

Article

Office Decentralization and Functional Obsolescence After COVID-19: Empirical Evidence from Hong Kong

Ervi Liusman ¹  and Kwong Wing Chau ^{2,*} ¹ School of Hotel and Tourism Management, The Chinese University of Hong Kong, Shatin, Hong Kong SAR, China; ervi@baf.cuhk.edu.hk² HKUrbanLabs, Ronald Coase Centre for Property Rights Research, The University of Hong Kong, Pokfulam Road, Hong Kong SAR, China

* Correspondence: hrrbckw@hku.hk

Abstract

The COVID-19 pandemic, particularly during its declared Public Health Emergency of International Concern (PHEIC) period, has flattened the bid-rent curve and increased the rate of functional obsolescence of older office buildings. A critical question remains as to whether these trends have persisted or moderated following the official end of the PHEIC in May 2023. This study investigates the trajectory of office market dynamics in Hong Kong during and after the PHEIC period. Using secondary transaction data from Hong Kong, we find that the decline in the marginal value of proximity to the central business district (CBD), which was most pronounced during the PHEIC period, has subsequently moderated. In addition, this moderation is significantly stronger for high-end offices than for low-end ones. Furthermore, we find that the functional obsolescence of older office buildings not only accelerated during the PHEIC period but continued and further strengthened after the PHEIC period.

Keywords: COVID-19; decentralization; proximity to the CBD; building age effect; building density effect

1. Introduction

The COVID-19 pandemic profoundly altered patterns of living, working, and spatial interaction, with significant implications for office market dynamics and pricing structures. One salient impact has been the erosion of the traditional premium associated with proximity to the central business district (CBD). Studies [1–6] show that the pandemic accelerated decentralization, flattening the bid-rent curve as firms reassessed the necessity of centrality under the widespread adoption of remote and hybrid work arrangements.

Equally important, though less immediately visible, has been the increased demand for modern office stock equipped with digital infrastructure and designed to accommodate flexible work practices. This shift has accelerated the functional obsolescence of older office buildings, many of which lack the technological and spatial adaptability required in the post-pandemic era [7,8]. Studies conducted during the period when the World Health Organization (WHO) classified COVID-19 as a “Public Health Emergency of International Concern (PHEIC)” provide empirical evidence of both the flattening of the bid-rent curve and the accelerated depreciation of older office assets.

On 5 May 2023, the WHO declared that COVID-19 was no longer a PHEIC, signaling the end of the crisis phase for cities worldwide. In the subsequent post-COVID-19 period,



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many firms reinstated office attendance, raising critical questions for real estate investors, occupiers, and policymakers: has the decentralization of office demand slowed, and has the pace of functional obsolescence moderated?

This study addresses these questions using transaction data from Hong Kong. Hong Kong serves as an appropriate case study given its role as an international financial center with free capital flows, currency convertibility, and a low-tax regime that attracts multinational corporations and global investors. Its office market is characterized by strata title buildings with actively traded units, which generated abundant transaction data for empirical analysis. The city's compact geography, transparent regulatory framework, and coexistence of premium CBD offices and lower quality stock further enhance its suitability as a benchmark for understanding post-COVID-19 office market dynamics.

We hypothesize that the COVID-19-induced office decentralization has persisted after the PHEIC period but at a slower pace than during the PHEIC period. The dramatic exodus from CBDs has eased, with some firms even "recentralizing" to capitalize on lower CBD rents.

The premium associated with CBD proximity is not solely attributable to reduced transport costs or agglomeration economies: it also reflects a reputational or "labelling effect," whereby a CBD address signals financial strength, stability, and ambition [9–12]. Empirical observations support this: ambitious tenants often pursue "flight-to-quality" moves into CBDs to enhance brand prestige, despite higher rental costs. CBDs also host multinational banks, law firms, and consultancies, reinforcing their symbolic role as command centers of global cities. A CBD location conveys credibility to clients, investors, and employees, enhancing recruitment and retention through perceived prestige and superior amenities. We therefore hypothesize that the decline in the marginal value of proximity to the CBD (flattened bid-rent curve) induced by COVID-19 is smaller for high-end offices than for low-end offices in the post-COVID-19 period. For high-end tenants, the reputational premium sustains a steeper bid-rent curve relative to cost-sensitive occupiers.

Based on transaction records from Hong Kong, our evidence suggests that the decline in the marginal value of CBD proximity, which led to a reduction in rent gradient, was most pronounced during the COVID-19 crisis (PHEIC period) but has moderated since the end of the PHEIC period. This moderation effect is uneven across market segments. Our quantile regression results show that the moderation effect is stronger for high-end offices, where the reduction in the rent gradient during the PHEIC period has vanished in the post PHEIC period. However, the low-end offices remain more vulnerable to decentralization pressures even after the PHEIC period.

We also argue that accelerated office obsolescence represents a structural transformation rather than a temporary pandemic shock. Sustainability mandates, tenant expectations for wellness and flexibility, and digital infrastructure requirements continue to drive rapid transformation. Many older offices cannot justify the capital expenditure required for modernization, which has reinforced their obsolescence even further after the PHEIC period. This is supported by our empirical results.

This study contributes to the literature on COVID-19's impact on office markets by focusing on post-COVID-19 dynamics, as most existing research has concentrated on the effects during the pandemic itself. This study enhances our understanding of the longer-term impact of COVID-19 on the office market, thereby enabling real estate investors and developers to make more informed decisions.

The remainder of this paper is structured as follows: Section 2 reviews the relevant literature on the impacts of COVID-19 on real estate markets; Section 3 develops the hypotheses; Section 4 outlines the research design; Section 5 presents and discusses the empirical results; and Section 6 concludes the study.

