for the space quality plans (column 4, Table 2) is rather surprising. Evidence from the raw data (as shown in Appendix Table A1) indicates that 47% of the firms in the sample plan to make improvements to their space quality; the results from the empirical exercises however show that these planned changes are not significantly influenced by the WFH experience or the COVID-19 pandemic in general. While the results are generally consistent with the proposition that space occupiers may require less office space in the future (Cluttons, 2021), it goes contrary to the element of the proposition which suggests that these COVID-19-related changes will induce firms to prioritise the provision of the highest quality of space with stronger levels of demand as a major potential benefit (Avison Young, 2021).

These results generally provide novel perspectives on the ongoing debates on the COVID-19 pandemic and its effects on the office market. Whilst most of the anecdotes and descriptive statistics in professional and industry reports indicate that organisations' perception of office space use has changed since the pandemic, our study shows that these changes may relate more to quantitative elements with economic and financial benefits than they relate to other qualitative elements with social and environmental benefits. JLL (2019) cautions that contrary to most narratives in this respect, WFH may not necessarily translate to a decrease in demand for space. Our results also reveal that the pandemic may not automatically drive changes to firms' strategies, rather, firms that plan to make changes to their office space strategies will most likely have also recorded positive WFH experiences (or at least non-negative experiences). This further implies that firms that have generally reported a negative work-from-home experience are likely to have different office space use strategies than firms with non-negative experiences. Firms that wish to reduce their office space sizes and possibly seek shorter lease terms may therefore need to first invest in providing the necessary tools and enabling environment to support staff to work from home with a higher level of satisfaction. They may need to investigate the reasons for negative WFH experiences and go further to develop strategies to address these issues, to benefit from the potential reduction in real estate cost (associated with less space) and more flexible and favourable lease terms.

[14] It should be noted that not all the countries in this category are classed as "developing". Due to the way the data is collected (at the continental level), we are unable to identify the specific countries within this category.

[15] A cross-tabulation of the WFH experience variable and the continental categories reveals that indeed, there is a higher proportion of positive WFH experience in firms with Headquarters in Europe and America in comparison to Asia, the Middle East and Africa.

Another key part of the results in column 4 (space quality improvement) is worthy of being highlighted. One of the significant predictor variables in this model is the proportion of the real estate portfolio that is in serviced or in co-working space. The result particularly shows that having a higher proportion of service space is likely to lead to an increase in space quality. This suggests that firms that may wish to improve their space quality may not be prepared to provide these spaces or manage the spaces within their core property management operations.

Conclusion and summary

The COVID-19 pandemic meant that firms across a range of sectors and on a global scale were required to work remotely. Consequently, this led many to review their office space strategies. Whilst numerous studies regarding the effect of the COVID-19 pandemic on different real estate market sectors have been undertaken, there is no evidence of a study going beyond descriptive statistics to analyse the user segment of the office market. This paper analyses the key areas of expected changes to office space use in the future, exploring the important factors which may influence these changes. In particular, it examines the influence of the COVID-19 pandemic on firms' strategies regarding both quantity and quality of office space.

The paper utilises data from a survey of corporate firms across different industry sectors, that have a business presence in the UK. We employ probit and multinomial models to examine the influence of the pandemic on firms' plans for the future use of office space concerning quantity and quality. The results from this study highlight the relationship between COVID-19 and changes to the demand for office space, and with this, the inevitable changes to office space use. It further illustrates that the perceived WFH experience is a key consideration in the expected changes to office space use, it being a fundamental factor that will have a notable influence over both real estate strategies and firms' wider business planning in the future. We also observe that the WFH experience, together with the pandemic more generally, has had a more significant effect on those areas relating directly to the economic aspect of office space use than it has to the social and environmental aspects, which perhaps contradicts some anecdotes in this area. Furthermore, the results reveal that firms are more inclined to make changes to the quantity of their office space rather than the quality, again suggesting that those economic factors may remain core priorities, while less weight is attached to social and environmental factors. We observe an inverse relationship between employees' remote working experience and future space quantity requirements i.e., a positive employee remote working experience increases the probability that organisations will demand less space going forward, which will influence real estate strategy and business planning. The results obtained provide validity to the proposition that firms need to review their overall real estate strategy to ensure that space use meets with the realities of current business operations (Scarrett & Wilcox, 2018).

