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The Capital Value of Pedestrianization in Asia's Commercial Cityscape:

Evidence from Office Towers and Retail Streets

Highlights

- The commercial value of pedestrianization in Asian cities is examined
- Skywalks generate positive price effects on office towers near rail stations
- Both skywalks and zone schemes have no price effects on retail streets
- Pedestrinization can contrinute to capital accumulation via office towers
- Pedestrinization may induce neither retail revitalization nor gentrification

The Capital Value of Pedestrianization in Asia's Commercial Cityscape: Evidence from Office Towers and Retail Streets

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The Capital Value of Pedestrianization in Asia's Commercial Cityscape:

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Abstract

Asian cities have increasingly been promoting the creation of walkable built environments as a catalyst for local economic development in global competition. However, the economic influences of pedestrianization are still debatable without sufficient quantitative assessments in Asia's commercialized cityscape along with mega-rail projects, high-rise buildings, and traffic-choked streets. This research examines the net capitalization effects of skywalk network and pedestrian zone schemes on office towers and retail streets using the case of Hong Kong. The sets of hedonic regression models in a quasi-experimental research framework show mixed results. The expansion of skywalk networks produced positive capitalization effects on podium-level office units connected by footbridges near metro rail exits, while having insignificant impacts on street-level retail units. The models also reveal that the implementation of pedestrian zone schemes generated insignificant capitalization effects on street-level retail units regardless of rail proximity. The evidence gives some credence to the notion that the creation of walkable built environments in Asian cities would contribute to capital accumulation through mega-rail plus international office tower projects. However, the findings also infer that pedestrianization initiatives in global competition would lead to neither commercial revitalization nor gentrification on local retail streets around metro rail stations.

Keywords: pedestrianization; rail accessibility; vertical urbanism; economic development; commercial gentrification

1 1. Introduction

2

3 Asian cities have increasingly been undertaking great efforts to create walkable built environments for
4 the viability of dense commercial districts under the pressure of global competition. Noticeably, such
5 pedestrianization initiatives have been associated with metro rail projects amid Asia’s rapid, dense, and
6 monocentric urbanization. According to transportation studies, metro rail investments are expected to
7 promote local economic development via enhanced accessibility and agglomeration economies,
8 depending on the adaptation of transit-oriented land use measures (e.g., density, mixture, and
9 compactness) and urban design elements for last-mile travel experience by walk in station catchment
10 areas – called “new urbanism” principles (Banister and Berechman, 2001; Calthorpe, 1993; Cervero and
11 Kockelman, 1997; Weisbrod and Reno, 2009).

12 The economic outcome of new urbanism practices around rail stations is debatable from the
13 viewpoint of density. Some researchers claim that the competitive advantage of rail-oriented built
14 environments is likely to diminish with the congestion, chaos, and other negative externalities (e.g.,
15 noise, air pollution, and infectious diseases) intensified by densification (Hamidi et al., 2020; Lin and
16 Gau, 2006; Richardson, 1995; Yildirim et al., 2020). Nevertheless, several international case comparisons
17 present that Asian cities in global competition tend to accept much higher densities around rail terminals
18 through entrepreneurial urban regeneration schemes for greater accessibility and agglomeration benefits
19 than Western cities do (Author [Blinded], 2018; Authors [Blinded], 2009; Curtis et al., 2009; Kong and
20 Pojani, 2017; Suzuki et al., 2013). Other researchers further suggest that mega-rail projects along with
21 new urbanism practices have the possibility to induce commercial gentrification due in part to the extra
22 floor area ratios exclusively permitted for commercial real estate redevelopment around selected stations
23 (Fainstein, 2001; González et al., 2019; Lin and Gau, 2006; Lin and Yang, 2019; Padeiro et al., 2019).

24 In principle, pedestrian-friendly design elements are supposed to mitigate the adverse effects of
25 urban densification on local economies by curbing excess traffic, reducing physical exposures to risks,
26 producing a sense of place, attracting diverse kinds of people, connecting street blocks and local
27 communities, and facilitating social interactions and consumer spending at small-scale retail, workshops,

1 galleries, cafés, and restaurants (Florida, 2005; Jacobs, 1961; Global Designing Cities Initiative, 2016). In
2 reality, however, design-led urban regeneration is rather inclined to enhance the brand image of flagship
3 office towers and shopping streets as symbolic and aesthetic places for regional headquarters, advanced
4 producer services, and creative class workers in global markets (Bell and Jayne, 2003; Biddulph, 2011;
5 Gospodini, 2002; Julier, 2005; Madanipour, 2006; Ponzini, 2011; Sassen, 2002; Smit, 2011; Zukin et al.,
6 2009).

7 Of various design aspects, the formation of pedestrian networks plays a critical role in
8 characterizing the degree and pattern of local economic development through changes in four built
9 environment attributes: (1) the vertical and horizontal distribution patterns of rail accessibility around
10 stations -- “the three-dimensional distribution of accessibility”; (2) traffic dis-amenity and
11 comfortableness – “(dis)amenity”; (3) building design image and authenticity – “design” ; and (4)
12 efficiency to walk -- “walkability.” In accordance with modernistic and utilitarian design standards,
13 pedestrian spaces can be laid out to produce efficient, safe, and comfortable built environments in the
14 form of multi-level grade separation or street-level traffic restriction (Brambilla and Longo, 1977;
15 Buchanan, 1963; Corbusier and Eardley, 1973). Indeed, both vertical skywalk network and horizontal
16 pedestrian zone schemes have been implemented to promote the revitalization of distressed commercial
17 districts across European, American, and Australian cities in competition with the growth of car-
18 dependent suburbia over the past five decades (Hass-Klau, 1993; Parajuli and Pojani, 2018; Robertson,
19 1993; Yoos and James, 2016).

20 The assemblage of above-grade, climate-controlled walkway connectors between commercial
21 buildings was initially envisioned as a quasi-public space to protect people from vehicle traffic and harsh
22 weather conditions. As the volume of pedestrian circulation grew with the incremental addition of
23 connectors, the demand for elevated commercial spaces rose. Consequently, the extensions of skywalk
24 corridors throughout multiple street blocks have been driven by the desire of private building owners to
25 increase the value of commercial properties for enhanced connectivity and vertical accessibility (Corbett
26 et al., 2009). Moreover, city leaders have been underscoring the modern and utilitarian image of skywalk
27 systems as a competitive edge of business districts to attract international investments, firms, and tourists.

1 In some cities, density bonuses have been granted to property developers in exchange for the acquisition
2 of public rights-of-way between private buildings and the enlargement of skywalk networks over the
3 whole city center. Despite the practical popularity, several researchers express the concern that elevated
4 **urban** spaces (called “vertical urbanism”) are likely to take apart wealthy office workers from street
5 economies, have undesirable impacts on street-level retailers, and make up the image of high-rise
6 business districts as elitist (Byers, 1998; Cui et al., 2013; Greco, 2018; Robertson, 1993; Yoos and James,
7 2016).

8 In contrast, the conversion of congested road spaces to car-free, traffic-calming, or pedestrian-
9 only zones (**called “pedestrian malls” in American cities**) has long been implemented as some kind of
10 public program to improve the viability of shopping streets in historic city centers (Hass-Klau, 2014).
11 The different types of schemes commonly presume that the growth of street-level pedestrian flows can
12 bring about increases in local consumers, retail turnovers, occupancy rates, and shop rents (Hass-Klau,
13 1993). **However, local merchants were initially reluctant to support pedestrian zone schemes since**
14 **limited private vehicle access and parking spaces would discourage citywide consumers from visiting**
15 **traditional retail outlets. Indeed, many pedestrian mall practices had turned out to be commercially**
16 **unsuccessful across American cities by the 1980s, in part for the inadequate design and operation of**
17 **parking spaces (Pojani, 2008; Robertson, 1993). Thus, the designation of pedestrian zones has been**
18 **associated with the construction of underground parking facilities for vertical accessibility and/or street-**
19 **level tram/light rail stops for horizontal accessibility in European cities (Castillo-Manzano et al., 2014;**
20 **Parajuli and Pojani, 2018; Soni and Soni, 2016).** A body of studies **further** points out the dilemma that the
21 commercial success of pedestrian zone schemes is likely to spur the replacement of local small retailers
22 with international chain stores due to increased shop rents for higher accessibility (Özdemir and Selçuk,
23 2017). Essentially, a large part of the retail turnovers increased by accessibility enhancement and
24 commercial gentrification can be transferred from competitive tenant shopkeepers to street-level property
25 owners who are required to recover the costs of pedestrian zone schemes through special levies, taxation,
26 or land value capture (Hass-Klau, 1993; 2014; Parajuli and Pojani, 2018; **Pojani, 2008**).

1 Likewise, the proliferation of both skyway network and pedestrian zone schemes has been
2 reported from competitive cities in Asia, such as Hong Kong, Singapore, Tokyo, Taipei, Shanghai, and
3 Shenzhen (Cheng and Shih, 2006; Cui et al., 2013; Parajuli and Pojani, 2018; Yoos and James, 2016;
4 Yueb and Chor, 1997). Noticeably, with relatively low car ownership, many of the competitive cities in
5 Asia have been applying “minimum” or “moderate” private vehicle access and parking space
6 requirements on high-rise buildings in transit-oriented locations (Barter, 2011; Kong and Pojani, 2017).
7 Thus, the economic influences of pedestrianization can be great but controversial in Asia’s
8 commercialized cityscape along with mega-rail projects, high-rise buildings, and traffic-choked streets. In
9 Hong Kong, as an example of Asian capitalist cities, the three-dimensional formation of pedestrian
10 networks has been pragmatized by the planning department, railway corporation, and private developers
11 not merely to circulate massive traffic flows around stations but rather to produce substantial land
12 premiums for enhanced accessibility and agglomeration benefits (Authors [Blinded], 2009; Loo et al.,
13 2010). In recent years, such property-led walkway design is widely advertised as a key feature of
14 “livable” and “sustainable” cities, while a few case studies illustrate the uneven distribution of
15 accessibility between international office towers and local retail streets as the nature of mega-rail plus
16 property projects in pursuit of revenue generation and competitiveness (Barber, 2020; Dimitriou and
17 Trueb, 2005; Tan and Xue, 2014). Nonetheless, the economic impacts of pedestrianization initiatives
18 have been discussed based on limited quantitative evidence, especially in Asia’s emerging markets (Cui
19 et al., 2013; Whitehead et al., 2006).