2. Literature Review

The COVID-19 pandemic has profoundly reshaped housing markets worldwide, with impacts varying across geographies, property types, and institutional contexts. A growing body of research has examined these dynamics using hedonic price models, difference-in-differences approaches, and causal inference techniques.

Several studies document a flattening of the bid-rent curve, reflecting declining premiums for central locations and rising suburban demand. In the United States, Ref. [1] showed that house prices and rents fell in city centers while increasing in peripheral areas, with effects amplified by remote work prevalence and regulatory constraints. Similar evidence emerged from Wuhan, where [2] found a 5–7% decline in house prices post-lockdown and discounted premiums in high-density areas. Ref. [3] extended this analysis to Shanghai, demonstrating that policy shocks altered price gradients, with steepening effects for commercial property units. Ref. [4] further highlighted a dual restructuring in Shanghai, with decentralization in the urban core and integration of peripheral areas into metropolitan systems.

Related to the flattening of the bid-rent curve is the rise in remote and hybrid work, which has been central to housing market transformations. Ref. [5] coined the “donut effect,” showing that households relocated from city centers to suburbs, driven by hybrid work arrangements. Ref. [6] examined Guangzhou’s housing market, finding that while the direction of coefficients for homeworking-related attributes remained stable, their magnitudes shifted, with higher premiums for properties facilitating remote work. In Vienna, Ref. [13] observed increased rent premiums for amenities supporting work-from-home routines, suggesting enduring preference shifts.

Evidence consistently points to declining demand for density. Ref. [14] found reduced demand for high-density neighborhoods in the U.S., driven by the diminished value of proximity to jobs and amenities. Ref. [15] reported a temporary decline in metro accessibility premiums in Chengdu, with elasticity of distance to metro stations decreasing during the pandemic. In Tokyo, however, Ref. [16] observed robust demand for transit-accessible properties, while peripheral locations gained attractiveness due to reduced commuting burdens.

Rental markets exhibited heterogeneous responses across property types. Ref. [17] analyzed Austin’s rental market, finding positive pandemic effects on suburban single-family residences but negative impacts on condominiums and duplexes. Ref. [18] used causal machine learning in Germany, showing temporary rent declines for retail and office real estate but price increases in the top commercial segment. Ref. [19] contrasted German housing markets with the U.S., finding limited evidence of the donut effect and slower suburban price adjustments.

Stay-at-home shocks significantly increased housing demand. Ref. [20] demonstrated that counties with greater time spent at home experienced faster price increases, with young households disproportionately crowded out by rising prices. Ref. [21] found shutdown orders reduced prices in dense urban areas but increased suburban property values. Ref. [22] reported contagion effects in Shanghai, with housing prices in infected communities declining by 0.7% and widening wealth gaps between low- and high-value homeowners.

Beyond housing, pandemic shocks altered amenity visits and urban geography. Ref. [23] showed that amenity-oriented trips in Somerville, MA, diverged from expected patterns early in the pandemic but largely normalized by late 2020. Ref. [24] emphasized the role of population density, amenities, and pollution in shaping pandemic spread, with implications for geographically targeted lockdowns.

3. Development of Hypotheses

This section develops the hypotheses concerning the impact of COVID-19 on office decentralization and functional obsolescence during and after the pandemic. In this study, the COVID-19 period is defined as the interval between the World Health Organization's (WHO) declaration of COVID-19 as a Public Health Emergency of International Concern (PHEIC) on 30 January 2020 and its cancellation on 5 May 2023. The post-COVID-19 period refers to the time following the cancellation of the PHEIC. This operationalization establishes a clear temporal boundary for analyzing structural shifts in office location dynamics.

Conceptual Framework:

We propose a conceptual framework for a pandemic-induced structural shift in office market dynamics, explaining the evolution of the office markets through the lens of an exogenous technological and behavioral shock from the COVID-19 pandemic. This shock disrupted traditional work patterns and revealed lasting changes in firm and employee preferences. The framework draws on location theory [25] and agglomeration benefits [26], the impact of technological progress on building obsolescence [27,28], and emerging theories and empirical evidence on remote and hybrid work adoption [29,30].

The core proposition is that during the pandemic, COVID-19 acted as a catalyst, accelerating decentralization trends enabled by technology [20,21,31,32] while simultaneously hastening the functional obsolescence of older office buildings [33,34]. After the pandemic, however, this decentralization trend has partially reversed for high-quality offices, as firms continue to value agglomeration benefits and collaborative environments [35]. At the same time, the obsolescence of older office buildings has intensified [33].

The result is a bifurcated office market: strong demand persists for new and high-end offices, while older and low-end assets face declining relevance and accelerated depreciation. This bifurcation underscores the pandemic's role as both a catalyst and a filter, reshaping the trajectory of office real estate markets. Figure 1 shows the diagrammatic representation of the framework.

