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Determinants of Pricing of New Condominiums in Proximity to a Bangkok Transit System: A Case of the Sukhumvit Line Using Web-Based Data

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Abstract—A condominium's structural characteristics and its proximity to certain locations play a role in its pricing. Yet, no study has examined how the selected variables from the two groups could determine the pricing of new condominiums along the BTS Sukhumvit track. The study was thus an attempt to serve this purpose. Using the data from one real estate website, the regression analysis confirmed the significant effects of the structural attributes and the distances to the nearest BTS stations on the pricing. In addition to extending insights into the determinants of the pricing, real estate developers may apply the findings to alter their pricing operation.

Keywords—Pricing, New Condominiums, Sukhumvit, Bangkok Transit System, Proximity

I. INTRODUCTION

Residents of Bangkok in Thailand have long experienced numerous traffic problems. Several measures from the government are meant to alleviate these problems. One of them is to offer new commuting channels. The Bangkok Transit System (BTS) has been in service since 1999. The Sukhumvit line was among the first routes available to the public. Covering the central of Bangkok, the track starts in the north, connects to the central business district before ending in the east of the capital.

Real estate developers have realized business opportunities and many new condominiums close to the BTS have consequently been in the market. Researchers have verified that the pricing of these new condominiums are significantly determined by the proximity to the BTS stations. Sirikolkarn [7] used the data from realtors to confirm this effect on the condominium price offers. Such effects were also evident in Malaysia and Turkey [3], [4].

Although the effects have been verified in various contexts [3, 7, 13], a review of this work exhibits research possibilities. First, nearly all past research provided little detail on how their data were gathered. This leads to a few questions on the data quality, the findings or the conclusion. The pricing itself could be conceptualized from the demand side or the supply side; but it is unclear in many studies which side the authors would take. Only Kulkosa [5] stated clearly that she collected the price for which the condominium targets are willingness to pay. Many claimed they gathered the pricing on the supply

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side, but their papers have insufficient detail to ascertain the acceptable quality of the data. Generally speaking, no sellers want to disclose how much they price their offers. Hence, the research using a questionnaire to gather the pricing is often questionable. Second, a fair amount of previous work claim they have elicited actual pricing from online announcements such as those in realtor websites. Despite the relatively acceptable quality of the collected data, the explanation on how the authors had accessed and recorded the web-based data was unclear. Finally, only few empirical research has examined both proximity to mass transit train stations and structural characteristics of the condominiums in Bangkok [10, 11]. Hence, our main purpose was to test if the structural factors of new condominiums around the Sukhumvit BTS line and their proximity to the stations could significantly determine the pricing.

II. LITERATURE REVIEW

Bangkok has been the capital of Thailand for nearly 240 years [9]. In 2022, there are about 10.5 million residents registering to all districts in Bangkok [1]. This number does not include commuters from adjacent provinces who must visit Bangkok daily. Subsequently, it should not come as a surprise that the traffic has been listed among the top five most concerned issues.

In 1999, the first two lines of Bangkok's BTS stations started their operation with the expectation that they could have reduced the number of cars and other vehicles on streets. While it is difficult to prove if the BTS operation could actually alleviate the problems, it is clear that their business has attracted tremendous new condominium projects [8]. According to Dziauddin [3], people are willing to pay high price for their housing if they are close to mass transit train stations.

The Sukhumvit line is one of the first two BTS tracks. At the beginning, the line had 17 stations. The first one was Mor-Chit, and the terminal station was On-Nut. However, it has expanded so on the one end is the Koo-Kot station in the north skirt of Bangkok and on the other end is the Khaha station in its west. 70.05 kilometers in its current length, the Sukhumvit line has the total of 48 stations. See Figure 1 for the selected stations on the Sukhumvit line.

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Fig. 1. Geographical detail of the BTS Sukhumvit line [14]

Since its inception, the Sukhumvit line has significant impact on real estate pricing close to it. Examining the effects of the Silom and the Sukhumvit routes on pricing of the new condominiums alongside them, Kulkosa [5] confirmed its significant impact on the pricing. A year later, Serearuno [6] had researched exclusively on the Sukhumvit line regarding the transit-oriented development of the BTS stations. He first classified all stations into three clusters and then tested to see if the pricing of the condominiums in the three clusters were explained by the selected factors. Common to all three clusters is the distance to the nearest stations that explained the significant portion of the pricing.