20 This article contributes to the literature by providing new evidence from Asia’s commercial
21 cityscape in four important ways. First, both skyway network and pedestrian zone schemes are
22 investigated between comparable commercial districts in one case city – Hong Kong. Second, net
23 capitalization effects are estimated using property transaction prices with and without the implementation
24 of each scheme over multiple-year periods. Third, the economic influences of pedestrianization are
25 examined in two commercial property sectors – office towers and retail streets. Forth, the three-
26 dimensional distribution patterns of pedestrian accessibility are inspected in the presence of metro rail
27 stations. A set of hedonic pricing analyses present mixed findings. The net capitalization effects of

1 skyway networks on office towers are significant at podium-level units within close distance from rail
2 stations, whereas those of both skyway networks and pedestrian zone schemes on retail streets are not
3 negative but insignificant regardless of proximity to stations. The evidence lends some credence to the
4 notion that the creation of walkable built environments in Asian cities can promote capital accumulation
5 through international business competitiveness rather than local retail revitalization on the rationale of
6 mega-rail plus property projects. However, the findings do not give full support to the claim that
7 pedestrianization practices in Asian capitalist cities lead to commercial gentrification through the three-
8 dimensional distribution of accessibility, (dis)amenity, design, and walkability around rail stations.

9 The remainder of this article proceeds as follows. The second section reviews the empirical
10 literature on the capitalization of built environment attributes in property prices. The third section
11 describes the pedestrianization cases and methodology applied to analyze property transaction data in
12 Hong Kong, and analytical results are reported in the fourth section. **The fifth section includes a summary
13 and discussion of the findings as well as challenges for future research.** .

14

15 **2. Literature Review – Evidence on Property Prices**

16

17 The economic value of a built environment attribute can be measured by analyzing the revealed or stated
18 preferences of consumers under the assumption of utility theory (Lancaster, 1966). Particularly, the
19 technique of hedonic regression allows researchers to decompose one property price revealed in a
20 competitive market into the element values of key attributes as derived from various transactions in
21 different built environments (Rosen, 1974). The hedonic pricing method has widely been used to assess
22 the economic impacts of public capital projects or determine the value of “non-market environmental
23 goods” in the presence of externalities (Brookshire et al., 1982; Freeman III, 1981; Kanemoto, 1988).
24 While there are numerous applied studies for various objectives, this review section gives attention to
25 evidence on the capitalization **effects** of **four built environment attributes – accessibility, (dis)amenity,
26 design, and walkability.**

1 Over the past four decades, a growing body of hedonic regression work has cumulated findings on
2 the impacts of various rail projects, including commuter rail, heavy/metro rail transit, light rail transit,
3 and bus rapid transit, across cities in developed countries and emerging economies. According to the bid-
4 rent theory established by Alonso (1964), Muth (1964), and Mills (1972), the accessibility benefits of rail
5 systems to firms or households can be capitalized into commercial or residential properties around
6 stations. Meta-analyses of rail accessibility commonly addressed significant variations in price estimates
7 across case studies, attributed to methodological techniques and contextual characteristics (e.g., station
8 proximity measures, rail system types, real estate categories, and road access conditions). Noticeably,
9 many of the studies have investigated residential properties rather than commercial properties due in
10 large part to the availability of transaction data (Higgins and Kanaroglou, 2016). Nevertheless, commuter
11 and metro rail systems tend to have greater accessibility impacts on commercial properties than
12 residential ones within walking distance from stations – typically 1/4 mile or 400 meters (Debrezion et
13 al., 2007). The international literature further implies that metro rail projects are likely to create higher
14 price premiums in the central business districts (CBDs) of Asian cities with rapid, dense, and
15 monocentric urbanization (Mohammad et al., 2013; Wu et al., 2020).

16 On the other hand, several studies have detected price discounts within immediate distance from
17 high-intensity access nodes for the environmental disamenities brought by rail and road systems, such as
18 excess traffic, noise and air pollutions, and high crime rates (Authors [Blinded], 2018; Andersson et al.,
19 2010; Bowes and Ihlanfeldt, 2001; Diao et al., 2016; Higgins et al., 2019; Nelson, 2008; Seo et al., 2019).
20 Another body of work has scrutinized respective or synergistic price premiums for rail accessibility and
21 new urbanism attributes in residential neighborhoods (Atkinson-Palombo, 2010; Bartholomew and
22 Ewing, 2011; Duncan, 2011a; 2011b; Higgins, 2019; Li and Huang, 2020; Park et al., 2016; Ryan and
23 Weber, 2007; Song and Knaap, 2003; Tu and Eppli, 2001) while providing little evidence on the
24 capitalization of rail-oriented built environment attributes in commercial districts (Yu et al., 2018).

25 There is a small body of research on the economic value of architectural design as quasi-public
26 goods, although competitive cities nowadays employ internationally known architects for the promotion
27 of urban regeneration programs with the distinctive quality of office towers in terms of vertical form,

1 image, function, and symbolism (Fuerst et al., 2011; Nase et al., 2015). Some present that office
2 occupiers are willing to pay high rental premiums for the excellence of design, measured by design award
3 status or building quality score (Gat, 1998; Hough and Kratz, 1983; Vandell and Lane, 1989). Others
4 reveal that the quality of architectural design as local public goods can generate not only internal rental
5 premiums but also external capitalization effects on residential properties in the vicinity of office towers
6 (Ahlfeldt and Holman, 2016; Thibodeau, 1990).

7 Recent studies have increasingly examined the association of walkability scores with residential
8 prices in different submarkets, such as single-family homes, high-end condominiums, and affordable
9 apartments (Boyle et al., 2014; Gilderbloom et al., 2015; Kim and Kim, 2020; Li et al., 2015; 2014;
10 Rauterkus and Miller, 2011; Zhang et al., 2019). While many disclose the insignificance of walkability in
11 determining the value of high-income, low-density, and car-dependent neighborhoods, one shows that
12 walkability benefits can be capitalized into office, retail, and apartment values across American cities
13 (Pivo and Fisher, 2011). A few studies pay attention to specific pedestrianization schemes rather than
14 aggregate walkability scores. In Istanbul, the relationship between land values and distance to
15 pedestrianized streets was negative for commercial revitalization (Arslanlı et al., 2017; Dokmeci et al.,
16 2007). From Hong Kong, one research reports a significant increase in retail prices after pedestrianization
17 – about +17% premium for higher walkability (Yiu, 2011).

18 In summary, little evidence has been provided on the net capitalization effects of skywalk network
19 and pedestrian zone schemes in Asia’s commercial property markets, regarding the three-dimensional
20 distribution of accessibility, (dis)amenity, design, and walkability in pursuit of local economic
21 development under global competition.

22
23 **3. Methodology**

24
25 **3.1 Study areas**

26

1 Hong Kong is selected as a case city about Asia’s pedestrianization initiatives under **eight** important
2 conditions: (i) dense, monocentric urban spatial structure; (ii) international business hub; (iii) world-class
3 rail investment; (iv) rail-oriented property development; (v) high demand for limited commercial space;
4 **(vi) low private car ownership and bicycle usage; (vii) minimum parking space requirements; and (viii)**
5 **busy streetscape with a mix of passengers and commercial vehicle flows -- buses, coaches, taxis, and**
6 **trucks**. Indeed, the Urban Design Guidelines for Hong Kong¹ encourages the creation of pedestrian-
7 oriented streetscape in core areas with three-dimensional design elements, such as “mega-towers,”
8 “podiums,” “footbridges,” and “traffic calming” (HKSAR Planning Department, 2003). The Territorial
9 Development Strategy “Hong Kong 2030²” also suggests the revitalization of commercial districts
10 through private initiatives around mass railway transit (MTR) stations as one of the key factors to identify
11 the core areas for pedestrianization projects (HKSAR Planning Department, 2007). From these
12 perspectives, this case study focuses on the expansion of skywalk networks between office towers on
13 Hong Kong Island and the implementation of pedestrian zone schemes on retail streets in Kowloon,
14 respectively (Figure 1).

15
16 [Figure 1 about here]

17 18 **3.1.1 Expansion of skywalk networks on Hong Kong Island**

19
20 On Hong Kong Island, a few elevated footbridge systems have been developed between office towers,
21 shopping podiums, hotels, public squares, and government buildings during the past five decades. Of
22 them, the Central Elevated Walkway forms the most extensive pedestrian network(s) with a total length
23 of about 8 km across Central and Sheung Wan. The initial segments of this system were constructed by
24 Hongkong Land in the 1970s, and its surrounding landmarks were connected by the government and

¹ The Hong Kong Special Administrative Region (HKSAR) Planning Department completed a study on the Urban Design Guidelines for Hong Kong (UDG Study) in 2003 to promote Hong Kong’s “image” as a world-class city and enhance the quality of built environments.

² Hong Kong 2030 stresses the importance of encouraging better building and urban design since the Severe Acute Respiratory Syndrome (SARS) epidemic in 2003 aggravated the Asian financial crisis of the late 1990s and raised public concern about the negative effects of high-density development layout in old districts.

1 several private developers in sequence throughout the 1980s. The large expansion of skywalk networks
2 came about for 1998–2003, accompanied by Phases I and II of the International Finance Center (IFC)
3 above Hong Kong Station. MTR’s Rail Plus Property program physically integrated the multilayer
4 terminal facilities with the IFC commercial complex. The addition of nine building connectors along with
5 multiple MTR exits was supposed to enlarge the station catchment area of Hong Kong, Central, and
6 Sheung Wan or to reconfigure the three-dimensional distribution of rail accessibility within 300 meters
7 from the MTR exits³, which is examined in comparison to that of Wan Chai without the expansion of
8 skywalk networks in recent years (Figure 2).

9
10 [Figure 2 about here]

11
12 The two study areas contained about 23,800 business establishments for 222,000 workers, accounting for
13 9.3% of Hong Kong’s total employment in 2007⁴ – a few years after the completion of the IFC
14 commercial complex. Over 62% of the workers engaged in the five industrial sectors that could be related
15 to office properties (Information and Communications; Financing and Insurance; Real Estate;
16 Professional, Scientific, and Technical Services; Administrative and Support Services), while around
17 27% of the workers engaged in the three industrial sectors that could be related to retail properties
18 (Import/Export, Wholesale, and Retail Trades; Accommodation and Food Services; Arts, Entertainment,
19 and Recreation). Figure 3 further presents changes in employment across the five office-related and three
20 retail-related sectors for 2000–2007. The industrial composition change may suggest that the relocation
21 of office-related employment was likely to happen from Wan Chai to Hong Kong (especially IFC), but
22 the occurrence of gentrification between the office- and retail-related sectors was less likely after the
23 expansion of skywalk networks in Hong Kong, Central, and Sheung Wan.

24

³ 300 meters is regarded as walking distance because metro station spacing is relatively short on Hong Kong Island and in Kowloon.

⁴ Hong Kong’s employment data was extracted from HKSAR Census and Statistics Department’s Table E009: Number of establishments and persons engaged (other than those in the Civil Service) analyzed by industry section and Tertiary Planning Unit (TPU).