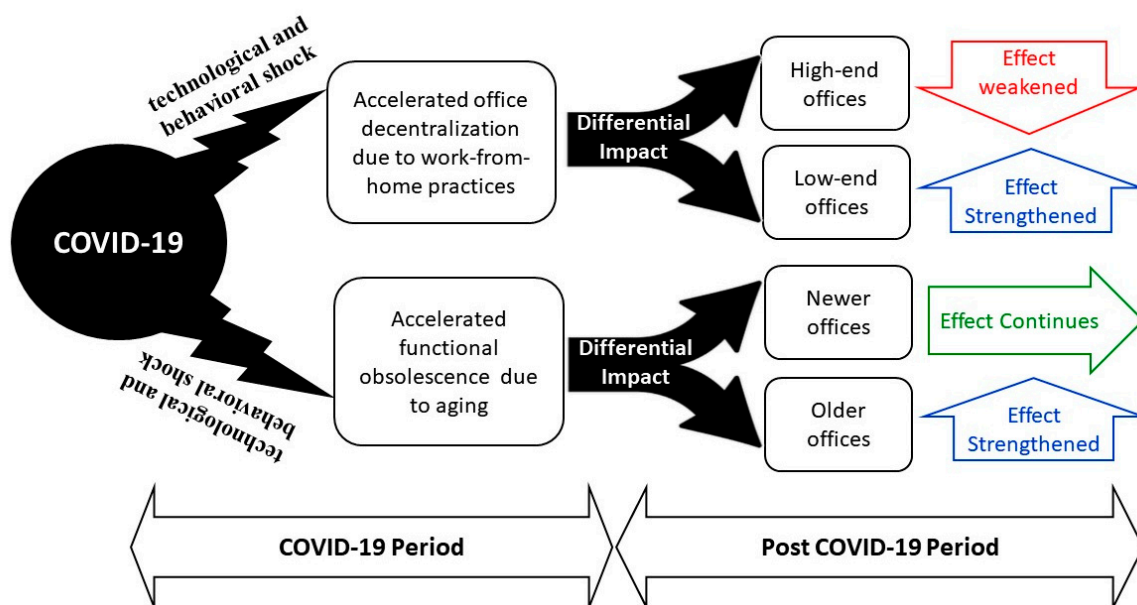


Figure 1. Pandemic-induced structural shift in office market dynamics.

The following hypotheses are developed from this conceptual framework:

Hypothesis 1a. *The pace of office decentralization accelerated markedly during the COVID-19 period.*

Hypothesis 1b. *The pace of office decentralization during the COVID-19 period has moderated in the post-COVID-19 period.*

These hypotheses are based on the interaction of three post-pandemic forces that have reshaped the relative attractiveness of central versus decentralized office locations.

First, the structural transition toward hybrid and remote work arrangements, catalyzed by the pandemic, continues to exert a decentralizing influence on office markets. The widespread adoption of flexible work models has reduced the necessity of daily presence in central offices, enabling firms to pursue cost minimization strategies through relocation or downsizing in central business districts (CBDs) [8,31]. Evidence of persistence is found in the so-called “donut effect”—the dispersion of economic activity away from urban cores—which remains pronounced in cities with high levels of remote work [32].

Second, the WHO’s termination of the PHEIC designation marked a critical attenuation of health-related risks associated with density and proximate interaction. During the pandemic, such risks disproportionately penalized central urban locations [1,14]. With this driver of decentralization now substantially weakened, the urgency for firms to vacate core urban areas has diminished, allowing location decisions to be recalibrated with health safety being a less dominant consideration.

Third, countervailing the decentralizing trend are the enduring economic benefits of urban agglomeration. Proximity to the CBD continues to confer advantages in accessibility, knowledge spillovers, talent acquisition, and collaboration, benefits that remain difficult to replicate in fully remote contexts [36]. Empirical evidence highlights the resilience of demand for centrally located, well-connected properties even during the pandemic [16] and slower-moving decentralization trends in markets such as Germany [19], which underscores the continued relevance of centrality.

Taken together, these dynamics suggest that while decentralizing forces (e.g., hybrid work and cost savings) persist, their momentum has moderated in the post-PHEIC era. The attenuation of health risks and the enduring premium on agglomeration economies are posited to act as stabilizing forces, producing not a reversal but a deceleration of the decentralization observed at the pandemic’s peak. The office market thus appears to be transitioning from a shock-induced exodus toward a new equilibrium that balances the flexibility afforded by remote work with the irreplaceable value of physical proximity.

Hypothesis 2. *COVID-19 accelerated the functional obsolescence of older office buildings during the COVID-19 period.*

The pandemic functioned as a catalytic shock, not by creating new trajectories of obsolescence, but by intensifying pre-existing structural vulnerabilities and reshaping tenant and investor priorities. This acceleration is observable through three interrelated mechanisms:

1. **Hybrid Work and Reduced Demand for Traditional Space:** The pandemic-induced transition to remote and hybrid work compelled firms to reassess their corporate real estate portfolios. Ref. [37] demonstrates that firms initially reduced the quantity of office space while simultaneously upgrading its quality. This dynamic created a surplus of less desirable stock, disproportionately affecting older buildings unable to compete on quality. Ref. [8] further identifies hybrid work as a permanent organizational feature, thereby structurally depressing demand for obsolete office layouts.
2. **Intensified Flight to Quality:** COVID-19 heightened awareness of building health and functionality. Tenants are increasingly demanding “healthy buildings” equipped with advanced ventilation, flexible layouts, and robust digital infrastructure [7]. Older stock, lacking these attributes, is particularly vulnerable. Evidence from Hong Kong illustrates this bifurcation: JLL [38] data show that buildings aged 0–5 years recorded

strong positive net absorption, whereas those over 30 years experienced negative absorption despite lower rents.

3. **Convergence with ESG and Energy Efficiency Pressures:** The pandemic coincided with rising environmental, social, and governance (ESG) imperatives. Ref. [7] argues that COVID-19 “put a spotlight on environmental sustainability as well as health and wellness in buildings,” thereby accelerating obsolescence and penalizing energy-inefficient assets. This has produced a bifurcated market characterized by a “green premium” for sustainable assets and a “brown discount” for obsolete ones. Regulatory interventions, such as London’s prohibition on leasing non-compliant buildings, further reinforce this repricing dynamic.

The above analysis is also consistent with the following observations:

- In Hong Kong, 44% of Grade A office stock exceeds 30 years of age and is projected to reach 55% by 2030. JLL [38] estimates that 20% of these buildings risk functional obsolescence by 2035 without significant upgrades.
- McKinsey [39] projects enduring reductions in office demand across global hubs, driven by hybrid work’s persistence and its erosion of downtown vibrancy.
- Recovery trajectories diverge sharply. Success in the post-pandemic office market depends on assets meeting new tenant expectations, leaving obsolete buildings with aging systems and poor energy efficiency at a competitive disadvantage [7].

