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MASS APPRAISAL APPLICATION FOR LAND VALUATION BY USING REGRESSION MODEL: A CASE STUDY IN THE C ZONE OF *NAM HOI AN* PROJECT, THANG BINH, QUANG NAM

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Abstract. This study focuses on building a regression model in the series of land pricing for frontages and alleys in the C zone of the *Nam Hoi An* project, Thang Binh, Quang Nam. With the regression model of mass land valuation, the local authorities can determine land prices of any land plot accurately and quickly to create favorable conditions for users to determine their financial obligations and for land acquisition and site clearance. The research applied the data collection method (secondary and primary), the data processing method, and regression analysis method to build a model of mass land valuation. This study shows that the facade's location in the C zone of the *Nam Hoi An* project is affected by various factors such as security, plot width, plot shape, distance to Hoi An city, traffic congestion, land use type, and road boundary. Meanwhile, the unit price of land in the alley is influenced by factors such as security, alley level, plot shape, distance to Hoi An city, road structure, traffic congestion, and alley location. The most significant factor affecting frontage land price is the type of land use with regression coefficient $B_{LAND\_USE\_TYPE}$ = 14,199. In terms of unit price of alley land, it is the type of alley with regression coefficient $B_{ALLEY\_LOCATION}$ = 10,772. The results of verification of the accuracy of the land unit price from the regression model to the compensation land unit price have a negligible difference, which is entirely consistent with the requirement of determining the price level close to the market price. This study shows the practical applicability of mass appraisal for land valuation by using a regression model in land acquisition and financial management of land.

Keywords: land valuation, mass appraisal, Hoi An, regression model

1 Introduction

In Vietnam, valuation of land to determine financial obligations related to land use and speed up land acquisition and site clearance is always of the top concern [2]. The land valuation theory in Vietnam is formulated explicitly in Land Law 2013 and Decree No. 44/2014/ND-CP on the Government's land price regulation, dated May 14, 2014 [18, 19]. There are five possible land valuation methods: a direct comparison, deduction, income, surplus, and land price adjustment [5]. These methods are inherited from the traditional land valuation methodology commonly

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used in the world, and they are well applied in determining the value of each land plot [21]. However, according to current valuation methods, land valuation for each plot takes a lot of time, effort, and cost for appraisal [3]. This can lead to a decrease in the State Budget revenue from the collection of land use taxes or raise disagreements, even backlash from the people during the process of land acquisition, slow down the progress of projects, and causing difficulties and discouraging investors [4]. Today, under the modern approach, there is a method of mass land valuation based on mathematical models and computer techniques combined with databases called mass appraisal [11, 14].

Mass appraisal is the process of valuing a group of properties as of the given date and by using common data, a standardized method, and statistical testing [8]. Before the 21st Century, relevant institutions and scholars have performed fruitful work on the standard setting of real estate mass appraisal such as Standard on Mass Appraisal of real property [6], RICS Valuation-Global Standard [13], International Valuation Standards [7], Uniform Standards of Professional Appraisal Practices [17]. The development direction of mass appraisal of real estate is to model elements and find algorithms by constructing mathematical models and estimating regression functions on land values with factors as characteristics of the parcel of land [20]. The factors such as conditions, parameters, correlation coefficients, and regression coefficients depend a lot on each locality, but if a standard definition is given, this method will be an effective tool in mass valuation [10].

The C zone of the *Nam Hoi An* project is located in Thang Binh, Quang Nam. The land price in this area is affected by the Vinpearl project; for this reason, the market land price is relatively high, which makes land users not accept the compensation price of the State-set prices [16]. Therefore, the investors and the State discussed the compensation price based on market land price with affected land users to get an agreement. This study was carried out to apply mass appraisal for land valuation by using a regression model in the C zone of the *Nam Hoi An* project to guarantee benefits for land users, provide compensation at market prices, and accelerate land acquisition and site clearance progress.

2 Materials and methods

2.1 Data collection

Secondary data

The land price table in 2019 of Quang Nam provincial People's Committees were collected from Department of Natural Recourse and Environment. The socio-economic development reports in 2019 are collected at the People's Committee of Thang Binh. In addition, the research also collects

additional materials such as books, magazines, etc. related to the land price in the *Nam Hoi An* project.

Primary data

The study interviewed four staff working in the Land Fund Development Centre of Thang Binh to identify factors affecting the value of land plots in the C zone of *Nam Hoi An* project. The staff chosen for the interview have to know thoroughly about the study area, have a college degree or higher, and work in the Centre for at least 10 years.