It is acknowledged, through other studies, that COVID-19 has had an impact on and changed the perception of office space use. However, in this paper, we show that it is not just the impact of the pandemic in isolation, but also the perception (positive or negative) of the WFH experience which will influence how a firm will alter its approach and strategy regarding office space in the future. We show that the COVID-19 pandemic may not have an "umbrella" effect on space use, rather, companies' perception of WFH satisfaction is likely to be a key determinant of the COVID-19-related office space changes. Space users, managers and employers in general that aim to reduce their office space sizes may need to ensure that their employees have a positive WFH experience. Furthermore, a decrease in office space use may likely lead to a concomitant increase in the use of residential spaces and alt (alternative) spaces as workspaces, which can also affect the space use dynamics in the residential and operational real estate sectors. Future research may therefore explore the impact of changing office demand dynamics on residential real estate markets and other alt spaces.

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Appendix

Table A1. Variable description and descriptive statistics

	Variable	Sub-categories	Summary statistics (/1.0)
Outcome variables	Space quantity (binary)	Decrease = 1	0.34
		Increase or staying the same = 0	0.65
	Lease length (binary)	Decrease = 1	0.34
		Increase or staying the same = 0	0.66
	Space density (binary)	Decrease = 1	0.36
		Increase or staying the same = 0	0.64
	Space quality (binary)	Improvement in space quality = 1	0.47
		Downgrading space quality or keeping the quality the same = 0	0.52

End of Table A1

	Variable	Sub-categories	Summary statistics (/1.0)
Explanatory variables	WFH experience during the pandemic (categorical)	Negative = 1 (*reference category*)	0.59
		Neutral = 2	0.29
		Positive = 3	0.12
	Effect of COVID-19 on organisation's office space strategy (categorical)	No effect = 1 (*reference category*)	0.27
		Medium term (3 years) = 2	0.48
		Long-term effect = 3	0.25
	Occupational Sector (categorical)	Tertiary = 1 (*reference category*)	0.59
		Secondary = 2	0.19
		Other sectors/unclassified = 3	0.22
	World region/continent location of company HQ (categorical)	Asia, ME and Africa = 1 (*reference category*)	0.20
		North America = 2	0.15
		Europe = 3	0.40
		Australia/classified/missing = 4	0.25
	Organisation's general plans for quality of space in the next 3 years (categorical)	To decrease = 1 (*reference category*)	0.08
		To increase = 2	0.47
		To remain the same = 3	0.45
	Proportion of portfolio that is in serviced/co-working space (categorical)	Less than 5% = 1 (*reference category*)	0.57
		5–20% = 2	0.26
		21–50% = 3	0.09
		More than 50% = 4	0.08
	Expected average lease length (categorical)	To decrease = 1 (*reference category*)	0.33
		To increase = 2	0.10
		To remain the same = 3	0.57
	Expected density of occupation (categorical)	To decrease = 1 (*reference category*)	0.36
		To increase = 2	0.24
		To remain the same = 3	0.40
	Influence of sustainability consideration on office space use strategy (categorical)	No influence = 1 (*reference category*)	0.18
		Some influence = 2	0.63
		Major = 3	0.19
	Probability of moving to a new space in the next three years (binary)	Likely = 1 (*reference category*)	0.38
		Unlikely = 0	0.62
	Global workforce (categorical)	Less than 1,000 Likely = 1 (*reference category*)	0.24
		1,000 to 9,999 = 2	0.18
		10,000 to 99,999 = 3	0.23
		100,000 and more = 4	0.06
		Unclassified = 5	0.29

Table A2. Probit models showing the probability that staff will demand for provision of specific services and amenities in their workspaces

Variables		(1) Food & bev (paid)	(2) Food & bev (free)	(3) Gym	(4) Cycle storage	(5) Mental health support	(6) Healthcare facilities	(7) Concierge	(8) Childcare facilities	(9) Desk to person ratio	(10) Collaborative space
WFH experience during the pandemic	Negative	–	–	–	–	–	–	–	–	–	–
	Neutral	0.025	0.026	0.088	0.089	–0.082	0.025	–0.096	–0.098	0.003	–0.042
	Positive	–0.056	0.110	0.019	0.164*	–0.003	0.090	–0.152	–0.025	0.038	0.075
Effect of COVID-19 on organisation's office space strategy	No effect	–	–	–	–	–	–	–	–	–	–
	Medium term (3 years)	0.033	–0.026	0.070	0.042	0.038	0.158**	0.071	–0.014	0.189***	0.000
	Long term	0.163**	–0.049	0.093	0.094	0.217***	0.145*	–0.085	0.030	0.221***	0.204***
Other controls		YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
	pseudo r^2	0.0784	0.0823	0.0673	0.165	0.127	0.0810	0.0804	0.0835	0.139	0.192
	Observations	317	317	317	317	317	317	317	317	317	317

Notes: Standard errors in Parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. The models are the exact specification in Table 2; The outcome variables are in binary form: e.g., Provision of paid food and beverage in the office = 1; no provision of food and beverage in the office = 0 etc.