Hypothesis 3. *The accelerated functional obsolescence of older office buildings, initiated during the COVID-19 period, has not slowed in the post-COVID-19 period.*

Although the acute public health emergency has subsided during the post-COVID-19 period, the structural transformations it catalyzed in workplace norms and tenant expectations have become enduring features of the office market. Obsolescence of older buildings has transitioned from a temporary shock effect to a sustained trajectory, reinforced by two key dynamics:

1. **High cost of Retrofitting and Persistent Flight to Quality:** The pandemic-induced demand for higher-quality office space has crystallized into a long-term market standard. Older buildings require substantial capital investment to retrofit ventilation systems, achieve ESG compliance, and enable flexible layouts—investments often economically unviable. Consequently, the competitive gap between prime and obsolete assets continues to widen. JLL’s [38] 2024 absorption data from Hong Kong confirm this persistence: newer buildings (0–5 years) recorded strong positive net absorption, while those over 30 years experienced negative absorption, which suggests decline in competitiveness of older office buildings.
2. **Hybrid Work and ESG as Enduring Structural Drivers:** The forces accelerated by COVID-19 are not transient. Ref. [8] identifies hybrid work and the integration of health and sustainability as permanent organizational strategies. Ref. [7] similarly contends that COVID-19 “increased the pace” of obsolescence by permanently shifting tenant and investor focus toward sustainability, wellness, and amenities. This bifurcation, characterized by a “green premium” and “brown discount,” is described as a long-term dynamic rather than a temporary phenomenon. Ref. [37] further demonstrates that firms continue to prioritize quality of space even as return-to-office mandates intensify, confirming that qualitative demands forged during the pandemic remain entrenched.

Preliminary post-2023 data shown in the JLL [38] reports on Hong Kong’s office market show the ongoing “flight to quality” and the sustained underperformance of older

buildings. This empirical evidence shows that the accelerated obsolescence is actively continuing in the post-COVID-19 period.

Hypothesis 4. *The post-COVID-19 period moderation of decentralization is more pronounced for high-end offices than for low-end offices.*

High-end offices refer to premium workspaces distinguished by their superior architectural design, high-quality construction materials, refined craftsmanship, and advanced facilities. With other factors held constant, these offices command higher rent/prices per unit of floor area relative to those of low-end offices.

We hypothesize that the decentralization impetus, accelerated by the widespread adoption of remote work technologies during the COVID-19 pandemic, does not exert uniform effects across office market segments. This heterogeneity arises because the value proposition of central business district (CBD) locations is multifaceted rather than monolithic. The advantages of CBD tenancy can be analytically divided into two categories:

1. **Functional Advantages of Proximity:** These encompass agglomeration economies, access to a diverse labor pool and client base, and superior infrastructure [40]. Such benefits are salient for a broad spectrum of firms, including those occupying low-end offices. For these firms, often engaged in low-value-added or localized business activities, cost efficiency and basic convenience are primary determinants of location choice.
2. **Intangible Strategic Advantages:** For high-value-added and multinational corporations, CBD locations confer critical, less substitutable benefits that extend beyond functional convenience. Firms in high-end offices derive disproportionate value from the following:
 - **Prestige and Reputational Signaling:** A prime CBD address functions as a strategic asset, projecting credibility, stability, and elevated status [9,10]. This “symbolic economy” is integral to corporate identity and brand image, shaping stakeholder perceptions [11]. Location itself forms part of the “reputational network” that facilitates trans-local business relations [12].
 - **Enhanced Face-to-Face Interaction (“Buzz”):** Complex negotiations, innovation processes, and trust-building thrive on spontaneous, high-quality interpersonal contact [41]. CBDs uniquely generate this “buzz,” which is indispensable for knowledge-intensive and creative industries [42]. Such interaction constitutes a key driver of productivity and innovation in urban cores [40].

Accordingly, the locational strategies of firms occupying high-end offices are less susceptible to substitution by remote work technologies. The choice of a CBD location represents a long-term corporate strategy [43] aimed at securing reputational capital and fostering synergistic interaction, advantages that digital technologies cannot fully replicate. Consequently, while demand for low-end offices may decentralize more readily in response to technological change, demand for high-end offices in prestigious CBD locations is expected to exhibit stronger resistance to decentralization.

4. Research Design

To test the hypotheses developed above, we estimate a series of hedonic price models using transaction data from the second-hand office market in Hong Kong before the COVID-19 period (i.e., 1 January 2017–29 January 2020) and (1) during the COVID-19 or PHEIC period (i.e., 30 January 2020–5 May 2023), and (2) separately with the post-COVID-19 period (i.e., 6 May 2023–31 July 2025).

Hong Kong provides an appropriate and robust setting for examining the long-term impact of COVID-19 on office markets. As an international financial center characterized by

the free flow of capital, currency convertibility, and a low-tax environment, Hong Kong has attracted a significant presence of multinational corporations and global investors, many of whom maintain offices in the city. The office market is distinguished by the prevalence of strata title buildings, where individual units are actively traded, which generates a large volume of reliable transaction data for empirical testing. The city's compact geography and high density make decentralization effects particularly visible, while its transparent regulatory framework, including comprehensive transaction records maintained by the Land Registry, ensures data quality and verifiability. Moreover, the Hong Kong office market has a full spectrum of high- to low-end offices which allows for nuanced analysis of market segmentation and "flight to quality" dynamics. Given its role as a global hub, trends observed in Hong Kong often serve as leading indicators for other international cities, making its data both locally significant and globally relevant for understanding post-COVID-19 office market adjustments.