1 [Figure 3 about here]

2

3 **3.1.2 Implementation of pedestrian zone schemes in Kowloon**

4

5 HKSAR Transport Department has been implementing some kind of street-level traffic restriction
6 schemes⁵ in seven commercial districts across Hong Kong Island and Kowloon since 2000. Of the seven
7 districts, this research looks at the implementation of pedestrian zone schemes around Sham Shui Po
8 Station – one of the busiest retail streets and popular tourist destinations in Kowloon. The public program
9 has taken an incremental approach with support from the District Council of Sham Shui Po. At first, a
10 few part-time pedestrian paths were implemented on a trial basis from 12 noon to 9 pm daily in October
11 2001. Next, the pedestrian street schemes came into a full-time operation, and two other part-time
12 pedestrian paths began in May 2002. These pedestrian schemes also became permanent in May 2004, and
13 the implementation of traffic-calming schemes started on six other streets in 2008. As a consequence, the
14 station catchment area of Sham Shui Po was supposed to form a rail-oriented pedestrian zone for
15 horizontal accessibility within 300 meters from the existing MTR exits, which is studied in comparison to
16 the station catchment areas of Prince Edward and Cheung Sha Wan without the implementation of
17 pedestrian zone schemes on the same MTR line (Figure 4).

18

19 [Figure 4 about here]

20

21 The three study areas included about 6,900 business establishments for 32,200 workers in 2012 – a few
22 years after the commencement of traffic calming schemes on busy retail streets in Sham Shui Po. Around
23 65% of the workers engaged in the three industrial sectors that could be related to retail properties. Figure
24 5 shows changes in employment across the three retail-related sectors for 2000–2012. The employment

⁵ HKSAR Transport Department adopts three types of pedestrian street schemes: full-time; part-time; and traffic calming. On full-time pedestrian streets, the highest priority is given to pedestrians and vehicle access is restricted to emergency services only. On part-time pedestrian streets, vehicle access is allowed in specific times, but there is no on-street parking space except loading bays for commercial vehicles. On traffic calming streets, there is no restriction to vehicle access, but various street design measures are applied to discourage access for non-essential vehicles (e.g., speed tables, kerb build-outs, sharpened corners, car lane narrowings, and gateways).

1 statistics indicates that the substantial removal of retail trade businesses was likely to happen in the three
2 study areas, although more street vendors (called “fixed pitch hawkers⁶”) got licensed in practice.
3 Instead, the rapid progress of arts, entertainment, and recreational businesses turned out to be identifiable
4 in Sham Shui Po, Prince Edward, and Cheung Sha Wan, regardless of the implementation of pedestrian
5 zone schemes.

6
7 [Figure 5 about here]

8

9 **3.2 Model specification**

10

11 This research applies the method of hedonic regression in a difference-in-differences (DID) framework to
12 estimate the net capitalization effects of pedestrianization on commercial properties within the two
13 comparable areas on Hong Kong Island and the three comparable areas in Kowloon, respectively. DID is
14 a quasi-experimental research technique to examine the causal association of treatment with an outcome
15 by comparing the average change over time in the outcome between treatment and control groups under a
16 parallel trends assumption (Diao et al., 2017; Higgins, 2019). This DID application studies changes in the
17 value of both office towers and retail streets before and after the expansion of skywalk networks on Hong
18 Kong Island and those in the value of retail streets before and after the implementation of pedestrian zone
19 schemes in Kowloon. This quasi-experimental research calls for three sets of hedonic regression models.
20 The three sets of models commonly assume that unit buyers are willing to pay high premiums for
21 commercial properties with productive built environment attributes, such as rail accessibility, amenity,
22 building design, and walkability, distributed by pedestrianization initiatives – the expansion of skywalk
23 networks or the implementation of pedestrian zone schemes – in the treatment area. Based on this
24 assumption, the value of commercial properties within the treatment and control areas can be formulated
25 as below:

⁶ HKSAR Food and Environmental Hygiene Department authorizes the licensee to hawk at a fixed pitch on the ground in any place or street for the use of commerce. There are seven categories of fixed-pitch hawker licenses: bootblack; cooked food or light refreshment; newspaper; tradesman; barber; wall stall; and others.

1

$$\ln P = \alpha + \beta NC + \gamma BE + \delta ST + \lambda DF + \mu YF + \nu QF + \varepsilon \quad \dots(1)$$

2

3 where **ln P** is a vector of log-transformed property unit price per gross floor area, **α** is a constant term,
 4 **NC** is a vector of the net capitalization effects generated by pedestrianization initiatives, **BE** is a vector of
 5 built environment attributes related to skywalk networks, **ST** is a vector of structural attributes (gross
 6 floor area, net-gross ratio, age of building, and floor level), **DF** is a vector of district fixed-effects for
 7 unobservable neighborhood attributes (or called “spatial heterogeneity”), **YF** is a vector of year fixed-
 8 effects dummies for unobservable temporal attributes, **QF** is a vector of quarter fixed-effects dummies for
 9 unobservable seasonal attributes, **ε** is an error term, and **β, γ, δ, λ, μ, ν,** and **τ** are vectors of coefficients
 10 for independent variables. After preliminarily testing spatial autoregressive models, this study found
 11 spatial fixed-effects as a logically suitable and statistically stable estimator for Hong Kong’s commercial
 12 property transactions within 300 meters from MTR exits because the heterogeneity of variance tends to
 13 be identical in tertiary planning units (TPUs) and is correlated with independent variables. The first set of
 14 models are constructed to inspect whether the expansion of skywalk networks generated positive
 15 capitalization effects on office units within 300 meters from MTR exits on Hong Kong Island.
 16 Particularly, the variables of interest associated with differences in skywalk networks are incorporated
 17 into Equation (1) as below:

18

$$\beta NC = \beta_1 \text{Treatment} + \beta_2 (\text{Treatment} \times \text{SkyConnected}) + \beta_3 (\text{Treatment} \times \text{SkyNearby}) + \beta_4 (\text{Treatment} \times \ln \text{DisMTR} \times \text{SkyConnected}) + \beta_5 (\text{Treatment} \times \ln \text{DisMTR} \times \text{SkyPodium}) \quad \dots(2)$$

$$\text{Treatment} = \text{Treatment Area} \times \text{Post Three Years} \quad \dots (3)$$

20

21 where **Treatment** is a dummy variable for office property transactions in **Treatment Area** after the
 22 expansion of skywalk networks or not – for **Post Three Years** (1/0), **SkyConnected** is a dummy

1 variable for office properties directly connected with skywalk networks or not (1/0), **SkyNearby** is a
 2 dummy variable for office properties not directly connected with skywalk networks but next to skywalk
 3 access points or not (1/0), **In DisMTR** is log-transformed distance from nearest MTR exit, and
 4 **SkyPodium** is a dummy variable for podium-level office units directly connected with skywalk
 5 networks or not (1/0). β_1 , β_2 , β_3 , β_4 , and β_5 are coefficients for treatment variables, indicating the degree
 6 and pattern of net capitalization effects on office properties hypothetically: (H1-1) in the whole treatment
 7 area; (H1-2) connected with skywalk networks in the treatment area; (H1-3) near skywalk access points;
 8 (H1-4) connected with skywalk networks with distance from nearest MTR exit; (H1-5) at the podium
 9 levels connected with skywalk networks with distance from nearest MTR exit.

10 The second set of models are estimated to examines whether street-level retail unit buyers tend to
 11 pay significantly discounted prices for vertical segregation enhanced by the expansion of skywalk
 12 networks from 1998 to 2003 in Hong Kong, Central, and Sheung Wan. Oppositely, the third set of
 13 models are estimated to test whether street-level retail unit buyers are willing to pay high premiums for
 14 properties with profitable built environment attributes, such as rail accessibility, amenity, and walkability,
 15 produced by the implantation of pedestrian zone schemes from 2001 to 2008 in Sham Shui Po. For these
 16 retail price discount or premium estimates, the variables of interest associated with differences in
 17 skywalk networks or pedestrian zone schemes are incorporated in Equation (1) as below:

18

$$\beta' NC = \beta'_1 \text{Treatment} + \beta'_2 (\text{Treatment} \times \text{StreetLV}) + \beta'_3 (\text{Treatment} \times \ln \text{DisMTR}) + \beta'_4 (\text{Treatment} \times \text{StreetLV} \times \ln \text{DisMTR}) \quad \dots(4)$$

19

$$\text{Treatment} = \text{Treatment Area} \times \text{Post Three Years} \quad \dots (5)$$

20

21 where **Treatment** is a dummy variable for retail property transactions in **Treatment Area** after
 22 pedestrianization or not – for **Post Three Years** (1/0), **StreetLV** is a dummy variable for street-level
 23 retail unit or not (1/0). β'_1 , β'_2 , β'_3 , and β'_4 , are coefficients for treatment variables, demonstrating the

1 degree and pattern of net capitalization effects on retail properties hypothetically: (H2-1/H3-1) in the
2 whole treatment area; (H2-2/H3-2) at the street level; (H2-3/H3-3) with distance from MTR exits; and/or
3 (H2-4/H3-4) at the street level with distance from MTR exits.

4 This work preliminarily tested different functional forms (e.g., linear, semi-log, full-log, and
5 squire) and finally confirmed that a full-log form could produce consistent results with high model
6 fitness. Importantly, full-log regression models can lessen the effects of heteroscedasticity and allows
7 researchers to interpret the coefficients for treatment variables as elasticities.

8

9 **3.3 Data collection and description**

10

11 Data on Hong Kong's commercial properties were obtained from EPRC Limited's transaction database
12 (<http://eprc.com.hk/>), recording street-level address, name of building, floor level, gross floor area, net
13 floor area⁷, date of sale, open year of building, and sales price from Hong Kong's Land Registry. The
14 sales prices⁸ are supposed to reflect unit buyers' willingness to pay not merely for short-term operating
15 profits but rather long-term capital gains derived from productive built environment attributes – improved
16 three-dimensional (vertical and horizontal) accessibility, amenity, building design, and walkability
17 through pedestrianization around rail stations. From the two study areas on Hong Kong Island, both
18 office and retail transaction records were compiled for 1994–1996 (pre-expansion) and 2005–2007 (post-
19 expansion). Likewise, from the three study areas in Kowloon, retail transaction records were compiled
20 for 1997–1999 (pre-implementation) and 2010–2012 (post-implementation). This data analysis does not
21 attempt to examine the capitalization effects of initial announcements and intermediate
22 constructions/implementations between the two time periods. To improve the reliability and validity of
23 data, transactions with incomplete information were excluded from hedonic regression analysis. To

⁷ Net floor area is used to analyze retail properties since gross floor area was not recorded in many retail unit transaction cases. For the same reason, the ratio of net floor area to gross floor area is not computed for retail properties.

