Space allocation and tenant placement at high-rise shopping malls

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Chung-Yim Yiu
is currently an assistant professor in the Department of Real Estate and Construction, the University of Hong Kong. He is a qualified building surveyor, a professional facility manager and a corporate member of the Hong Kong Institute of Surveyors, the Royal Institute of Chartered Surveyors and the American Real Estate Society. His research interests and expertise are in facility performance assessment, building maintenance, and property and construction economics and finance.

Sherry Y.S. Xu
is a student of Chung-Yim Yiu in the Department of Real Estate and Construction, the University of Hong Kong.

Hing Cheong Ng
is a research assistant to Chung-Yim Yiu in the Department of Real Estate and Construction, the University of Hong Kong.

Abstract
This paper explores the relationship among shop size (space allocation), tenant type (tenant placement) and locations of shop in a shopping mall. In contrast with previous studies, this paper tests the hypotheses empirically by means of regression models, in the context of high-rise shopping malls. The results show that bigger shops and tenants of non-impulse trades are more likely to be found at upper floors. The findings have strong practical implications for shopping mall design, and for space allocation and tenant placement strategies at shopping malls to maximise their profits.

Keywords:
shopping malls, high-rise, space allocation, tenant placement

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INTRODUCTION

Shopping malls, famous for their huge size and variety of tenants, have blossomed in many parts of the world. They have tended to be larger and larger in recent years, as shown in Table 1. There are two ways to expand their sizes: horizontally and vertically. In general, most of them expand their sizes horizontally by increasing their footprint, and the number of storeys of a shopping mall is often below six. For example, the Golden Resources Shopping Mall in Beijing, China, which opened in 2004, provides more than 1,000 shops and 560,000 m^2 gross lettable area (GLA)

Chung-Yim Yiu
Department of Real Estate and Construction
The University of Hong Kong
Pokfulam, Hong Kong
Tel: +852 2857 8629
Fax +852 2559 9457
E-mail: ecyyiu@hkucc.hku.hk

Table 1: World's ten largest shopping malls (in the order of Gross floor area (GFA))

Shopping mall	Year opened	GFA (m2)	GLA (m2)	No. of shops
South China Mall, Dongguan, China	2005	892,000	660,000	1,500
Berjaya Times Square, Kuala Lumpur, Malaysia	2005	700,000	320,000	1,000
Golden Resources Shopping Mall, Beijing, China	2004	680,000	560,000	>1,000
Dubai Mall, Dubai, United Arab Emirates	2008*	590,000	377,000	1,200
West Edmonton Mall, Alberta, Canada	1981	570,000	350,000	800
Beijing Mall, Beijing, China	2005	440,000	320,000	600
Cevahir Istanbul, Istanbul, Turkey	2005	420,000	348,000	280
Zhengjia Plaza, Guangzhou, China	2005	420,000	270,270	>1,000
SM Mall of Asia, Pasay City, Philippines	2006	386,000	386,000	1,000
SM City North Edsa, Quezon City, Philippines	1985	331,800	270,270	900
SM Megamall, Mandaluyong City, Philippines	1991	331,600	324,300	800

Source: The rankings are based on statistics from Eastern Connecticut State University
*To be opened on 30 October 2008

over six floors. It is understandable why shopping malls are mostly flat and low-rise, as shoppers are generally reluctant to climb to upper floors, even though lifts and escalators are provided.

Interestingly, in some parts of the world, there is another recent trend of expanding mall size vertically. These high-rise shopping malls, which are of relatively smaller sized footprint, are much taller in height. They are more commonly found in cities of very high land price, but the question of how they prosper has seldom been studied. How to encourage shoppers to go upstairs becomes one of the most important challenges to the owners of these high-rise malls. There are at least two approaches: first, reducing the space in the upper storey and second, allocating space strategically in the shopping mall to lead shoppers' flow.

So far, there is no official definition of a high-rise shopping mall. In fact, there have been very few studies on this issue, even though the trend has been rapidly spreading in some cities. In this study, a high-rise shopping mall is defined as a shopping mall with more than seven storeys of retail area (excluding car parks and including basement levels). Table 2 shows some of the tallest shopping malls, which are mostly located in Asian countries such as Taiwan, Japan and Hong Kong.