The transaction of offices in Hong Kong provides a particularly rich dataset, characterized by substantial variation in building attributes, locational features, and transaction timing. This dataset enables us to estimate the pandemic-related shocks to office value during and after the COVID-19 period holding the impact of other attributes on office price constant.

To test Hypothesis 1 and 2, we estimate the following hedonic price model [44] with office transaction data before and during the COVID-19 period (i.e., 1 January 2017 through 5 May 2023):

$$\begin{aligned} \ln(\text{RUP}) = & \alpha_0 + \alpha_1 \ln(\text{SFA}) + \alpha_2 \ln(\text{FL}) + \alpha_3 \ln(\text{MTR}) + \alpha_4 \text{SV} + \alpha_5 \ln(\text{AGE}) \\ & + \alpha_6 \text{COVID} * \ln(\text{AGE}) + \alpha_7 \ln(\text{DCBD}) + \alpha_8 \text{COVID} * \ln(\text{DCBD}) \\ & + \alpha_9 \text{COVID} + \alpha_{10} \ln(\text{OPI}) + \sum_{i=1}^{N-1} \beta_i \text{DISTRICT}_i + \varepsilon \end{aligned} \quad (1)$$

where $\ln(X)$ denotes the natural log of X , RUP is the transaction price per sq ft of saleable floor area (SFA) deflated by the office price index (OPI) compiled by the Rating and Valuation Department, FL is the floor level; SV is a sea view dummy, AGE is the age of the building in years, MTR is the walking time to the nearest MTR exit in minutes, DCBD is the distance to the CBD in km, COVID is a COVID-19 period dummy variable which equals 1 during the COVID-19 period and zero otherwise, DISTRICT_i is a dummy variable that equals 1 if the transacted office is located in district i , and zero otherwise, and ε is the error term. The variables included in the model are similar to those in [45,46].

We first estimate the model using ordinary least squares (OLS) and then test for heteroskedasticity in the residuals using White's test [47]. We anticipate heteroskedasticity; if confirmed, we re-estimate the model using OLS with White's [47] heteroskedasticity-robust standard errors.

A key feature of the model is the inclusion of interaction terms involving a COVID-19 dummy variable, which equals 1 during the COVID-19 period and 0 otherwise. These interaction terms enable us to test Hypotheses 1a and 2. Hypothesis 1a predicts that the coefficient on the interaction between the COVID-19 dummy and $\ln(\text{DCBD})$ is positive and statistically significant. Hypothesis 2 predicts that the coefficient on the interaction between the COVID-19 dummy and $\ln(\text{AGE})$ is negative and statistically significant.

To test Hypotheses 1b and 3, we estimate the following model with office transaction data before (i.e., 1 January 2017–29 January 2020) and during the post-COVID-19 period (i.e., 6 May 2023–31 July 2025):

$$\begin{aligned} \ln(\text{RUP}) = & \alpha_0 + \alpha_1 \ln(\text{SFA}) + \alpha_2 \ln(\text{FL}) + \alpha_3 \ln(\text{MTR}) + \alpha_4 \text{SV} + \alpha_5 \ln(\text{AGE}) \\ & + \alpha_6 \text{P_COVID} * \ln(\text{AGE}) + \alpha_7 \ln(\text{DCBD}) + \alpha_8 \text{P_COVID} * \ln(\text{DCBD}) \\ & + \alpha_9 \text{COVID} + \alpha_{10} \ln(\text{OPI}) + \sum_{i=1}^{N-1} \beta_i \text{DISTRICT}_i + \varepsilon \end{aligned} \quad (2)$$

where P_COVID is a post-COVID-19 period dummy variable which equals 1 during the post-COVID-19 period and zero otherwise.

Hypothesis 1b implies that the coefficient on $P_COVID \cdot \ln(DCBD)$ in Equation (2) is insignificant or smaller than the corresponding coefficient in Equation (1). Hypothesis 3 implies that the coefficient on $P_COVID \cdot \ln(AGE)$ in Equation (1) is not more negative than the corresponding coefficient in Equation (2).

To test Hypothesis 4, we estimate Equation (2) using quantile regression. The results for high-end offices are based on the 75th percentile ($\tau = 0.75$), which corresponds to the highest 25% of prices per floor area, *ceteris paribus*. Similarly, the results for low-end offices are based on the 25th percentile ($\tau = 0.25$), which corresponds to the lowest 25% of prices per floor area, *ceteris paribus*. Hypothesis 4 predicts that the coefficient on the interaction term $P_COVID \cdot \ln(DCBD)$ will be larger (in absolute terms) or more significant in the low-end office model than in the high-end office model.

5. Empirical Results

We use office transaction records registered with the Land Registry of the Hong Kong SAR Government to test our hypotheses. The data were purchased from a third-party provider, EPRC, and we added additional attributes for estimating the hedonic price models. The descriptive statistics of the data used in the empirical analysis are presented in Table 1. Panel A contains transaction records from the pre-COVID-19 period (1 January 2017–29 January 2020) and the COVID-19 period (30 January 2020–5 May 2023). Panel B contains transaction records from the pre-COVID-19 period and the post-COVID-19 period (6 May 2023–31 July 2025).

Table 1. Descriptive statistics. Panel A and Panel B provide descriptive statistics of the data used for estimating Equations (1) and (2), respectively.