Based on the research examining factors affecting pricing of condominiums, we can group those determinants into two categories. First, the characteristics of the condominiums often drive how developers price their offers. In his thesis, Thamrongsrisook [8] confirmed that the room size, the number of floor levels and the building age were the significant determinants of the pricing. However, his sample of 63 units were relatively small and how the data were collected was unclear. A study examining factors influencing the pricing of condominiums in Stockholm confirmed the significant effects of a large set of structural variables [2]. For instance, if the condominium for sale is on the high floor, its price is more expensive than those on the low floor. Also, the large rooms are pricier than the small ones. Dai [2] also confirmed the negative impact of the total number of units on its pricing. In other words, the condominiums in the building with the small number of rooms are more expensive than those in the building with the large number. One of the drawbacks in Dai [2]'s study was that they excluded from their project those accessibilities to certain locations (e.g., the proximity to train stations). A study in Kuala Lumper, Malaysia discovered the effects of facilities in the building on the condominium pricing [3]. Such facilities include a gym room, a swimming pool, or a jogging track, each of which was treated as a binary variable. One of the notable findings in Dziauddin [3] is that authors gathered the actual pricing from 476 the condominiums for sale from one website. The only unclear issue is there is no detail on how Dziauddin [3] accessed the web-based data. Had it done manually, it would have distorted the study reliability.

Among the structural characteristics, we are particularly interested in seven factors. They are (1) the total number of floors; (2) the total number of condominium units; (3) the parking spaces; (4) the gross floor area, which was included as a control variable; and whether the building has (5) a swimming pool, (6) a fitness or a gym room, or (7) a business lounge. For the final three facilities, we created a proxy variable called facility scores which combine the value of the three binary variables. As such, there are five structural attributes in the current study. The definitions of these four characteristics are in Table 1.

Second, the condominium's location attributes play a key role in its pricing. An interest in a secondhand condominium pricing led Tochaiwat, et al. [10] to gather the data on 200 samples and verify that the distance to mass transit stations was a negative yet significant determinant of their pricing. In addition, Tochaiwat, et al. [10] included in their study certain structural characteristics. The examples included whether the rooms were fully furnished, whether they are in high-rise buildings or whether they came with the kitchen utensils. This is one of few studies addressing both structure and location factors to explain the condominium pricing. Yet, their explanation on how to obtain all data was unclear and their focus was not on the new condominiums. In the investigation of condominiums in Malaysia [3], the distances to neighborhood were significant in determining the pricing. It is slightly disappointing; however, that the distance to a mass transit train was not. Yet, one of the important variables was whether the buildings were within the 800-mteter radius from the mass transit stations. Such an odd operationalization of the location traits; however, left readers with imprecise insights. One remark on Dziauddin [3]'s work is that the Euclidean distance was used instead of the walking or the driving distances to the stations. While valid, the Euclidian figures often depict the unrealistic of the distance as compared to other two. In economic research, Kulkosa [5] used the geographically weighted regression to validate that the location attributes suggested no spatial dependency among the collected prices. Using the multiple regression, she later confirmed the proximity to the BTS stations was one of the attributes that could explain the pricing significantly [5]. In addition, the amount of carpark was also significant. Similar to other previous work, the detail on how the data in Kulkosa (2016) was unclear. The quality of the conclusion is still debatable.

TABLE I.	DEFINITIONS	OF KEY	VARIABLES
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Variables	Definitions
Y: Listed price of	The condominium price listed for sale on the
condominiums	website
(Baht)	
S1: The number of	The total number of floors in the building where
floors	the condominium is listed
S2: The number of	The total units of condominiums in the building
condominium	where it is listed
units	
S3: Percentage of	The proportion of the parking spots per the total
parking (%)	number of condominium units
S4: Facility scores	The total of the binary indicators of whether the
	condominium project has a swimming pool, a
	fitness or a business lounge
S5: Gross floor	The total area of the condominium which the
area (m2)	owner can utilize
L1: Walking	The walking distance from the building to the
distance to the	nearest station on the Sukhumvit BTS line (km)
nearest station	
L2: Driving	The driving distance from the building to the
distance to the	nearest station on the Sukhumvit BTS line (km)
nearest station	

Two location factors we included in the current study are (1) the walking distance (in kilometers) from the building to the nearest BTS station on the Sukhumvit line, and (2) the driving distance measured in a similar manner. We decided not to use the Euclidean distance (i.e., the direct path) because the walking and the driving distances are more practical in terms of the determinants of the condominium pricing than the direct path. The definitions of these two distances are in Table 1. How we measured these two distances is in the research methodology section.