How do they survive? What are the strategies in space allocation at these high-rise malls? These are the research questions of this paper. The aim of this study is to test empirically how landlords allocate space in high-rise shopping malls, by considering data samples from Hong Kong. It provides an economic explanation for the space allocation patterns of shops with different sizes and functions at different height levels. We put forward the following two hypotheses for empirical testing in this paper:

1. The higher floor level a shop is located at a mall, the larger floor area of the shop, *ceteris paribus*.
2. Shops selling impulse merchandise are located on lower storeys, *ceteris paribus*.

LITERATURE REVIEW

Since the 1990s, research on space allocation among shopping malls boomed as a branch of research on shopping centre leasing. Space

Table 2: High-rise shopping malls around the world (in the order of no. of storey)

Name of the shopping mall	No. of storey* (B=basement level; /F=floor level)
Mega Box, Hong Kong	19 (G/F to 18/F)
Langham Place, Hong Kong	15 (B2 to 13/F)
Living Mall, Taiwan	15 (B3 to 12/F)
Times Square, Hong Kong	15 (B2 to 13/F)
Dream Mall, Taiwan	12 (B2 to 10/F)
Berjaya Time Square, Kuala Lumpur, Malaysia	11 (LG/F to 9/F)
APM, Hong Kong	11 (B4 to 6/F and 11/F)
Marunouchi Building, Japan	11 (B1 to 8/F and 35/F, 36/F)
New Town Plaza, Hong Kong	10 (B2 to 8/F)
Osaka Garden City, Japan	9 (B2 to 7/F)
Zhengjia Plaza, Mainland China	9 (B1 to 7/F)
TaiMall, Taiwan	9 (B2 to 7/F)
Shin-Marunouchi Building, Japan	8 (B1 to 7/F)
Grand Century Plaza, Hong Kong	7 (1/F to 7/F)

Source: Public website of each shopping mall
*All information is based on the statistics in the end of 2007

allocation within a shopping mall refers to the way by which retail spaces are distributed to different categories of shops with the aim of sales/profit maximisation of the shopping centre. Sim (1984) posited that the optimal size of a retail shop depends on the balance between operating costs and floor space requirements. Thus, businesses such as electrical appliance shops, furniture outlets and restaurants require large floor areas to accommodate their business activities, while those selling beauty products, jewellery and watches are smaller in size but grow in number to meet the consumer demand. This model does not, however, take rent and shoppers' flow into account, which are the crux of the space allocation of a shopping mall.

Consideration of shoppers' flow in the space allocation of a shopping mall had not been well established until the works of Brueckner (1993). He demonstrated that there are both anchor and nonanchor demand externalities. Hence, mall owners can maximise their profit by allocating space to various types of tenants. Following Brueckner's line of thought, Eppli and Shilling (1993) suggested that a landlord must allocate space to a mix of shop categories to maximise total rental income. Miceli *et al*. (1998) further explained the phenomenon by showing that increased customer traffic can increase the mall's overall profit.

Yet, there have been very few studies on tenant placement issue as far as space allocation of a mall is concerned. The space — position relationship of retail stores has seldom been addressed in previous literature, let alone that of high-rise malls, despite the well-known relationship among shoppers' flow, tenant mix and tenant placement in practice. In light of this, this paper aims to study empirically the relationship between stores' size and their positions at height.

Tenant mix and tenant placement have long been regarded as one of the most important determinants of the success of a shopping mall. For example, Sim and Cheok (1989) contended that an appropriate tenant mix

determines the success or failure of a shopping mall and tenant placement is always vital in influencing the shoppers' circulation. Many studies, including Dawson (1983), Abratt *et al*. (1985), Casazza and Spink (1985), Sim and Cheok (1989) and Alexander and Muhlebach (1990), have emphasised the importance of a tenant placement strategy in achieving a better shoppers' flow, stimulating impulse shopping, etc.

Some general principles of tenant placement strategy have been put forward, such as Casazza and Spink's (1985) and Alexander and Muhlebach's (1992) 'Mix or Match' principle. Unlike the theory of space allocation in the 1980s, their models took all the three stakeholders, namely owners, tenants and shoppers, into consideration. Brown (1992), on the other hand, placed more emphasis on the spatial relationship between anchor and nonanchor tenants, and low-impulse and high-impulse trades,[1] in tenant placement strategies. For example, Brown (1992) posited that high-impulse trade should be placed nearer to areas with higher pedestrian flow. This is similar to Sim and Cheok's (1989) contention that high-impulse trades, such as boutiques, gift shops and toy shops, require high pedestrian flow and better locations to sustain their businesses.