Panel A					
Variables	N	Mean	Max	Min	Std. Dev.
RUP	3900	2907.77	11,828.19	247.82	1072.61
OPI	3900	528.13	625.70	415.60	35.30
SFA	3900	895.32	31,816.00	96.47	2084.40
FL	3900	12.94	45.00	1.00	7.41
AGE	3900	23.46	56.82	0.05	13.82
SV	3900	0.04	1.00	0.00	0.20
MTR	3900	2.44	5.00	1.00	1.18
DCBD	3900	5.29	23.31	0.12	4.54
COVID	3900	0.45	1.00	0.00	0.50
Panel B					
Variables	N	Mean	Max	Min	Std. Dev.
RUP	3303	3007.66	12,548.17	270.30	1157.77
OPI	3303	485.38	625.70	292.30	84.08
SFA	3303	992.32	31,816.00	98.00	2318.55
FL	3303	13.51	46.00	1.00	7.59
AGE	3303	22.76	66.04	0.03	14.30
SV	3303	0.06	1.00	0.00	0.23
MTR	3303	2.46	5.00	1.00	1.19
DCBD	3303	5.32	23.31	0.12	4.24
P_COVID	3303	0.35	1.00	0.00	0.48

Table 2 reports the bivariate correlations among the variables. Consistent with Table 1, the results in Panel A and Panel B are highly similar. Most correlations are small and

statistically insignificant, which suggest that multivariate models are required to adequately capture the determinants of office prices.

Table 2. Correlation matrices. Panel A and Panel B provide bivariate correlation between variables used to estimate Equations (1) and (2), respectively.

Panel A									
Variables	RUP	OPI	SFA	FL	AGE	SV	MTR	DCBD	COVID
RUP	1.000								
OPI	−0.081	1.000							
SFA	0.181	0.122	1.000						
FL	0.246	0.083	0.077	1.000					
AGE	−0.113	0.118	−0.045	−0.057	1.000				
SV	0.562	−0.296	0.050	0.024	0.073	1.000			
MTR	−0.172	−0.139	−0.045	−0.144	−0.226	−0.045	1.000		
DCBD	−0.152	−0.057	0.029	−0.019	−0.519	−0.104	0.079	1.000	
COVID	0.005	−0.261	−0.079	−0.056	0.153	−0.056	−0.041	0.114	1.000
Panel B									
Variables	RUP	OPI	SFA	FL	AGE	SV	MTR	DCBD	P_COVID
RUP	1.000								
OPI	−0.166	1.000							
SFA	0.176	0.065	1.000						
FL	0.276	−0.024	0.104	1.000					
AGE	−0.147	0.007	−0.050	−0.118	1.000				
SV	0.566	−0.143	0.026	0.039	0.031	1.000			
MTR	−0.186	−0.041	−0.050	−0.178	−0.208	−0.082	1.000		
DCBD	−0.034	−0.166	0.033	0.079	−0.509	0.016	0.095	1.000	
P_COVID	0.123	−0.830	−0.030	0.035	0.115	0.014	−0.033	0.162	1.000

Column 1 of Table 3 presents the ordinary least squares (OLS) estimates for the during-COVID-period model (Equation (1)). White’s test [47] indicates the presence of heteroskedasticity ($p < 0.001$). Accordingly, we re-estimate the model using OLS with White’s heteroskedasticity-robust standard errors; these results are reported in Column 2 of Table 3. The two sets of estimates are similar, but we focus on Column 2 for inference. The coefficient on **COVID*ln(DCBD)** is positive and statistically significant, which is consistent with Hypothesis 1a and previous studies by [1,14,31,32]. In addition, the coefficient on **COVID*ln(AGE)** is negative and statistically significant, consistent with Hypothesis 2 and study [7].

Column 1 of Table 4 presents the OLS estimates for the post-COVID-period model (Equation (2)). White’s test [47] again confirms heteroskedasticity ($p < 0.001$). We therefore re-estimate the model using OLS with White’s heteroskedasticity-robust standard errors; these results, reported in Column 2 of Table 4, form the basis for testing our hypotheses. The coefficient on **P_COVID*ln(DCBD)** is statistically less significant than that on **COVID*ln(DCBD)** in Equation (1), which is consistent with Hypothesis 1b. Moreover, the coefficient on **COVID*ln(AGE)** in Equation (1) (Column 2 of Table 3) is smaller in absolute magnitude than the coefficient on **P_COVID*ln(AGE)** in Equation (2) (Column 2 of Table 4), which is consistent with Hypothesis 3. This shows the COVID-19-induced faster rate of building obsolescence has continued and even further strengthened after COVID-19, which is consistent with the results in Gupta et al. [33].

Table 3. Results of estimated office prices before and during the COVID-19 period [Equation (1)]. This table presents the OLS regression estimation results (Column 1) and White’s estimator (Column 2). The dependent variable is $\ln(\text{RUP})$. The independent variables of interest are **COVID* $\ln(\text{AGE})$** and **COVID* $\ln(\text{DCBD})$** . All variables are described in Appendix A. The standard errors are reported in parentheses. *** denotes significance of the t -statistics at the <1% levels.

Variables	Column 1	Column 2
Constant	2.9441 *** (0.4114)	2.9441 *** (0.3972)
$\ln(\text{SFA})$	−0.0063 (0.0055)	−0.0063 (0.0074)
$\ln(\text{FL})$	0.0814 *** (0.0058)	0.0814 *** (0.0061)
$\ln(\text{MTR})$	−0.0463 *** (0.0096)	−0.0463 *** (0.0106)
SV	0.7644 *** (0.0199)	0.7644 *** (0.0213)
$\ln(\text{AGE})$	−0.1354 *** (0.0059)	−0.1354 *** (0.0052)
COVID*$\ln(\text{AGE})$	−0.0336 *** (0.0080)	−0.0336 *** (0.0070)
$\ln(\text{DCBD})$	−0.1554 *** (0.0249)	−0.1554 *** (0.0337)
COVID*$\ln(\text{DCBD})$	0.0379 *** (0.0113)	0.0379 *** (0.0117)
COVID	0.1494 *** (0.0336)	0.1494 *** (0.0314)
$\ln(\text{OPI})$	0.8307 *** (0.0650)	0.8307 *** (0.0632)
District Dummies	Yes	Yes
R ²	0.5459	0.5459
Observations	3900	3900

Table 4. Results of estimated office prices before and during the post-COVID-19 period [Equation (2)]. This table presents the OLS regression estimation results (Column 1) and White’s estimator (Column 2). The dependent variable is $\ln(\text{RUP})$. The independent variables of interest are **P_COVID* $\ln(\text{AGE})$** and **P_COVID* $\ln(\text{DCBD})$** . All variables are described in Appendix A. The standard errors are reported in parentheses. *** and ** denote significance of the t -statistics at the <1% and 5% respectively.