The study also randomly conducted face-to-face interviews with households who had acquired land in the C Zone of *Nam Hoi An* Project, Thang Binh by using a Semi-structure questionnaire. The content of the questionnaires focuses on the factors related to land parcels such as security situation, location, the shape of plots, distance to Hoi An city, traffic situation, etc. The sample size was calculated by using Cochran's formula (formula 1) [1].

$$n = \frac{pqz^2}{e^2} \qquad (1)$$

where e is the desired level of precision (i.e., the margin of error); p is the (estimated) proportion of the population with the attribute in question; q is $1 - p$.

In this research, $p = q = 0{,}5$; $e = 0{,}1$; $z = 1.96$. Cochran's formula gives the sample size 97. However, to increase accuracy and ensure the sample size, the research was issued 150 questionnaires. After data cleaning, only 140 questionnaires met the requirement.

2.2 Data processing

The collected data is entered into and processed by SPSS software for data analysis to build a regression model for the mass valuation of land.

Survey samples (households) were collected from valuation certificates in the Land Fund Development Center of Thang Binh. There are two types of real estate in the sample: Land with and without the house. However, this research focused only on land price; therefore, the value of the properties, including building, was estimated and deducted from real-estate value so that only land prices remain.

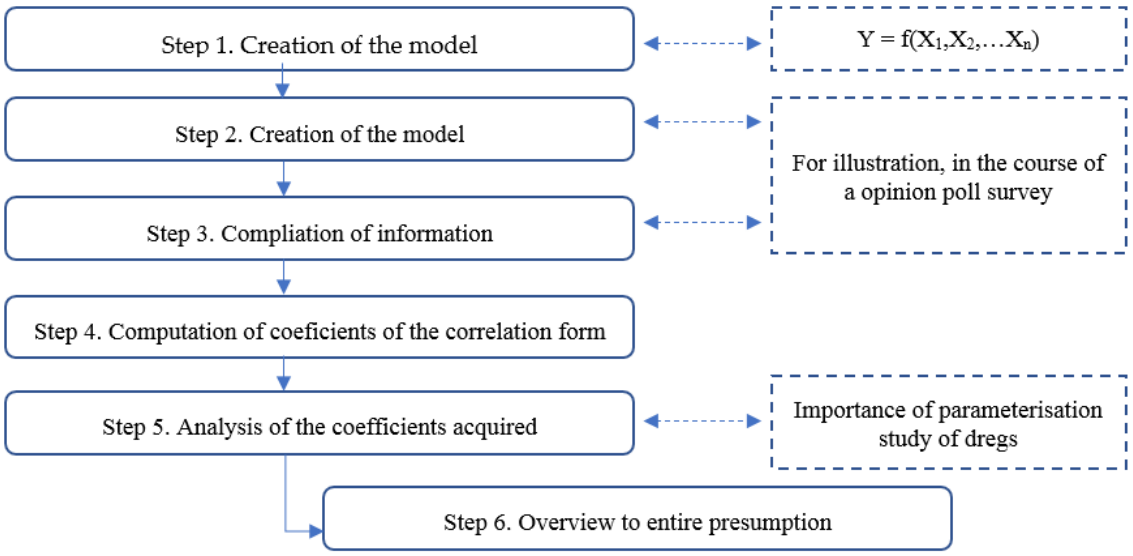

Figure 1. Flow chart for regression analysis

2.3 Method of land valuation using regression model in mass appraisal

To build a mass valuation of land model for the C zone of *Nam Hoi An* project in Thang Binh, we conducted the research following this procedure:

Step 1: Researching the econometric theory of Ramanathan [12], the theory of real estate market (real estate), the theory of real estate valuation, the theory of land price mathematical series and statistics as well as referring to the types of models previously studied.

Step 2: Developing a theoretical framework.

Step 3: Finding appropriate data for the model. The data used is provided by professional valuation companies, in which experts have appraised the unit price of land with field knowledge and experience from the field. For this reason, the study's reliability is relatively high.

Step 4: Formatting variables for the model.

Step 5: Setting the model based on the theoretical framework and selected variables from the collected data.

Step 6: Estimating the model.

Step 7: Testing whether there is a hypothesis violation. In case of violation, reset the model, move back to step 5, reprocess until the model is correct, follow the assumptions, and explain in practice. If the models meet the statistical criteria and the assumptions, step 8 is skipped.

Step 8: Interpreting the results based on the model, from which to relate to reality.

Step 9: Forecasting the results of land prices based on the regression model obtained.