Along this line of thought, it is plausible to hypothesise that shops of high-impulse trades and nonanchors would be allocated on lower storeys, whereas shops of low-impulse trades and anchors are on upper storeys. Thus, shops on lower storeys would be smaller in size, whereas shops on upper storeys are bigger.

DATA AND METHODOLOGY

Three high-rise shopping malls in Hong Kong are chosen for the empirical study: Langham Place (LP), Times Square (TS) and Grand Century Place (GCP). They are chosen because they are of similar scale, are located at three different prime locations of the urban developed area of Hong Kong and are old enough for appropriate tenants to settle down. General information of the three malls is summarised in Table 3, which shows that the three malls are of similar scale with about 200 shops and about 30,000 m^2 GLA. LP and TS have a 15-storey design, whereas GCP has a seven-storey design.

The lettable floor area (LFA) of each shop within these three malls is measured directly from the approved general building plans, with reference to the relevant shopper guides. The current retail trade of each shop and which floor level (FL) it is located on is identified by actual site visits. Summary statistics of the data are shown in Table 4. In these 653 shops, FL ranges from −2 (basement level 2) to 13

Table 3: Summary information of the sample malls

	LP	TS	GCP
No. of shops	221	228	204
Total GLA (m^2)	21,836	43,791	37,685
No. of storeys	15 (−2 to 13)	15 (−2 to 13)	7 (1 to 7)

Table 4: Summary statistics of the sample shops

Continuous variables	Mean	Standard deviation	Maximum	Minimum
FL	4.41	3.85	13	−2
LFA	158.21	373.80	6,210	3
LFA (at LP)	98.81	170.31	1,129	3
LFA (at TS)	192.07	391.02	3,927	7
LFA (at GCP)	184.73	490.45	6,210	6

No. of observations (*N*)=653

(13th Floor), and LFA ranges from 3 m^2 to 6,210 m^2. Figure 1 shows the distribution of the LFA of shops in these three malls.

In our sample, we found that there are two approaches to the allocation of space on upper storeys. In the first approach, the floor area of the whole storey decreases at upper storeys. In the second, the floor area of each shop increases on upper storeys. For example, Figure 2 shows a scatter plot and the best fit of the total LFAs of each storey versus FL in one of the sample shopping malls: LP. It shows a clear downward trend from FL_1 to FL_13. It reveals the first approach of reducing space in upper storeys of shopping mall in this sample case.

Besides, shop size allocation and tenant placement on different storeys can be studied by a simple regression model and a probit regression model, respectively. Equation (1) shows the regression model studying the effects of (FL), the malls (M) and the various trades of business (TB dummies) on the LFA of shop *i*:

$$LFA_i = \alpha + \beta_1 FL_i + \sum_{j=1}^{m-1} \gamma_j M_{ji} + \sum_{k=1}^{t-1} \lambda_k TB_{ki} + \varepsilon_i \qquad (1)$$

where $m=3$ is the total number of malls considered and $t=16$ is the total number of the trades categorised. α, β, γ, and λ are coefficients to be estimated and ε is the error term. One of the dummies in each group is omitted to avoid exact multicollinearity. Table 5 shows the descriptions of all the variables.

We consider the following trades as non-impulse trades: TB_2 (entertainment), TB_3 (food and beverage), TB_4 (supermarkets), TB_{12} (home furnishing products), TB_{13} (community services), TB_{14} (personal services) and TB_{15} (financial services). This is because consumers of all these trades are less likely to purchase on impulse. By means of this classification method, there are 135 shops of non-impulse trade in the three malls. Equation (2) shows the simple probit regression model studying the effects of FL on non-impulse trades (TB_NIT_i) of shop *i*:

$$\Lambda(TB\_NIT_i) = (\alpha' + \beta'_1 FL_i + \varepsilon'_i) \qquad (2)$$

where $TB\_NIT_i = TB_2 + TB_3 + TB_4 + TB_{12} + TB_{13} + TB_{14} + TB_{15}$, which equals 1 if shop *i* is non-impulse trade and 0 otherwise. Λ represents the probit function. In these two estimations, shops below ground floor (basement levels) are not taken into consideration.