Variables	Column 1	Column 2
Constant	7.4391 *** (0.2812)	7.4391 *** (0.2728)
$\ln(\text{SFA})$	−0.0190 *** (0.0063)	−0.0190 ** (0.0081)
$\ln(\text{FL})$	0.0998 *** (0.0072)	0.0998 *** (0.0079)
$\ln(\text{MTR})$	−0.0537 *** (0.0115)	−0.0537 *** (0.0119)
SV	0.6414 *** (0.0200)	0.6414 *** (0.0178)
$\ln(\text{AGE})$	−0.1232 *** (0.0065)	−0.1232 *** (0.0067)
P_COVID*$\ln(\text{AGE})$	−0.0622 *** (0.0102)	−0.0622 *** (0.0181)
$\ln(\text{DCBD})$	−0.1737 *** (0.0293)	−0.1737 *** (0.0308)

Table 4. Cont.

Variables	Column 1	Column 2
P_COVID*ln(DCBD)	0.0473 *** (0.0149)	0.0473 ** (0.0191)
P_COVID	0.2750 *** (0.0467)	0.2750 *** (0.0784)
ln(OPI)	0.1209 ** (0.0434)	0.1209 *** (0.0411)
District Dummies	Yes	Yes
R ²	0.5512	0.5512
Observations	3303	3303

Table 5 reports quantile regression estimates for Equation (2). Results for low-end offices ($\tau = 0.25$) and high-end offices ($\tau = 0.75$) are presented in Columns 1 and 3, respectively, while Column 2 presents results at the median ($\tau = 0.50$). The coefficient on **P_COVID*ln(DCBD)** is positive and statistically significant for low-end offices but insignificant for high-end offices, which is consistent with Hypothesis 4. The insignificant coefficient on **P_COVID*ln(DCBD)** at the median further suggests that in the post COVID-19 period, the impact of COVID-19 on decentralization is insignificant (at the median). This finding provides stronger support for Hypothesis 1b than the OLS results reported in Table 4. Given that the residuals of the OLS estimates of Equation (2) are heavily skewed, the quantile regression results are considered more representative of the underlying reality.

Table 5. Results of quantile regression estimates for office prices before the COVID-19 period and during the post-COVID-19 period [Equation (2)]. Results for low-end offices ($\tau = 0.25$), the median ($\tau = 0.50$), and high-end offices ($\tau = 0.75$) are presented in Columns 1, 2 and 3, respectively. The dependent variable is ln(RUP). The independent variable of interest is **P_COVID*ln(DCBD)**. All variables are described in Appendix A. The standard errors are reported in parentheses. ***, **, and * denote significance of the *t*-statistics at the <1%, 5%, and 10% levels, respectively.

Variables	Column 1 ($\tau = 0.25$)	Column 2 ($\tau = 0.5$)	Column 3 ($\tau = 0.75$)
Constant	6.7448 *** (0.4133)	7.0992 *** (0.3532)	7.8064 *** (0.3087)
ln(SFA)	−0.0172 * (0.0091)	−0.0043 (0.0066)	0.0155 ** (0.0070)
ln(FL)	0.0955 *** (0.0088)	0.0909 *** (0.0069)	0.0964 *** (0.0076)
ln(MTR)	−0.0348 ** (0.0154)	−0.0489 *** (0.0115)	−0.0688 *** (0.0124)
SV	0.6437 *** (0.0246)	0.5804 *** (0.0193)	0.5409 *** (0.0259)
ln(AGE)	−0.1430 *** (0.0080)	−0.1359 *** (0.0051)	−0.1154 *** (0.0085)
P_COVID*ln(AGE)	−0.0928 *** (0.0199)	−0.1158 *** (0.0179)	−0.1381 *** (0.0146)
ln(DCBD)	−0.1126 *** (0.0402)	−0.1444 *** (0.0267)	−0.1534 *** (0.0286)
P_COVID*ln(DCBD)	0.0493 ** (0.0227)	0.0210 (0.0196)	−0.0177 (0.0214)

Table 5. *Cont.*

Variables	Column 1 ($\tau = 0.25$)	Column 2 ($\tau = 0.5$)	Column 3 ($\tau = 0.75$)
P_COVID	0.3803 *** (0.0864)	0.4814 *** (0.0794)	0.5912 *** (0.0701)
ln(OPI)	0.2168 *** (0.0624)	0.1650 *** (0.0563)	0.0374 (0.0462)
District Dummies	Yes	Yes	Yes
R ²	0.3585	0.3830	0.4296
Observations	3303	3303	3303

We also estimated the quantile regression for Equation (1) for comparison. The results are presented in Table 6. It can be seen that the coefficients on **COVID*ln(DCBD)** are significant for all offices. Furthermore, unlike the result in Table 5, the coefficient of **COVID*ln(DCBD)** is also significant for $\tau = 0.25$ and 0.5 , which provides more empirical support for Hypothesis 1b. The result shows the importance of signaling reputation for the tenants occupying high-end offices and flight to quality after COVID-19, which is consistent with the results in Gupta et al. [33].