Step 10: Summarizing the interpretation results, making recommendations and solutions.

The land valuation model applied in this study is an additive multiple regression model based on a comparative approach. This model is used to test hypotheses about the relationship between a dependent variable (UNIT_PRICE) and independent variables, *X*s. Multiple regression can also be used to make predictions about the *Y* variable. That is why the statistical technique is useful to determine a property's likely sales price or worth [9].

$$Y = \beta_0 + \beta_1 \times X_1 + \beta_2 \times X_2 + \cdots + \beta_n \times X_n$$

where Y is the price of land calculated on 1 m² of area; X_i is the factor that affects the price of land; β_i is the regression coefficients.

3 Results and discussions

3.1 The study area

The C Zone of *Nam Hoi An* project belongs to Duy Hai and Duy Nghia communes (Duy Xuyen) and Binh Duong commune (Thang Binh) [15].

The adjacent faces are as follows:

– North: adjacent to Duy Nghia commune administrative area and Duy Hai resettlement area.

– South: adjacent to coastal resettlement area in Binh Duong commune.

– East sea bordering the east.

– West: adjacent to Duy Nghia and Binh Duong commune residential areas.

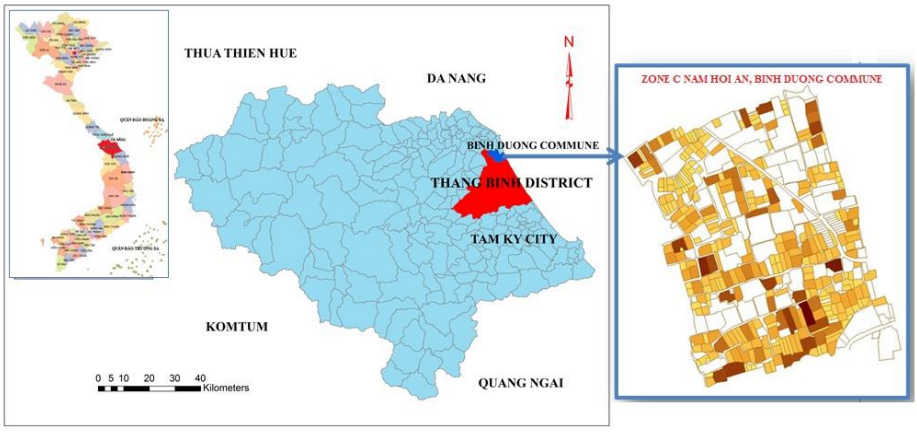

Figure 2. Location of the study area

Table 1. Current land use status of the area C of Nam Hoi An project, Thang Binh, Quang Nam in 2019

No	Land use purpose	Area (m^2)	Ratio (%)
1	Public building	203.026	9.4
2	Commercial	0	0.0
3	Hotel and resort	0	0.0
4	Mixed office	207.910	9.7
5	Residential	944.820	43.9
6	Green trees and water surface	404.912	18.8
7	Technical infrastructure	7.670	0.4
8	Transportation	381.790	17.8
	Total	**2.150.128**	**100.0**

Source: [16]

The statistical results in Table 1 show that in the C Zone of *Nam Hoi An* project, the largest residential land area is 944,820 ha (43.9% of the total area). The others are greenery land, transportation land, office land and public works with 404,912 (18.8%), 381,790 (17.8%), 207,910 (9.7%), and 203,026 ha (9.4%), respectively.

3.2 Variable description in regression model

Dependent variable

UNIT_PRICE: Unit price of land – this is a quantitative variable; the unit of calculation is thousand Dong/m^2. Land prices are calculated by subtracting the residual value of structures on land from the successful transaction price of the property. The unit price of land is calculated by dividing the land price based on the recognized land area.

Independent variables

A research questionnaire containing a list of affecting factors was outlined according to Hoa [3], Hoa and Duong [4], Benjamin and Sirmans [9], and Yeh [21]. This questionnaire was used to interview four staff of the Land Fund Development Centre of Thang Binh district who know thoroughly about the survey area to determine which specific factors truly affect the land price. Finally, the authors identified the factors affecting the value of individual land plots in the study area and coded them into dependent variables below:

1. SECURITY: The security of the surrounding area, where the property is located, is divided into five levels and receives corresponding values from 1 to 5: very poor, poor, average, good, and very good. The expected sign of the SECURITY variable is the (+) sign.