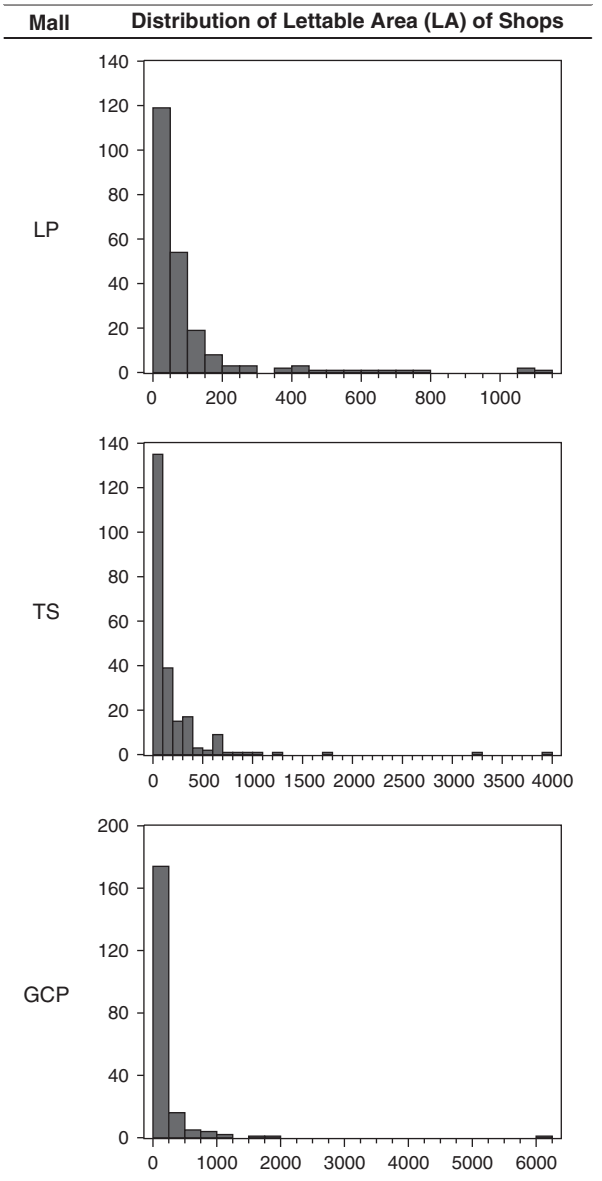

Figure 1: Histograms of LFA of the three malls

RESULTS

Table 6 shows the regression results of equation (1) that FL has a positive ($\beta = 9.70$) and significant impact on the LFA of individual shop, at the ten per cent significance level. This implies that one storey higher would result in about 9 m^2 more in LFA allocation of individual shops in high-rise shopping malls, other things being equal. TS (M_1) and GCP (M_3) generally have bigger shops than LP (M_2). Department stores (TB_1), shops for entertainment (TB_2), food and beverage shops (TB_3) and supermarkets (TB_4) are found to be significantly bigger than other kinds of shops. Yet the effects of other trades are not statistically significant.

Table 7 (Panel A) shows the probit regression results of equation (2) that FL has a positive and significant impact on the shop allocation for

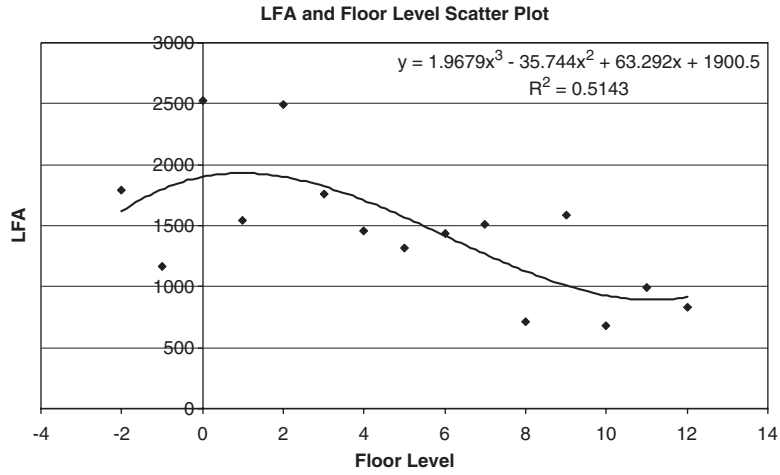

Figure 2: Scatter plot and the best fit of the total LFA of a storey plot against FL at LP

Table 5: Descriptions of the variables of equation (1)