Table 6. Results of quantile regression estimates for office prices before and during the COVID-19 period [Equation (1)]. Results for low-end offices ($\tau = 0.25$), the median ($\tau = 0.50$), and high-end offices ($\tau = 0.75$) are presented in Columns 1, 2 and 3, respectively. The dependent variable is ln(RUP). The independent variables of interest is **COVID*ln(DCBD)**. All variables are described in Appendix A. The standard errors are reported in parentheses. ***, **, and * denote significance of the *t*-statistics at the <1%, 5%, and 10% levels, respectively.

Variables	Column 1	Column 2	Column 3
Constant	3.4943 ** (0.3845)	3.7554 ** (0.3613)	3.6059 ** (0.3822)
ln(SFA)	−0.0167 ** (0.0058)	−0.0069 (0.005)	0.0147 ** (0.0055)
ln(FL)	0.0772 ** (0.0053)	0.0868 ** (0.0051)	0.0878 ** (0.0050)
ln(MTR)	−0.0561 ** (0.0097)	−0.0520 ** (0.0091)	−0.0651 ** (0.0103)
SV	0.732 *** (0.0183)	0.6939 ** (0.0198)	0.6950 ** (0.0221)
ln(AGE)	−0.1466 ** (0.0047)	−0.1387 ** (0.0040)	−0.1182 ** (0.0068)
COVID*ln(AGE)	−0.0392 ** (0.0081)	−0.0479 ** (0.0064)	−0.0456 ** (0.0070)
ln(DCBD)	−0.1340 ** (0.0394)	−0.1668 ** (0.0286)	−0.1316 ** (0.0202)
COVID*ln(DCBD)	0.0302 * (0.0150)	0.0372 ** (0.0118)	0.0378 ** (0.0099)
COVID	0.1831 ** (0.0403)	0.1889 ** (0.0296)	0.1802 ** (0.0280)
ln(OPI)	0.7496 ** (0.0578)	0.7109 ** (0.0567)	0.7093 ** (0.0607)
District Dummies	Yes	Yes	Yes
R ²	0.3867	0.4054	0.4456
Observations	3900	3900	3900

6. Conclusions

Although COVID-19 has receded, its legacy continues to shape the office market. Defining the pandemic period as the World Health Organization's Public Health Emergency of International Concern (PHEIC) period (January 2020–May 2023) as the COVID-19 period and the subsequent period as the post-COVID-19 era, our analysis of Hong Kong office transactions reveals several enduring dynamics. The bid-rent curve flattened during the COVID-19 period, which reflects decentralization pressures documented in other studies. Yet this effect has largely dissipated in the post-COVID-19 era for high-end offices, where the reputational value of a central business district (CBD) address sustains demand by signaling corporate prestige. In contrast, lower-end offices remain more vulnerable to decentralization forces. Moreover, functional obsolescence in older office buildings, accelerated during the pandemic, has persisted and even intensified, driven by sustainability mandates, tenant expectations for wellness and flexibility, and requirements for advanced digital infrastructure. Upgrading such assets often proves economically unviable, reinforcing a segmented market structure.

These findings carry important policy implications. First, the resilience of CBD premium offices highlights the need for continued investment in CBD infrastructure and amenities to preserve their global competitiveness. Second, the vulnerability of secondary office stock calls for adaptive reuse strategies, such as conversion to housing or mixed-use developments, to mitigate vacancy risks. Third, the persistence of obsolescence underscores the urgency of regulatory frameworks and incentive schemes that promote sustainable retrofitting, wellness-oriented design, and digital modernization. Finally, the observed “flight to quality” suggests that policymakers must monitor widening disparities between premium and secondary markets to ensure balanced urban development.

There are several limitations to this study. First, although the hypotheses are derived from a theoretical framework supported by previous studies, it is possible that the empirical results could be explained by an entirely different framework unrelated to COVID-19. However, until the COVID-19-induced office dynamics conceptual framework is rejected by empirical data, it can be considered a useful tool for analyzing the long-term impact of COVID-19 on the office market. Second, the post-COVID-19 period examined covers only two years and three months. Further studies spanning longer time horizons are needed to confirm the observed trends. Third, as our empirical evidence is drawn from Hong Kong, the results may not be generalizable to global office markets. We therefore encourage comparable studies in other cities to build a more comprehensive understanding of post-COVID-19 office market dynamics and to inform policy responses that foster resilient, sustainable, and inclusive urban office environments.

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Appendix A

Table A1. Variable definitions. This table presents definitions of the variables used in the empirical tests.

Variables	Definition
OPI	Office price index, a monthly constant quality index compiled by the Rating and Valuation Department of the Hong Kong SAR Government.
SFA	Saleable floor area of the office unit.
RUP	Real unit price, which is the transaction price per square foot of saleable floor area (SFA) deflated by the office price index (OPI).
FL	Floor level of the office unit.
SV	Sea view dummy, which equals 1 if the transacted office unit has a sea view and zero otherwise.
MTR	Walking time to the nearest MTR (Mass Transit Railway) exit in minutes.
AGE	Age of the office building in years.
DCBD	Distance to the CBD (central business district) in kilometers.
DISTRICT DUMMY	The district dummy equals 1 if the transacted office unit is in the respective administrative district and zero otherwise.
COVID	COVID-19 period dummy, which equals 1 if the office unit is transacted during the COVID-19 period and zero otherwise. The COVID-19 period is defined as the period between the World Health Organization's (WHO) declaration of COVID-19 as a Public Health Emergency of International Concern (PHEIC) on 30 January 2020 and its cancelation on 5 May 2023.
P_COVID	Post COVID-19 period dummy, which equals 1 if the office unit is transacted during the post-COVID-19 period and zero otherwise. The post-COVID-19 period is defined as the period after the WHO's cancelation of COVID-19 as a PHEIC.

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