A review of previous literature addressing the factors that explain the condominium pricing suggests three research gaps. First, there appears no empirical work which examines the effects of the influential factors chosen from the structural characteristics and from the location attributes on the pricing of new condominiums in Bangkok. What has been in the past (e.g., [3], [8], [10], [11] is a fraction of the entire picture. Nevertheless, it has paved the firm foundation for the current study. Second, only a small amount of research has detailed how the data on the pricing and the other factors were gathered. As such, it raises the quality issues. In our study, the pricing in on the supply side. Hence, the reliable detail must be from the condominium sellers. Nonetheless, asking them directly either via the interview or using the questionnaire is still doubtful since how the sellers price their offers is largely confidential. Finally, few of the previous publications claimed their data were harvested from reliable sources including the real estate website. While such data are of acceptable quality, many publications provided little explanation on how the data were collected and recorded for the subsequent analyses. In other words, it is unclear from the papers how researchers access to the online data, how the proximity to the mass transit train station is measured, or how to collect the structural attributes with acceptable quality. Therefore, we attempted to access and gather the actual pricing of new condominiums listed for sale in one real estate website together with all determining factors. Our main goal is to test if the pricing could be significantly determined by at least one of these factors.

III. RESEARCH METHODOLOGY

A. Data preparation

Our aim was to empirically verify whether the seven factors chosen from the structural characteristics (i.e., the number of floors, the number of units, the parking proportion, the facility scores and the gross floor area) and the location attributes (i.e., the walking and the driving distances to the nearest BTS station) could significantly determine the pricing of new condominiums in Bangkok. So, the unit of analysis must be one new room for sale and the research approach is quantitative. We developed the python script which crawled one real estate portal website. The script can be viewed as our main research instrument. The name of the website is withheld for research etiquette, but it has been one of the top property portal webs in Thailand [12]. It functions as a mediator matching potential buyers and sellers. Tested several times to ensure its capabilities, the script went to the website's "new condominiums" section and selected all entries announcing the sale of new rooms in November and December 2021 during which we were able record 494 units. This number were thus our samples. Given our focus on the Sukhumvit line, the selected units must be within the walking distance of less than 4 kilometers from one of the stations on the Sukhumvit line. See Table 2 for the number of units at each station. Readers should note that few stations had no rooms for sale at the time of data collection.

The details of the sale announcement allowed us to record the listed price, the total number of floors, the total number of units, the parking proportion, the gross floor area and to calculate the facility scores. In addition, we were able to access the condominium location (i.e., its latitude and longitude scales), which were used to calculate the walking and the driving distances to the nearest station. It is possible that a unit may situate between two stations. As such, the comparison was made to obtain the proper nearest distances.

B. Data Analysis

In addition to the report of descriptive statistics, we used the regression technique to test the determining effects of the number of floors; the number of condominium units; the parking percentage; the facility scores; and the walking, and the driving distances to the nearest station on the pricing of the condominiums. Please note that the gross floor area was in the equation as the control variable.

IV. RESULTS

As shown in Table 3, the average pricing of the observed condominiums were 11.75 million baht with the approximate 67.65 m² of the gross floor area. They were in the building with the total of 415.51 units and that of 15.34 floor levels in average. An approximate of 25% parking spaces and about two in three facilities were available. The buildings in which the observed condominiums were listed had the average walking distance of 0.89 km and the average driving distance of 1.65 km to the nearest location.

TABLE II. DEFINITIONS OF KEY VARIABLES

Station name*	Number of participating condominiums (%)
Mo Chit	2 (0.4)
Saphan Khwai	18 (3.6)
Ari	14 (2.8)
anam Pao	7 (1.4)
/ictory monument	3 (0.6)
Ratchathewi	12 (2.4)
Chit Lom	28 (5.7)
loen Chit	16 (3.2)
lana	33 (6.7)
sok	16 (3.2)
hrom Phong	45 (9.1)
hong Lo	66 (13.4)
kkamai	17 (3.4)
hrakhanong	19 (3.8)
InNut	45 (9.1)
ang Chak	11 (2.2)
unnawithi	34 (6.9)
Idonsuk	22 (4.5)
ang Na	18 (3.6)
Bearing	46 (8.1)
amrong	28 (5.7)
otal	494 (100)

* The station names are ordered spatially (see Figure 1)

The skewness and the kurtosis statistics in Table 3 validated that all variables are not normally distributed. Hence, they were transformed using a logarithm function, after which their distributions appeared normal and parametric techniques could be used for further analyses.