Variables	Descriptions
Dependent variable	
LFA_i	Lettable floor area of the shop *i* in the shopping mall
Independent variables	
FL_i	Floor level of the shop *i* in the shopping mall (ground level=1, shops below ground level are not considered in this test)
Malls (M)	
M_{1i}	=1 if the shop *i* is located at Times Square (TS), 0 otherwise
M_{2i}	=1 if the shop *i* is located at Langham Place (LP), 0 otherwise
M_{3i}	=1 if the shop *i* is located at Grand Century Place (GCP), 0 otherwise
Trade of business (TB)	
TB_{1i}	=1 if shop *i* is a department store (DS), 0 otherwise
TB_{2i}	=1 if shop *i* is providing entertainment (E), 0 otherwise
TB_{3i}	=1 if shop *i* is serving food and beverage (FB), 0 otherwise
TB_{4i}	=1 if shop *i* is a supermarket (S), 0 otherwise
TB_{5i}	=1 if shop *i* is selling fashion (F), 0 otherwise
TB_{6i}	=1 if shop *i* is selling sports wear (SW), 0 otherwise
TB_{7i}	=1 if shop *i* is selling accessories/leather/shoes/bags (LS), 0 otherwise
TB_{8i}	=1 if shop *i* is selling personal care/health/beauty products (PC), 0 otherwise
TB_{9i}	=1 if shop *i* is selling audio and video/electronics (AV), 0 otherwise
TB_{10i}	=1 if shop *i* is selling gifts/toys (GT), 0 otherwise
TB_{11i}	=1 if shop *i* is selling jewellery/watches (JW), 0 otherwise
TB_{12i}	=1 if shop *i* is selling home furnishing products (HF), 0 otherwise
TB_{13i}	=1 if shop *i* is providing community services (CS), 0 otherwise
TB_{14i}	=1 if shop *i* is providing personal services (PS), 0 otherwise
TB_{15i}	=1 if shop *i* is providing financial services (FS), 0 otherwise
TB_{16i}	=1 if shop *i* is vacant (VA), 0 otherwise

non-impulse trades, at the one per cent significance level. That is, more non-impulse trades are found on the upper floors of shopping malls. The result confirms our hypothesis that more non-impulse trades are allocated to upper storeys. Estimating the probability of having a shop of non-impulse trade on a certain floor level of a mall, Panel B of Table 7 reveals that two of the malls (TS and GCP) obtained highly significant and

Table 6: Estimation results of equation (1)

Dependent variable: LFA
Method: Least squares
Sample: 1,653 IF FL>0
Included observations: 569

Variable	Coefficient	Std. error	t-Statistic	Prob.
C	10.1766	69.0794	0.1473	0.8829
FL	9.7011	5.5834	1.7375	0.0829
M1 (TS)	94.9646	35.7053	2.6597	0.0080
M3 (GCP)	120.9038	40.4328	2.9902	0.0029
TB1 (DS)	1185.6500	126.3867	9.3811	0.0000
TB2 (E)	378.0738	93.2116	4.0561	0.0001
TB3 (FB)	165.8295	64.1090	2.5867	0.0099
TB4 (S)	767.7133	326.2949	2.3528	0.0190
TB5 (F)	−3.9701	59.7609	−0.0664	0.9471
TB6 (ALS)	−63.4828	66.8023	−0.9503	0.3424
TB7 (AVE)	−36.6355	87.2259	−0.4200	0.6746
TB8 (GCWT)	−84.0246	73.0648	−1.1500	0.2506
TB9 (HF)	−47.5916	98.7109	−0.4821	0.6299
TB10 (JW)	−91.6443	81.1013	−1.1300	0.2590
TB11 (PCHB)	−44.9914	71.9140	−0.6256	0.5318
TB12 (PS)	−53.8497	169.2100	−0.3182	0.7504
TB13 (FS)	−43.4843	169.7731	−0.2561	0.7979
TB14 (CS)	51.1224	327.0988	0.1563	0.8759
TB15 (VAC)	−74.9861	87.8318	−0.8537	0.3936
R^2	0.2520	Mean dependent var.		163.5193
Adjusted R^2	0.2275	SD dependent var.		364.4596
SE of regression	320.3349	Akaike info criterion		14.4094
Sum squared resid.	56,437,96	Schwarz criterion		14.5545
Log likelihood	−4,080.48	*F*-statistic		10.2920
Durbin–Watson stat.	1.2242	Prob(*F*-statistic)		0.0000

positive results, with coefficient at above 0.3, but that another mall (LP) obtained positive but statistically insignificant results, which is probably because this mall has already reduced substantially the LFA of its upper storeys, as shown in Figure 2 above, and is therefore under less pressure to place non-impulse trade tenants on the upper floors.