⁸ Commercial leases in Hong Kong are usually for a term of two or three years, depending on the two parties' (landlord-tenant) bargaining power and/or market conditions. Either party can terminate the commercial lease contact during the term. In addition, tenants do not have a right to continue to operate their businesses in the rental spaces after the expiry of a lease. Thus, rental prices are supposed to reflect unit users' willingness to pay for short-term operating profits (rather than long-term capital gains), which is less suitable for this study with a special focus on capital accumulation in global competition.

1 control for Hong Kong’s inflation effects, the transaction prices recorded for the pre- and post-treatment
2 periods were adjusted monthly using Hong Kong’s consumer price index (CPI) in December 2014.

3 Information on the formation of skywalk networks on Hong Kong Island was extracted from the
4 Task Force on Harbourfront Developments on Hong Kong Island’s discussion report, including open
5 year, building name, and connection pattern (HKSAR Transport Department, 2012). The locations of
6 skywalk access points and MTR exits were retrieved from Google Earth’s online satellite imageries and
7 MTR Corporation’s official station maps. Both locational and implementational details of the pedestrian
8 zone schemes in Kowloon were acquired from the government website and supplemented by the public
9 information requests (HKSAR Transport Department, 2019). All the datasets on built environment
10 attributes were geocoded by year and spatiotemporally matched up with those on commercial property
11 transactions on the geographic information system (GIS) platform. The horizontal straight distances
12 between commercial property units and nearest station exits were calculated using the GIS tool function
13 and interacted with the variables for skywalk networks and pedestrian zone schemes⁹ in the DID
14 framework. Additionally, the three-digit TPU codes were linked with the street-level addresses of
15 commercial property units to generate the dummy variables for district fixed-effects.

16 Table 1 summarizes the description of dependent and independent variables organized for the
17 three sets of hedonic regression models. Figure 6 further displays temporal changes in logged average
18 property unit prices (inflation-adjusted) between the treatment and control groups to indicate the
19 acceptability of a parallel trends assumption. All the three graphs indicate that the trend lines of
20 commercial unit price changes over the two time periods were nearly identical between the treatment and
21 control groups.

22
23 [Table 1 about here]
24 [Figure 6 about here]
25

⁹ The variables related to skywalk networks and pedestrian zone schemes are supposed to explain the effects of three-dimensional network distances and travel times/traffic conditions, including pedestrian safety and comfortableness.

1 **4. Results**

2

3 **4.1 Models for office properties on Hong Kong Island**

4

5 Table 2 shows the results of six models for office properties on Hong Kong Island, which predict about
6 78% of the office unit prices (Adjusted R-squared = 0.784 to 0.785) by controlling for the component
7 values of structural and built environment attributes along with district, year, and quarter fixed-effects.
8 No treatment variable is included in Model (1) as a baseline (BL1) estimate, and five treatment variables,
9 corresponding to Equation (2), are interchangeably incorporated into Models (2) to (6) to lessen the
10 severity of a multicollinearity problem (variance inflation factors [VIFs] = 1.191 to 4.707).

11

12 [Table 2 about here]

13

14 The coefficients of four treatment variables (β_1 , β_2 , β_3 , and β_4) suggest that the expansion of skywalk
15 networks had insignificant capitalization effects on office towers: (H1-1) in the entire treatment area;
16 (H1-2) connected with skywalk networks; (H1-3) near skywalk access points; and (H1-4) connected with
17 skywalk networks near MTR exits. The coefficient of one treatment variable “**Treatment (1/0) × ln**
18 **DisMTR (log) × SkyPodium (1/0)**” (β_5) in Model (6), however, reveals that the expansion of skywalk
19 networks generated positive capitalization effects on office units: (H1-5) at the podium levels connected
20 with skywalk networks near MTR exits (elasticity [logged price gradient] = -0.101 at the 5% significance
21 level).

22

23 A few of the control variables across the six models commonly capture the significant
24 associations of skywalk networks with office unit prices, as being distinguished from net capitalization
25 effects. The coefficient of “SkyConnected (1/0)” indicates that office properties with skywalk network
26 connectors were 39.6% to 41.6% more expensive than those without connectors. Similarly, the
27 coefficient of “SkyNearby (1/0)” suggests that office properties next to skywalk access points were
39.6% to 41.6% higher priced than those away from skywalk networks. The coefficient of “ln DisMTR

1 (log) × SkyPodium (1/0)” demonstrates that the value of podium-level office units connected with
2 skywalk networks more sharply declined with horizontal distance from MTR exits (elasticity [logged
3 price gradient] = -0.091 to -0.153) than that of upper-level ones in the study areas on Hong Kong Island.
4 In contrast, the coefficient of “ln Floor (log)” illustrates that upper-level office spaces were preferred by
5 unit buyers despite vertical distance (elasticity [logged price gradient] = 0.084 to 0.086).

6

7 **4.2 Models for retail properties on Hong Kong Island**

8

9 Table 3 reports the results of five models for retail properties on Hong Kong Island, which explain about
10 65% of the retail unit prices (Adjusted R-squared = 0.651 to 0.652) by controlling for the component
11 values of retail structure and built environment attributes along with district, year, and quarter fixed-
12 effects. No treatment variable is involved in Model (7) as a baseline (BL2) estimate, and four treatment
13 variables, corresponding to Equation (3), are interchangeably entered into Models (8) to (11) to avoid the
14 problem of multicollinearity (VIFs = 2.717 to 3.615).

15

16 [Table 3 about here]

17

18 The coefficient of “StreetLV (1/0)” across the five models describes that street-level retail spaces were
19 145.8% to 147.7% higher valued than basements and upper-level retail units in the study areas on Hong
20 Kong Island. The coefficient of “ln DisMTR (log)” also demonstrates that the value of retail units more
21 steeply dropped with horizontal distance from MTR exits (elasticity [logged price gradient] = -0.202 to -
22 0.204 in Table 3) than that of office units (elasticity [logged price gradient] = -0.055 to -0.057 in Table
23 2). However, the coefficients of four treatment variables ($\beta'1$, $\beta'2$, $\beta'3$, and $\beta'4$) disclose that the
24 expansion of skywalk networks generated insignificant capitalization effects on retail properties: (H2-1)
25 in the entire treatment area; (H2-2) at the street level; (H2-3) with distance from MTR exits; and (H2-4)
26 at the street level with distance from MTR exits.

27

1 4.3 Models for retail properties in Kowloon

2

3 Table 3 also presents the results of five models for retail properties in Kowloon, which clarify about 61%
4 of the retail unit prices (Adjusted R-squared = 0.616 to 0.617) by accounting for the component values of
5 retail structure and built environment attributes along with district, year, and quarter fixed-effects. No
6 treatment variable is used in Model (12) as a baseline (BL3) estimate, and four treatment variables,
7 corresponding to Equation (3), are interchangeably studied in Models (13) to (16) to overcome the
8 problem of multicollinearity (VIFs = 2.071 to 2.806).

9 The coefficient of “StreetLV (1/0)” depicts that street-level retail units were 108.7% to 109.5%
10 more valuable than basements and upper-level ones across the study areas in Kowloon. The coefficient of
11 ln “DisMTR (log)” also presents that the value of retail units much more sharply decreased with
12 horizontal distance from MTR exits in Kowloon (elasticity [logged price gradient] = -0.419 to -0.428 in
13 Table 4) than that of retail units on Hong Kong Island (elasticity [logged price gradient] = -0.202 to -
14 0.204 in Table 3). Nevertheless, the coefficients of four treatment variables ($\beta'1$, $\beta'2$, $\beta'3$, and $\beta'4$) unveil
15 that the implementation of pedestrian zone schemes produced insignificant capitalization effects on retail
16 properties: (H3-1) in the entire treatment area; (H3-2) at the street level; (H3-3) with distance from MTR
17 exits; and (H3-4) at the street level with distance from MTR exits.

18

19 5. Conclusions

20

21 Key findings from the sets of DID hedonic regression models are threefold: (1) the net capitalization
22 effects of skywalk network expansion were accrued most significantly into podium-level office units
23 connected by footbridges for rail accessibility, amenity, design, and/or walkability around stations; (2)
24 the expansion of skywalk networks generated no vertical influences on the value of street-level retail
25 units in the CBD; and (3) the implementation of pedestrian zone schemes in the traditional commercial
26 district produced no horizontal effects on the value of street-level retail units around metro rail stations.
27 The first finding gives some credence to the notion that the creation of walkable built environments in

1 Asian cities could contribute to capital accumulation through international office towers under the
2 rationale of mega-rail plus property projects. However, the other two findings rather imply that increasing
3 pedestrianization initiatives in Asian capitalist cities would lead to neither commercial revitalization nor
4 gentrification on local retail streets around metro rail stations.

5 The capital value of pedestrianization estimated by this study appears to be modest or even
6 inconsistent with the finding reported by another research from Hong Kong – about +17% rental price
7 premium on pedestrianized retail streets (Yiu, 2011). There are three possible explanations for the modest
8 or insignificant estimates. First, this study looks at sales prices but not rental prices. The commercial
9 influences of pedestrianization initiatives might be more sensitively reflected in short-term operating
10 profits (rental prices) than long-term capital gains (sales prices). Second, the study periods used for this
11 research are likely to make differences in the magnitude and direction of capitalization estimates. The
12 treatment period 1998–2003 might represent not only the expansion of skywalk networks together with
13 rail plus property projects but also the economic shock brought by the SARS epidemic to international
14 business centers, as well as local retail streetscapes. Indeed, the value of original skywalk networks was
15 largely capitalized into office towers until the early 1990s¹⁰ rather than through the treatment period.
16 Third, this study cautiously decomposes the net capitalization effects of pedestrianization initiatives (for
17 amenity and walkability) from the commercial price premiums for rail accessibility and building design
18 in a quasi-experimental research framework. The existing work on rail-oriented land use or new urbanism
19 practices in Asian cities might overestimate the commercial value of walkable built environments without
20 taking into account the three-dimensional distribution of rail accessibility, (dis)amenity, building design,
21 and/or walkability.

22 The economic implication of pedestrianization in Asia’s commercial cityscape – neither
23 commercial revitalization nor gentrification – is debatable in comparison with the success of car free
24 zones in transit-oriented European cities (Hass-Klau, 1993; 2014; Özdemir and Selçuk, 2017) and the
25 failure of early pedestrian malls in car-dependent American cities (Poiani, 2008; Robertson, 1993),

¹⁰ Hong Kong’s property transaction data before 1993 are unavailable. The early stage of skywalk networks may need to be investigated using recent transactions from Asian cities in emerging economies.