In Table 4 are the Pearson r correlation coefficients, most of which were significant. Further, none of the independent variables were heavily correlated. This supports the idea of testing if the pricing was significantly determined by the selected factors. In Table 5 are the analytic outcomes which yield three important findings. First, the F statistics of 246.209 with the p-value of .000 confirms the explanatory effect of at least one determining factors on the pricing. Second, the statistics in Table 5 confirm the significant effect of all but the facility scores on the pricing. Finally, the adjusted r^2 of 0.797 verified the acceptable quality of the effects of all significant factors on the listed prices. In addition, the tolerance and the VIF statistics in Table 5 suggest a bearable level of multicolinearity and the Durbin-Watson of 0.972 implies no serious concern on autocorrelation in the residuals. These details confirmed the acceptable quality of the regression outcomes.

The standardized (Beta) and the unstandardized (B) regression coefficients in Table 5 offer four additional findings. First, it can be expected that the gross floor area has the most contribution to the pricing for its largest Beta of 0.590. Simply, the larger, the more expensive. This is the main reason it was treated as the control variable in the current study. Second, the total number of floors and the parking proportion are the two factors with the largest and positive explaining effects on the pricing. This finding may imply that a condominium in a high-rise building with the large offer of parking can be listed more expensive than those in the lowrise building with the small amount of parking. However, the effect of the total number of units on the pricing is also significant but negative. Further discussion will be in the next section. Third, both walking and driving distances to the nearest BTS stations are also significant in how condominium sellers set their price offers. Their effects are negative which means the closer (or the shorter distance) to the station, the more expensive it can be. Finally, the effect of the facility scores on the pricing were not significant. Further discussion will be in the conclusion section.

TABLE III.	DESCRIPTIVE STATISTICS (N=46	4))
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Variables	Mean Standard		Skewness	Kurtosis	
(ur un nores		Deviation	Sheriness		
Y: Listed	11,745,045.68	18,575,111.67	4.77	31.99	
price (Baht)					
S1: The	23.35	15.34	0.38	-1.09	
number of					
floors					
S2: The	415.51	378.51	1.58	1.89	
number of					
condominium					
units					
S3:	61.13	24.95	1.51	4.33	
Percentage of					
parking (%)					
S4: Facility	2.05	0.31	0.32	12.13	
scores					
S5: Gross	67.65	76.33	5.78	52.67	
floor area					
(m2)					
L1: Walking	0.89	0.60	1.48	2.68	
distance to the					
nearest station					
L2: Driving	1.65	1.09	1.86	4.98	
distance to the					
nearest station					

TABLE IV. CORRELATION MATRIX

Variables	S1	S2	S3	S4	S5	L1	L2
Y: Listed price	0.4*	-0.2*	0.7*	0.1*	0.8*	-0.1	-
(Baht)							0.3*
S1: The	1	0.5*	0.3*	0.1	0.2*	-0.1*	
number of							0.4*
floor levels							-

Variables	S1	S2	S3	S4	S5	L1	L2
S2: The		1	-0.3*	-0.1	-	-0.1	-0.1
number of					0.2*		
condo units							
S3: Percentage			1	0.2*	0.6*	0.1	-
of parking (%)							0.3*
S4: Facility				1	0.1*	0.1	-
scores							0.1*
S5: Gross floor					1	0.1*	0.2*
area (m2)							
L1: Walking						1	0.5*
distance to the							
nearest station							
L2: Driving							1
distance to the							
nearest station							

V. CONCLUSION AND DISCUSSION

Using the Python script, we were able to crawl one real estate website and to record the listed prices of new condominiums in Bangkok together with their structural characteristics and the distances to the nearest BTS stations on Sukhumvit line. During the two-month data collection, the details of 464 condominiums for sale were gathered for the subsequent analyses.

The descriptive details revealed that the condominiums in our study were listed at the average price of 11.75 million baht. Approximately, the buildings in which they are located had about the 23.35 floor levels with the 415.51 units in total. Given our focus on the condominiums close to the BTS Sukhumvit line, these figures tap the profile of the units in this area. In fact, our findings are in line with those in Kulkosa [5]. Hence, the condominiums observed in this current study appears to represent the population under investigation.