Table 8 extracts the summary information of the biggest 15 shops in the data sample, and it can be seen that most of them are located on upper storeys and are anchor tenants. For example, eight of them are located on or above the fifth floor and are providing entertainment, food and beverage or supermarket services. The exceptions are department stores, which are mostly located on lower storeys. Furthermore, LP has the fewest big shops, which agrees with the above finding that LP adopts the design of reducing floor area on upper storeys.

CONCLUSIONS

Shopping malls are becoming bigger and higher, but how to encourage shoppers to go to upper levels is a big issue for owners of shopping malls. Although lifts and escalators have been provided, studies show that shoppers are reluctant to go higher. If successful strategies can be found, they could have strong practical implications on the retail industry. In this study, we found empirically that both space allocation and tenant

Table 7: Estimation results of equation (2)

Dependent variable: TB_NIT
Method: ML — Binary probit (Quadratic hill climbing)

Panel A — Combined sample

Sample: 1,653 IF FL>0
Included observations: 569
Convergence achieved after three iterations
Covariance matrix computed using second derivatives

Variable	Coefficient	Std. error	z-Statistic	Prob.
C	−0.9962	0.1130	−8.8147	0.0000
FL	0.0494	0.0168	2.9362	0.0033

Mean dependent var.	0.2373	SD dependent var.	0.4258
SE of regression	0.4223	Akaike info criterion	1.0876
Sum squared resid.	101.0960	Schwarz criterion	1.1028
Log likelihood	−307.4089	Hannan-Quinn criterion	1.0935
Restr. log likelihood	−311.7545	Avg. log likelihood	−0.5403
LR statistic (1 df)	8.6912	McFadden R^2	0.0139
Probability(LR stat)	0.0032		
Obs. with Dep=0	434	Total obs.	569
Obs. with Dep=1	135		

Panel B — Individual mall

Shopping mall	No. of shops of non-impulse trade	No. of shops of impulse trade	Coefficient of FL	Prob.
M1 (TS)	26	155	0.3201	0.0000
M2 (LP)	45	139	0.0094	0.7316
M3 (GCP)	64	140	0.3905	0.0000

Table 8: Summary information of the biggest 15 shops in the sample (in the order of LFA)

LFA in m2	FL	Mall	Trade of business
937	8	TS	Sports wear
950	5	GCP	Entertainment
957	6	GCP	Supermarket
1,075	10	LP	Entertainment
1,079.3	3	GCP	Dept. store
1,088	1	LP	Fashion
1,094	11	TS	Food and beverage
1,129	8	LP	Entertainment
1,139.3	3	GCP	Entertainment
1,238	3	TS	Entertainment
1,518.9	6	GCP	Food and beverage
1,740	1	TS	Dept. store
1,963.1	2	GCP	Dept. store
3,254	2	TS	Dept. store
6,210	7	GCP	Food and beverage

placement strategies have been employed to deal with this dilemma. First, the LFA of shops is found to be increasing on upper storeys. Secondly, shops of non-impulse trade are more likely to be found on upper storeys. The empirical results of three large-scale and successful shopping malls in Hong Kong show significantly that shop size increases by about 9 m^2

for each storey up, and the probability of finding shops of non-impulse trade increases on upper storeys.

The results of this study on tenant placement and space allocation strategies disagreed with Hillier's (1996, p. 161) hypothesis and Fong's (2003) configuration study that proposes that '(shoppers') movement is determined by the urban grid (configuration of the shopping mall) itself rather than by the specific attractors or magnets'. As shown in the findings of this study, successful malls are nowadays built to over ten storeys high and shoppers' movements can be stimulated by tenant placement and space allocation strategies. Our results show that these malls allocate bigger shops and non-impulse trade tenants at upper floors, so as to encourage more shoppers to go to higher storeys. This finding opens a new dimension for shopping mall design and profit maximisation tactics in retail development. The results may also shed light on how to improve shoppers' flow at low-rise shopping malls.

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Note

1 Nelson (1958) stated that low-impulse trades are of high-planned demand and are 'generative' business that customers can demand to buy from the shops in advance.

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