1 especially in three aspects. First, the intensity of pedestrian and commercial vehicle flows around rail
2 stations in Asian cities is much higher than those near tram/light rail stops in European cities. The
3 pedestrianization scheme alone could not be sufficient to clear out the negative externalities intensified
4 by high density in Asia's transit-oriented commercial districts. Second, the minimum or moderate
5 parking space requirements on high-rise buildings in Asian cities with low private car ownership are less
6 likely to influence the commercial outcome of pedestrianization than the inadequate provision of car
7 parking spaces in American cities with high private car ownership. Instead, it could be rather critical for
8 Asian cities to design commercial vehicle access spaces in dense business districts around rail stations.
9 Third, Asia's retail streets may not appeal new consumers by placing old-fashioned shops or standardized
10 chain stores, as previously experienced in American cities. Even if increased street vendors and
11 performers (e.g., fixed-pitch hawkers in Hong Kong) attract a number of visitors to the pedestrianized
12 places, the economic benefits accrued in the "semi-formal" sector could not significantly be capitalized
13 into the market value of retail properties.

14 This article highlights **five** analytical challenges for future research. First, this study pays attention
15 to multi-level grade separation and street-level traffic restriction only. The effectiveness of
16 pedestrianization as a catalyst for local economic development should be extensively assessed along with
17 specific operating characteristics (e.g., commercial associations, placemaking efforts, and street vendor
18 regulations) and detailed design elements (e.g., signage systems, barrier-free equipment, street furniture,
19 public arts, green spaces, roofs, and pavements). Second, the key findings drawn in this article rely on a
20 limited number of commercial property transactions, which might not accurately represent the degree and
21 pattern of local economic development. To grasp the commercial influences of pedestrianization in
22 details (e.g., short-term operating profits, increasing chain stores, licensed street vendors, and creative
23 business establishments), future research should add to this quantitative assessment using different kinds
24 of datasets (e.g., rental prices, vacancy rates, business turnovers, pedestrian flows, and interview
25 surveys). Third, the role of shopping malls in creating walkable built environments is outside the scope of
26 this work. Indeed, the commercial outcome of "shopping podium plus towers" design guidelines in
27 Asia's rail-oriented suburbanization should be compared with that of new urbanism principles in

1 America's car-dependent suburbia. Fourth, this article investigates the "commercial" value of walkable
2 built environments only. Indeed, the public rationale for various pedestrianization practices is not limited
3 to local economic development but rather extensive to broad social objectives, such as livability,
4 inclusiveness, health, and well-being. Lastly, it is debatable whether the capital value of pedestrianization
5 estimated from commercial property transactions over the last two decades will be still important for
6 Asian cities after going through the Coronavirus Disease 2019 (COVID-19) pandemic. Indeed, the
7 practices of teleworking, e-commerce, and social distancing are presently diminishing the demand for
8 office, retail, and interactive node spaces. However, we foresee that the creation of walkable built
9 environments will continue to play a key role in preventing high-intensity commercial districts from
10 potential pandemic threats and refining the competitiveness of Asian cities with new business norms.

11

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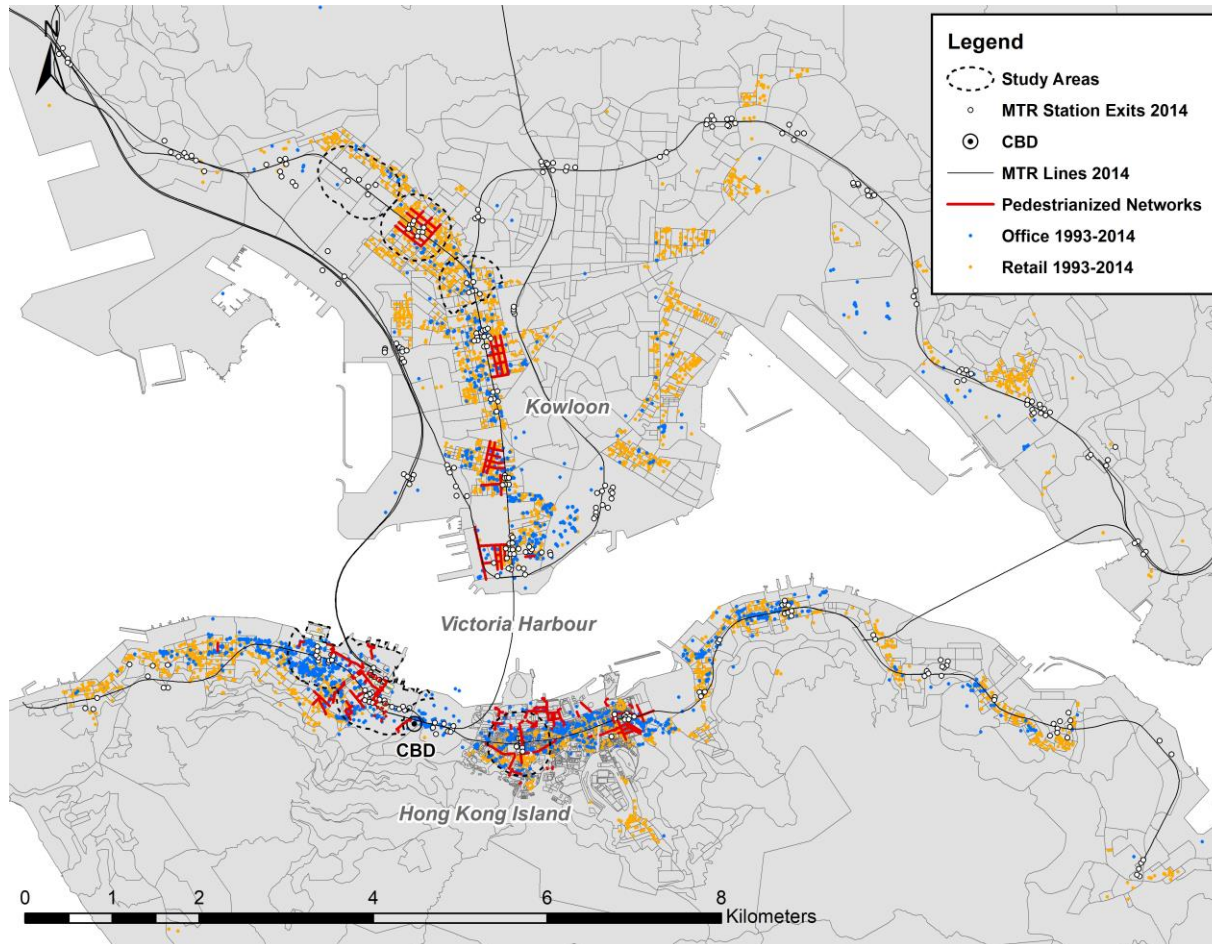
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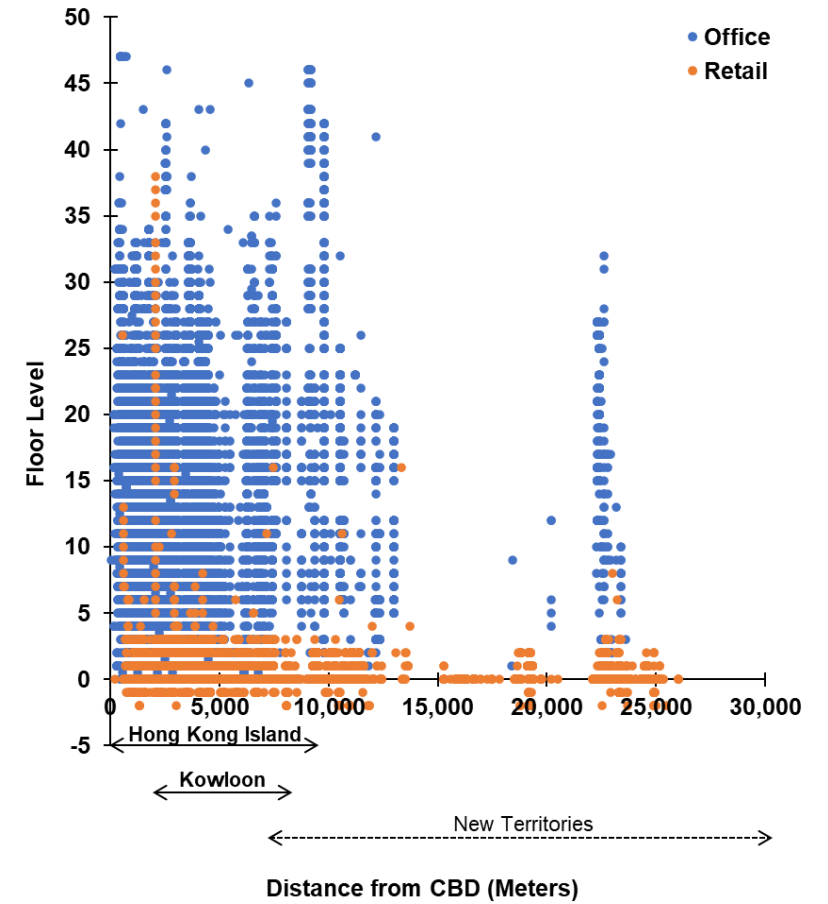
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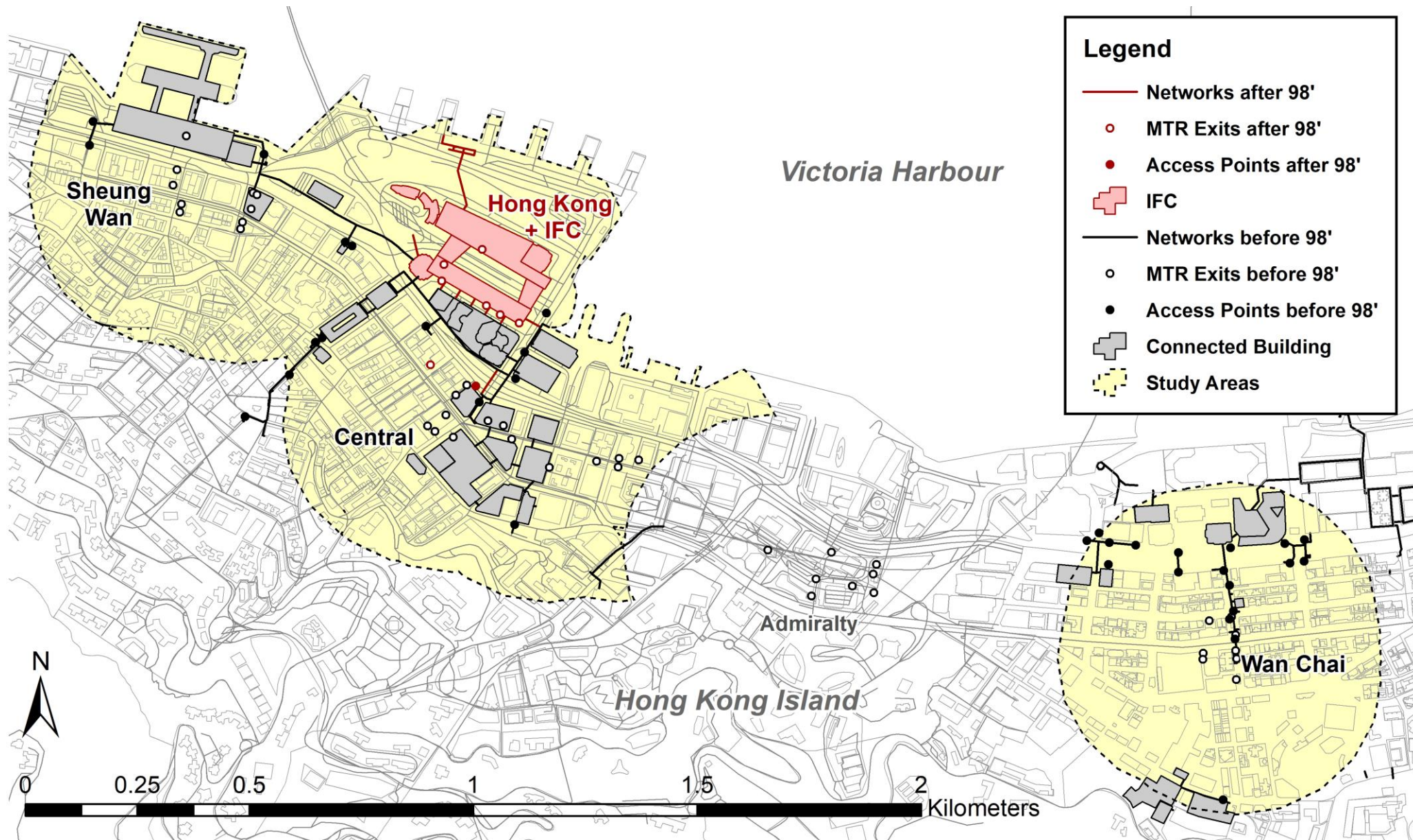
(a) Location