Variables	В	Beta	t-stat.	р-	Tolerance	VIF
				value		
S1: The	0.02	0.231	6.69	.000	0.369	2.57
number of						
floors						
S2: The	-	-0.186	-5.51	.000	0.406	2.45
number of	0.21					
condo units						
S3:	0.58	0.226	7.20	.000	0.470	2.13
Percentage						
of parking						
(%)						
S4: Facility	-	-0.016	-0.72	.473	0.964	1.04
scores	0.12					
S5: Gross	0.87	0.590	21.85	.000	0.636	1.57
floor area						
$(m^2)^+$						
L1:	-	-0.082	-3.14	.002	0.683	1.46
Walking	0.12					
distance to						
the nearest						
station						
L2: Driving	-	-0.058	-2.33	.020	0.756	1.32
distance to	0.09					
the nearest						
station						

TABLE V. REGRESSION ANALYSIS OUTCOME*

* Adjusted r2 is 0.797 with the Durbin-Watson of 0.972.

+ This factor was included as the control variable.

The analytic outcomes confirmed that the factors selected from the structural characteristics and the location attributes were able to capture 79.7% of the pricing of new condominiums along the Sukhumvit line. Speaking of the structural factors, the total number of floor levels, the total number of units and the parking proportion were significant determinants of the pricing. This is the results when the gross floor area was controlled for. While the fair amount of previous research [8], [10], [13] had verified the positive effects of the number of floors and the parking spaces on the pricing, our findings revealed the negative significant contribution of the total number of units in the building on the pricing. This could be our unique contribution. It is highly possible that the new condominium would be listed expensive if it is in the high-rise building with ample parking area. This unique contribution could validate further that the listed price could be even higher if the total units in the same building are small. We contemplate that the smaller number of rooms, the cozier the condominiums.

The trivial effect of the facility scores on the pricing in the current study warrants further discussion. Such finding contradicts to those in previous research [10, 13]. There are two speculations. First, we operated the score by combining the three binary indicators of the pool, the gym room, and the business lounge. This operation was to comply with the statistical assumption of the regression analysis in which independent variables should not be dichotomous. It may thus cannibalize the effect of each indicator on the pricing. Second, the combined scores had the low variance of only 0.0961 which may result in the insignificance.

Considering the location attributes, the two distances (i.e., the walking and the driving routes) to the nearest BTS stations were both significant in determining the condominium pricing. At the beginning of this research project, the two distances were assumed to be so heavily correlated that the regression technique would have used only one of them in the equation. Yet, the correlation analysis (see Table 4) proved otherwise. A comparison between these two distances revealed that the walking distance had more impact on the pricing than the driving path because the former's Beta is larger than the latter's. Previous research had confirmed the substantial effects of the proximity to mass transit stations on the real estate pricing [8, 13]. However, no publication had observed the effect of the walking or that of the driving distance on the condominium pricing. As such, this could be the other unique contribution of ours and we encourage researchers to adopt them as proxy constructs for the proximity in determining the pricing.

Our findings offer both theoretical and practical contributions. Theoretically, the study has extended insight into the determinants of new condominium pricing in the locations close to BTS stations in Bangkok. Our unique conceptual contribution is the empirical validation of the negative significant impacts of (1) the total condominium units and (2) the proximity measured by the two distances to the nearest stations on the pricing.

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Practically, our findings offer two guidelines. The first suggestion is for real estate developers. They could list their price high if the room is in the tall building (1) with the small number of units and ample parking spaces and (2) with the easy accessibility to BTS stations on the Sukhumvit line. This suggestion is based on our significant findings. Among the two distances from a condominium building to the nearest mass transit station, a seller may focus more on the walking than on the driving distances since the former appears to have larger impact on the pricing than the latter. Nevertheless, the real estate developers must take into consideration both of these two distances when they list their prices. The second guideline is for potential buyers of condominiums in proximity to BTS stations. Our findings may assist them to discern if the listed price is reasonable. For instance, being aware that the prices of new condominiums close to BTS Sukhumvit line are negatively correlated to the total number of units but positively related to the total number of floor levels or the parking spaces, potential buyers may want to check if the listed prices consistently align with the relationships.

The only limitation in the current research is its own scope which is on the pricing of the units close to the Sukhumvit BTS line. Despite the fair number of theoretical contribution and practical recommendation, we could offer no insight beyond this context. As a result, there is research opportunity for fellow researchers.

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