(b) Floor Level

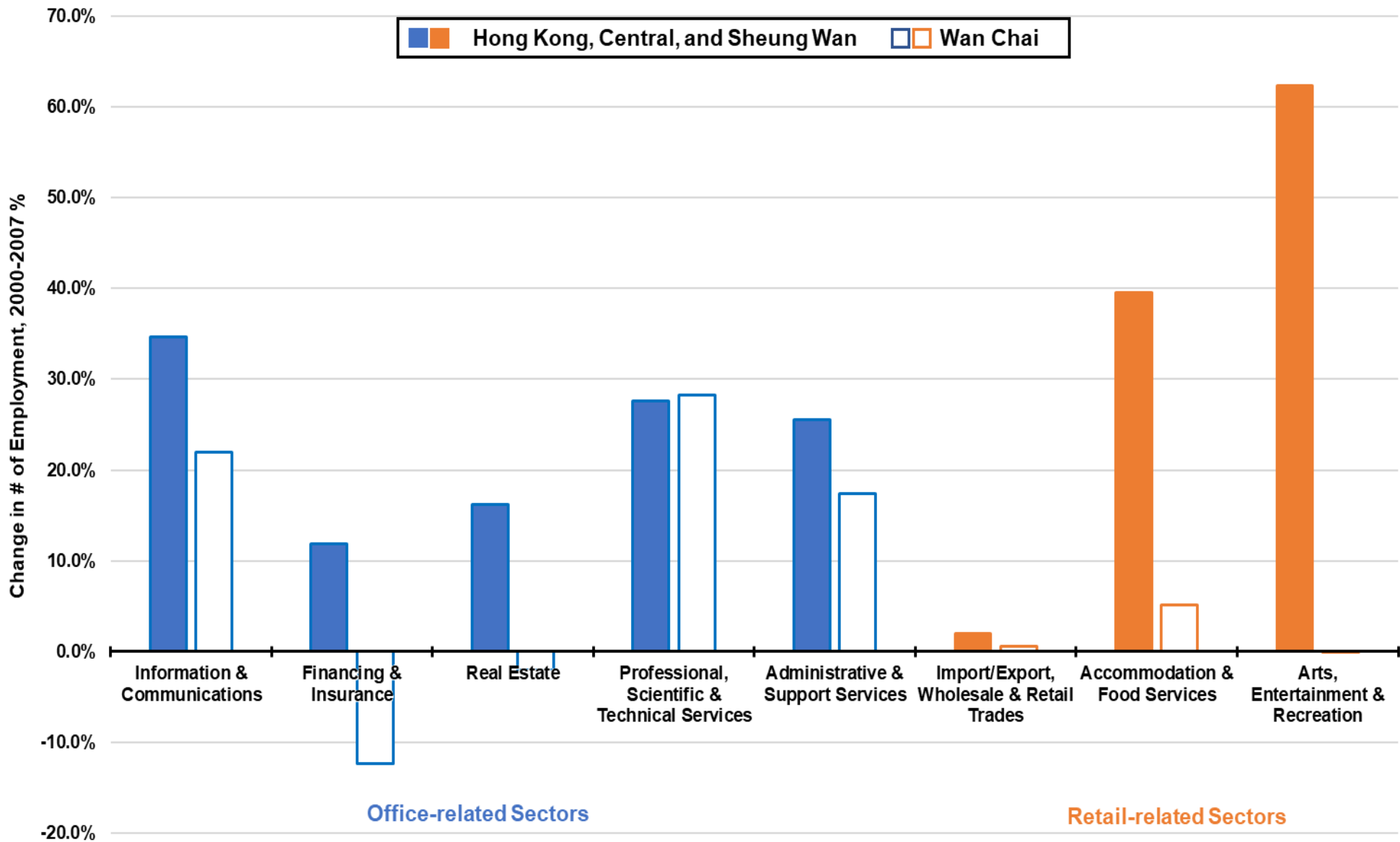
Source: Authors, with data from HKSAR Transport Department (2012), HKSAR Transport Department Pedestrian Schemes (2019), EPRC limited, and Hong Kong 2001 Population Census Map

Figure 1. Distribution of pedestrian networks and commercial property transactions, 1993-2014



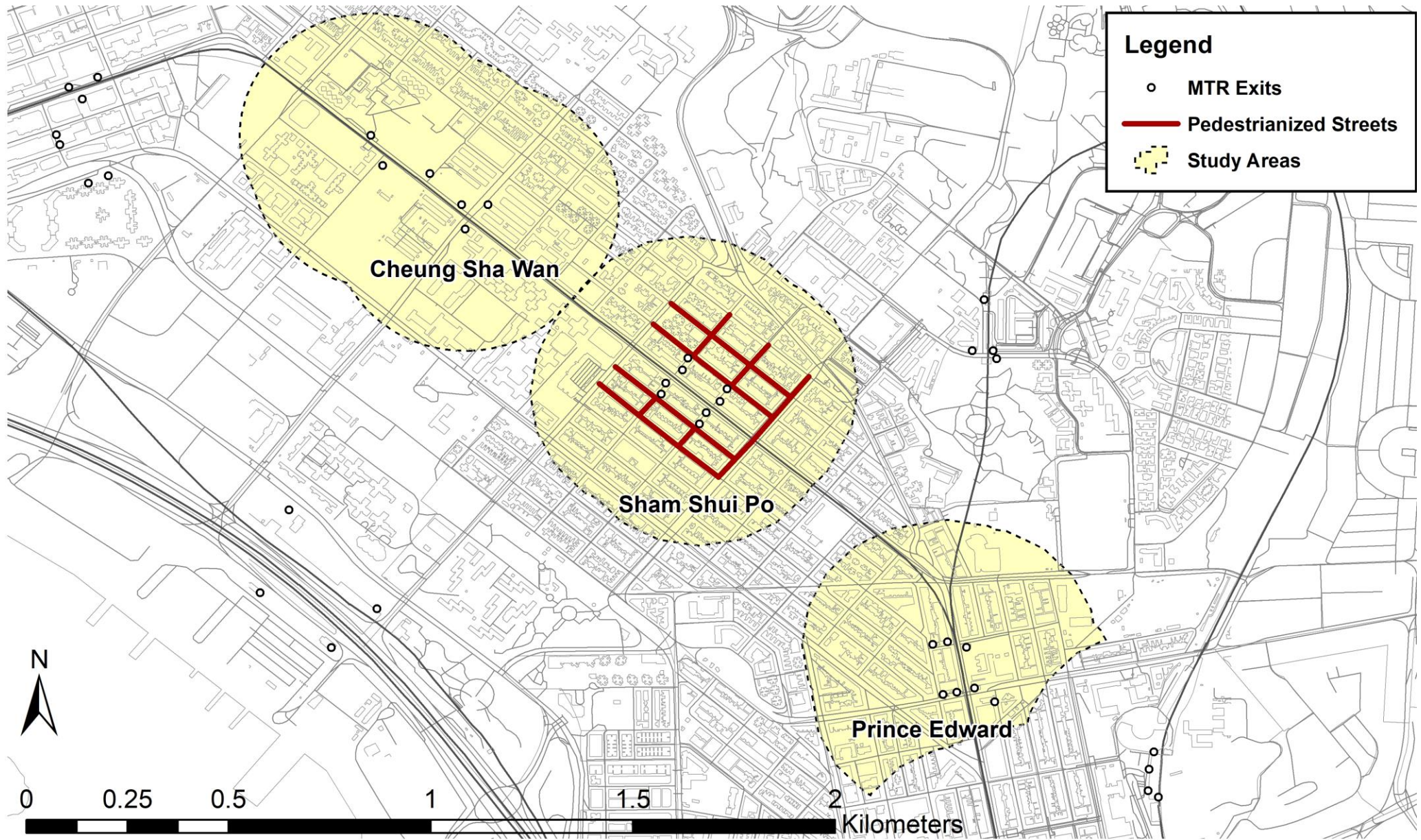
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Figure 2. Expansion of skywalk networks on Hong Kong Island, 1998-2003



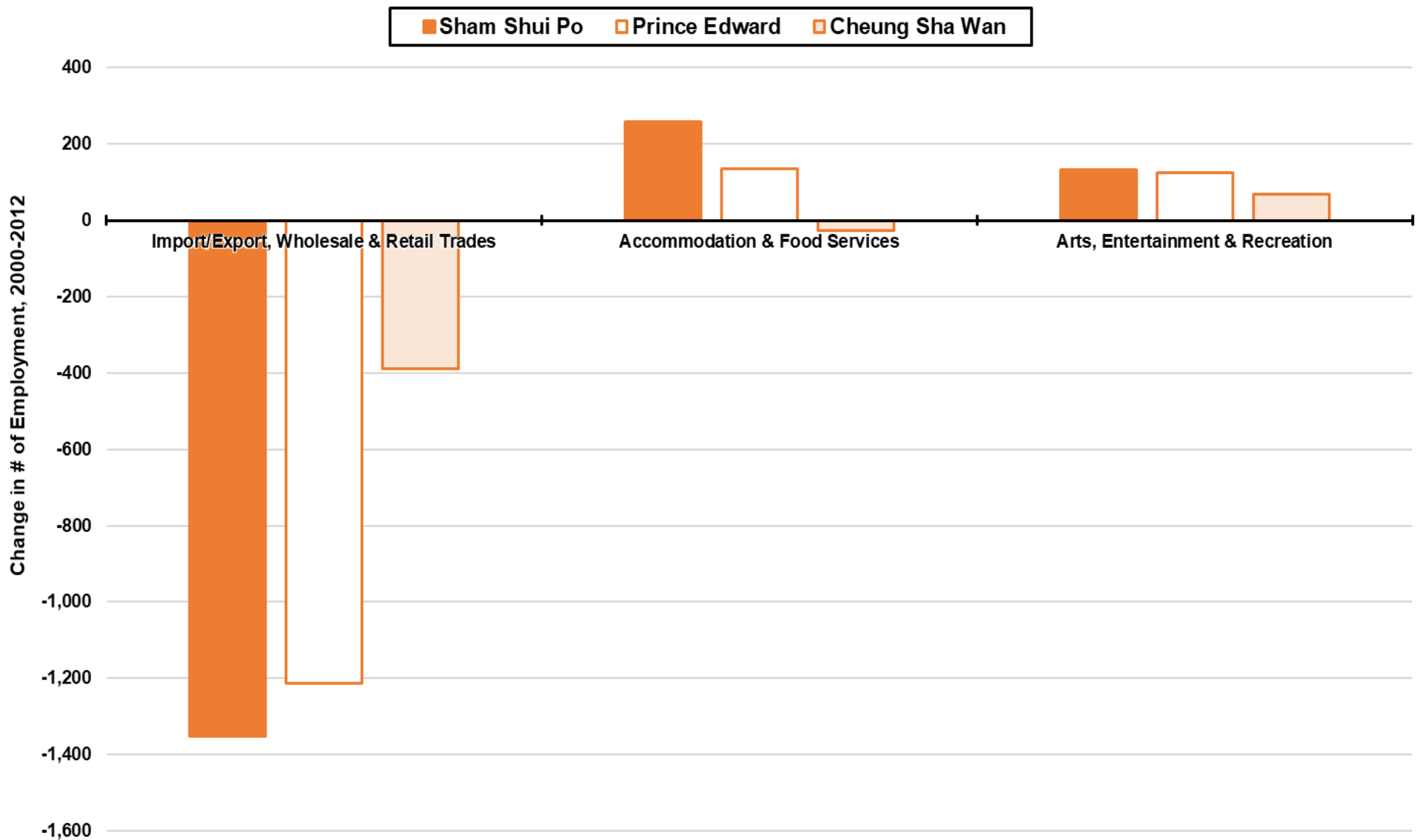
Source: Authors, with data from HKSAR Census and Statistics Department's Table E009: Number of establishments and persons engaged (other than those in the Civil Service) analyzed by industry section and Tertiary Planning Unit (TPU)

Figure 3. Change in the number of employment by industrial sector in the two study areas, 2000-2007



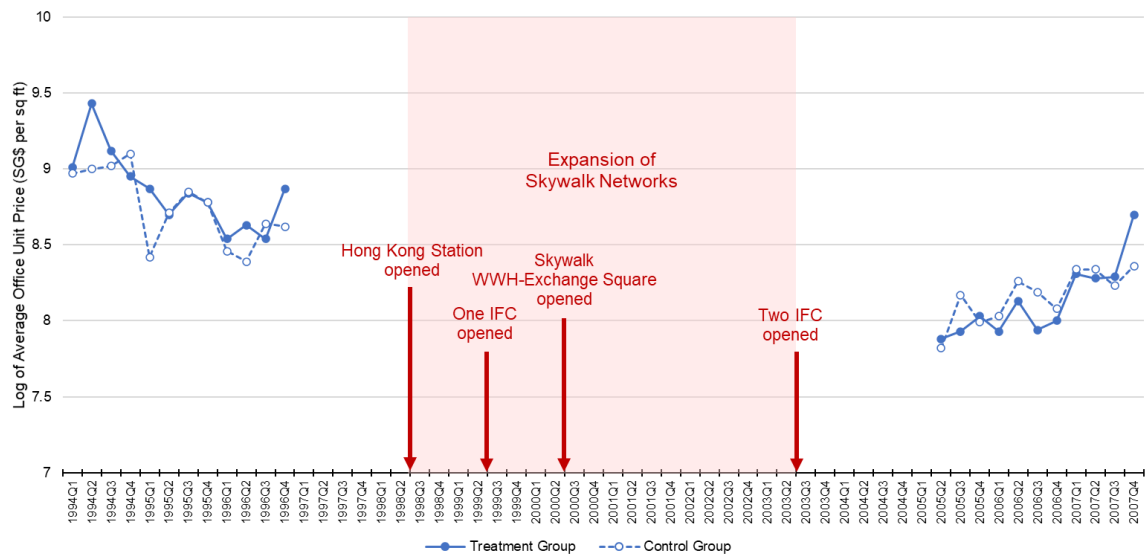
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Figure 4. Implementation of pedestrian zone schemes in Kowloon, 2001-2008

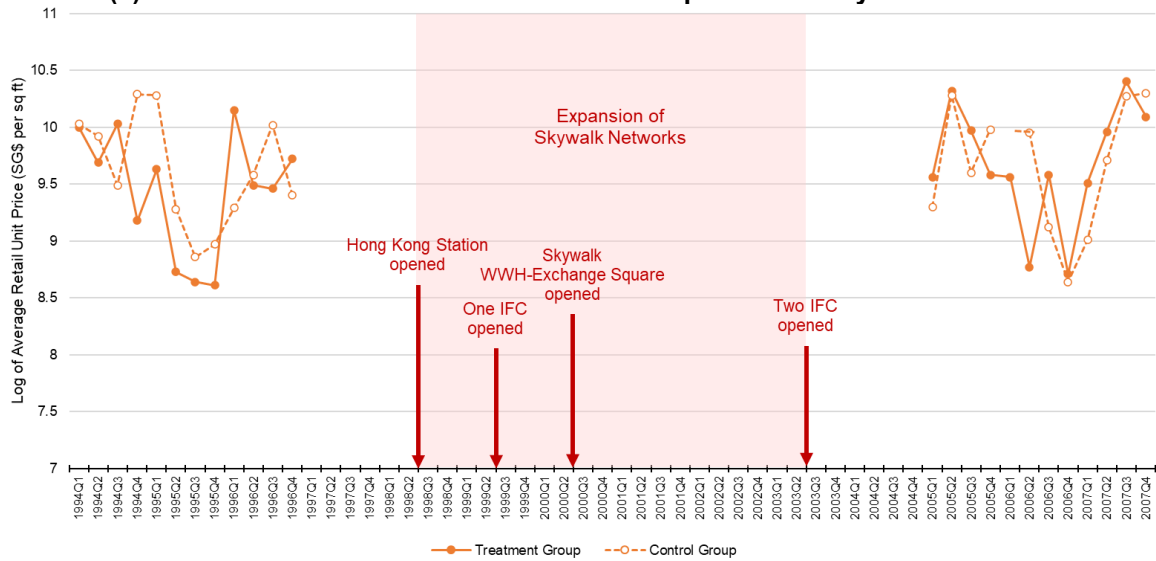


Source: Authors, with data from HKSAR Census and Statistics Department's Table E009: Number of establishments and persons engaged (other than those in the Civil Service) analyzed by industry section and Tertiary Planning Unit (TPU)

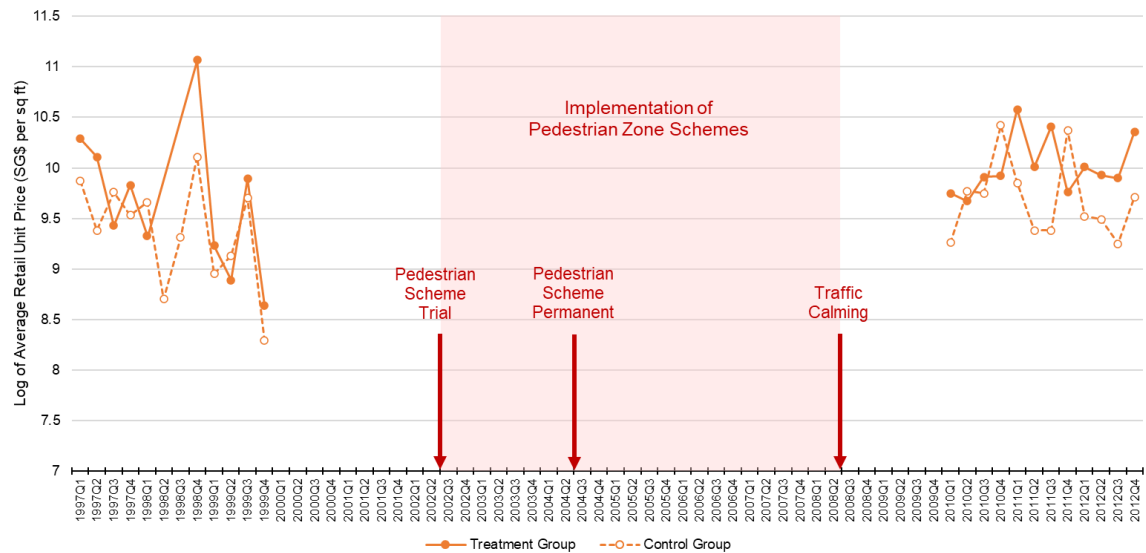
Figure 5. Change in the number of employment by industrial sector in the three study areas, 2000-2012



(a) Office transactions before and after the expansion of skywalk networks



(b) Retail transactions before and after the expansion of skywalk networks



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Source: Authors, with data from EPRC limited

Figure 6. Comparisons of temporal changes in logged average unit prices between the treatment and control groups

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Table 1. Descriptive statistics of candidate variables

Variable Name	Description	Hong Kong Island				Kowloon		Sources
		Office Means	Office SD	Retail Means	Retail SD	Retail Means	Retail SD	
<i>Dependent Variables</i>								
Office Price	Office unit price per gross floor area adjusted by the monthly CPI for December 2014 (HK\$ per sq ft)	6,169.6	4,216.1					EPRC limited
Retail Price	Retail unit price per net floor area adjusted by the monthly CPI for December 2014 (HK\$ per sq ft)			24,214.69	20,958.98	25,688.83	24,541.51	EPRC limited
<i>Structural (OS)Attributes</i>								
GFA	Gross floor area of office unit (sq ft)	1,385.5	1,398.2					EPRC limited
NFA	Net floor area of retail unit (sq ft)			584.0	811.4	623.5	758.7	EPRC limited
NG Ratio	Ratio of net floor area to gross floor area (%)	70.8	9.8					EPRC limited
Age	Age of property in transaction year (sales year of newly completed property =first year)	13.4	8.9	22.3	10.9	26.1	12.0	EPRC limited
Floor	Floor level of office unit (floor level)	13.3	6.8					EPRC limited
StreetLV	1 if retail unit locates at street level (ground floor), otherwise 0			0.70	0.46	0.73	0.45	EPRC limited
<i>Built Environment (BE) Attributes</i>								
SkyConnected	1 if office property is directly connected with skywalk networks, otherwise 0	0.13	0.33					HKSAR Transport Department (2012)
SkyNearby	1 if office property is not directly connected but next to skywalk access points, otherwise 0	0.04	0.20					HKSAR Transport Department (2012)
SkyPodium	1 if office unit locates at podium-level directly connected with skywalk networks, otherwise 0	0.07	0.26					HKSAR Transport Department (2012) & EPRC limited
DisMTR	Straight distance to nearest MTR station exit (m)	163.4	83.7	172.1	75.6	147.2	81.3	MTR/GIS shapefile
<i>Treatment – Net Capitalization (NC) Effects</i>								
Treatment	1 if transaction was made within the treatment area after the expansion of skywalk networks on Hong Kong Island or after the implantation of pedestrian zone schemes in Kowloon (for post three years), otherwise 0	0.35	0.48	0.29	0.46	0.25	0.44	OSI/GIS shapefile
<i>District Fixed-Effects</i>								
TPU113	1 if property locates in TPU113, otherwise 0	0.17	0.38	0.10	0.29			HKSAR Census
TPU114	1 if property locates in TPU114, otherwise 0	0.31	0.46	0.20	0.40			HKSAR Census
TPU121	1 if property locates in TPU121, otherwise 0	0.18	0.38	0.14	0.34			HKSAR Census
TPU122	1 if property locates in TPU122, otherwise 0	0.04	0.19	0.07	0.26			HKSAR Census
TPU123	1 if property locates in TPU123, otherwise 0	0.01	0.09	0.01	0.11			HKSAR Census
TPU131	1 if property locates in TPU131, otherwise 0	0.18	0.38	0.39	0.49			HKSAR

TPU132	1 if property locates in TPU132, otherwise 0	0.09	0.28	0.08	0.28			Census HKSAR
TPU133	1 if property locates in TPU133, otherwise 0	0.03	0.18	0.01	0.08			Census HKSAR
TPU221	1 if property locates in TPU221, otherwise 0					0.14	0.35	Census HKSAR
TPU222	1 if property locates in TPU222, otherwise 0					0.15	0.35	Census HKSAR
TPU264	1 if property locates in TPU264, otherwise 0					0.19	0.39	Census HKSAR
TPU265	1 if property locates in TPU265, otherwise 0					0.05	0.22	Census HKSAR
TPU266	1 if property locates in TPU266, otherwise 0					0.34	0.47	Census HKSAR
TPU267	1 if property locates in TPU267, otherwise 0					0.13	0.34	Census HKSAR
<i>Year Fixed-Effects</i>								
Y1994	1 if transaction was made in 1994, otherwise 0	0.25	0.43	0.25	0.43			EPRC limited
Y1995	1 if transaction was made in 1995, otherwise 0	0.08	0.27	0.09	0.29			EPRC limited
Y1996	1 if transaction was made in 1996, otherwise 0	0.18	0.39	0.14	0.34			EPRC limited
Y2005	1 if transaction was made in 2005, otherwise 0	0.10	0.31	0.25	0.44			EPRC limited
Y2006	1 if transaction was made in 2006, otherwise 0	0.15	0.36	0.09	0.29			EPRC limited
Y2007	1 if transaction was made in 2007, otherwise 0	0.24	0.43	0.18	0.39			EPRC limited
Y1997	1 if transaction was made in 1997, otherwise 0					0.14	0.35	EPRC limited
Y1998	1 if transaction was made in 1998, otherwise 0					0.15	0.35	EPRC limited
Y1999	1 if transaction was made in 1999, otherwise 0					0.19	0.39	EPRC limited
Y2010	1 if transaction was made in 2010, otherwise 0					0.05	0.22	EPRC limited
Y2011	1 if transaction was made in 2011, otherwise 0					0.34	0.47	EPRC limited
Y2012	1 if transaction was made in 2012, otherwise 0					0.13	0.34	EPRC limited
<i>Quarter Fixed-Effects</i>								
Q1	1 if transaction was made in first quarter, otherwise 0	0.24	0.43	0.31	0.46	0.23	0.42	EPRC limited
Q2	1 if transaction was made in second quarter, otherwise 0	0.25	0.43	0.30	0.46	0.27	0.45	EPRC limited
Q3	1 if transaction was made in third quarter, otherwise 0	0.24	0.43	0.17	0.38	0.23	0.42	EPRC limited
Q4	1 if transaction was made in fourth quarter, otherwise 0	0.27	0.44	0.21	0.41	0.26	0.44	EPRC limited

Note: SD = standard deviation; CPI = consumer price index; MTR = mass transit railway; TPU = tertiary planning unit; HKSAR Census = Hong Kong 2001 Population Census Map

Table 2. Results of DID hedonic regression models for office properties on Hong Kong Island (dependent variable = ln office unit price per sq ft)

	(1) BL1	(2) H1-1	(3) H1-2	(4) H1-3	(5) H1-4	(6) H1-5
Constant	6.593*** (0.293)	6.592*** (0.293)	6.585*** (0.293)	6.594*** (0.293)	6.583*** (0.293)	6.599*** (0.292)
<i>Structural (ST) Attributes</i>						
ln GFA (log)	0.154*** (0.015)	0.155*** (0.015)	0.153*** (0.015)	0.154*** (0.015)	0.153*** (0.015)	0.152*** (0.015)
ln NG Ratio (log)	0.319*** (0.067)	0.320*** (0.068)	0.321*** (0.068)	0.319*** (0.068)	0.322*** (0.068)	0.322*** (0.067)
ln Age (log)	-0.060*** (0.015)	-0.061*** (0.015)	-0.062*** (0.015)	-0.060*** (0.015)	-0.062*** (0.015)	-0.060*** (0.015)
ln Floor (log)	0.086*** (0.015)	0.086*** (0.015)	0.085*** (0.015)	0.086*** (0.015)	0.085*** (0.015)	0.084*** (0.015)
<i>Built Environment (BE) Attributes</i>						
SkyConnected (1/0)	0.399*** (0.049)	0.396*** (0.049)	0.413*** (0.054)	0.399*** (0.049)	0.416*** (0.054)	0.407*** (0.049)
SkyNearby (1/0)	0.136*** (0.049)	0.133*** (0.049)	0.138*** (0.049)	0.138*** (0.051)	0.140*** (0.049)	0.119** (0.049)
ln DisMTR (log)	-0.056*** (0.015)	-0.056*** (0.015)	-0.056*** (0.015)	-0.056*** (0.015)	-0.055*** (0.015)	-0.057*** (0.015)
ln DisMTR (log) × SkyPodium (1/0)	-0.153*** (0.024)	-0.151*** (0.024)	-0.151*** (0.024)	-0.153*** (0.024)	-0.150*** (0.024)	-0.091** (0.037)
<i>Treatment – Net Capitalization (NC) Effects</i>						
Treatment (1/0)		-0.038 (0.041)				
Treatment (1/0) × SkyConnected (1/0)			-0.034 (0.056)			
Treatment (1/0) × SkyNearby (1/0)				-0.026 (0.151)		
Treatment (1/0) × ln DisMTR (log) × SkyConnected (1/0)					-0.009 (0.011)	
Treatment (1/0) × ln DisMTR (log) × SkyPodium (1/0)						-0.101** (0.048)
District Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes
Multicollinearity Tolerance (VIFs < 4.0)	Yes	No	Yes	Yes	Yes	Yes
Observations	923	923	923	923	923	923
Adjusted R-squared	0.784	0.784	0.784	0.784	0.784	0.785

Note: *** p < 0.01; ** p < 0.05; * p < 0.10; Standard errors are in parentheses; VIFs = variance inflation factors.

Table 3. Results of DID hedonic regression models for retail properties on Hong Kong Island and in Kowloon (dependent variable = ln retail unit price per sq ft)

	Hong Kong Island					Kowloon				
	(7) BL2	(8) H2-1	(9) H2-2	(10) H2-3	(11) H2-4	(12) BL3	(13) H3-1	(14) H3-2	(15) H3-3	(16) H3-4
Constant	11.438*** (0.416)	11.453*** (0.418)	11.438*** (0.417)	11.435*** (0.416)	11.442*** (0.416)	12.455*** (0.397)	12.535*** (0.409)	12.482*** (0.410)	12.530*** (0.413)	12.482*** (0.414)
<i>Structural (ST) Attributes</i>										
ln NFA (log)	-0.216*** (0.047)	-0.218*** (0.047)	-0.216*** (0.047)	-0.215*** (0.047)	-0.216*** (0.047)	-0.299*** (0.035)	-0.302*** (0.036)	-0.300*** (0.036)	-0.300*** (0.035)	-0.300*** (0.035)
ln Age (log)	-0.184*** (0.051)	-0.182*** (0.051)	-0.185*** (0.051)	-0.186*** (0.051)	-0.186*** (0.051)	0.013 (0.050)	0.013 (0.050)	0.012 (0.050)	0.012 (0.050)	0.012 (0.050)
StreetLV (1/0)	1.472*** (0.082)	1.477*** (0.083)	1.467*** (0.089)	1.467*** (0.083)	1.458*** (0.088)	1.094*** (0.071)	1.095*** (0.071)	1.087*** (0.076)	1.094*** (0.071)	1.088*** (0.076)
<i>Built Environment (BE) Attributes</i>										
ln DisMTR (log)	-0.202*** (0.054)	-0.202*** (0.054)	-0.202*** (0.054)	-0.204*** (0.054)	-0.203*** (0.054)	-0.419*** (0.057)	-0.427*** (0.058)	-0.421*** (0.057)	-0.428*** (0.059)	-0.422*** (0.058)
<i>Treatment – Net Capitalization (NC) Effects</i>										
Treatment (1/0)		-0.066 (0.137)					0.091 (0.115)			
Treatment (1/0) × StreetLV (1/0)			0.018 (0.132)					0.029 (0.110)		
Treatment (1/0) × ln DisMTR (log)				0.010 (0.026)					0.015 (0.023)	
Treatment (1/0) × StreetLV (1/0) × ln DisMTR (log)					0.011 (0.025)					0.005 (0.022)
District Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Multicollinearity Tolerance (VIFs < 4.0)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	310	310	310	310	310	398	398	398	398	398
Adjusted R-squared	0.652	0.651	0.651	0.651	0.651	0.617	0.617	0.616	0.616	0.616

Note: *** p < 0.01; ** p < 0.05; * p < 0.10; Standard errors are in parentheses; VIFs = variance inflation factors.