2. PLOT_WIDTH: Width of plot. This is a quantitative variable expressed in meters, and the expected sign is (+).

3. PLOT_SHAPE: Shape of plot. This is a qualitative variable. We used the identifier scale to encode this variable with the following values: 1 if it is final or L-shaped; 2 if it is a square; 3 if it is parcel-back-hatched. The expectation sign is (+).

4. DISTANCE_CITY: Distance from real estate to city center. This is a quantitative variable (minute). Distances (km) are measured relatively accurately from the location of a particular property to the ancient town of Hoi An by a function in Google map. After that, this distance will be determined by the average speed of the motorbike (about 30 km/h). In fact, the further away the real estate from the centre, the lower the price compared with the real estate closer to the centre. The author expects the DISTANCE_CITY variable to be inversely proportional to the UNIT_PRICE variable; the expectation sign is (–).

5. STRUCTURE: Road structure. For alley land, this qualitative variable is encoded by the identification scale into three values: 3 if the alley is an asphalt road; 2 if the alley is a cement or concrete road; 1 if the alley is a dirt or stone road. The expectation sign is (+).

6. TRAFFIC_JAM: Traffic jam of main road – the road leading to the property. The variable TRAFFIC_JAM is coded by using the nominal scale, whereby it receives a value of 3 if it is rare, 2 if it is occasional, and 1 if traffic jams are frequent. The expectation sign is (+).

7. LAND_USE_TYPE: The primary type of land use of the road where the property is located. This is a qualitative variable, whereby whereby the identity scale codes it with four values: 4 if it is a business or a big busy trade; 3 if it is a retail business; 2 if the property is for residential or residential use; 1 if it is the cultivation or aquaculture. The expectation sign is (+).

8. BUILDING_LINE: Building line of the road where the property is located. This is a quantitative variable in meters. This variable is only applied to the properties located in the street front. The building line is determined according to the announcement of the right of trade – service routes in Thang Binh. Particularly for the routes where the author has not found planning information. The building line is estimated from a distance between two selected blocks. The expectation sign is (+).

9. ALLEY_LEVEL: Level of alley. This is a qualitative variable, and we used the identifier scale to encode it with the following values: 1 if it is an access path with a cross-section less than 2.5 meters (counting the narrowest area); 2 if it is an entrance with a width of 2.5 meters or more (measuring the narrowest place). The expectation sign of the ALLEY_LEVEL variable is the (+) sign.

10. ALLEY_LOCATION: The alley's location where the real estate is located. This is a qualitative variable and only applied to Real Estate located in the alley. The alley is paved with stones, asphalt, concrete, or cement. Principles to determine an alley location are as follows: Position 1 – alley with a width greater than 5 m; Position 2 – alley with a width from 3 m to 5 m; Position 3 – alley with a width from 2 to less than 3 m; Position 4 – alley with a width less than 2 m. An identifier scale encodes this variable into four values: 4 if the alley has Position 1; 3 if the alley has Position 2; 2 if the alley has Position 3; 1 if the alley has Position 4. The expectation sign is (+).

3.3 Building regression models for mass land prices

To clarify the relationship between the dependent variable UNIT_PRICE and the independent variables, we used the additive multiple regression model.

Regression model of mass valuation of frontage land

The regression analysis shows that all seven independent variables included in the mass pricing model for frontage land had the correct sign as expected (Table 2).

Table 3 shows that the estimated parameters of the regression model for mass pricing with land on the front are statistically significant. Specifically, the determination coefficient adjusted R^2 is 0.996, revealing that the linear regression model is consistent with the data set by 99.6%. In other words, 99.6% difference of the UNIT_PRICE variable can be explained by the difference in

Table 2. Variables list of the model in alleys and facades

No	Frontage land model	Model for land in the alley
1	UNIT_PRICE	UNIT_PRICE
2	SECURITY (+)	SECURITY (+)
3	PLOT_WIDTH (+)	ALLEY_LEVEL (+)
4	PLOT_SHAPE (+)	PLOT_SHAPE (+)
5	DISTANCE_CITY (–)	DISTANCE_CITY (–)
6	TRAFFIC_JAM (+)	STRUCTURE (+)
7	LAND_USE_TYPE (+)	TRAFFIC_JAM (+)
8	BUILDING_LINE (+)	ALLEY_LOCATION (+)

Source: Survey results, 2019

the independent variables in the model. The *F* value is 1917,587 with an observed significance level of Sig. = 0.000, lower than 0.05, meaning that the linear regression model was built following the whole. In addition, the magnification coefficient VIF of the independent variables is less than 10, indicating that the model does not have a multi-collinear phenomenon. Finally, the Sig. values of the regression coefficients are greater than 0.05. Therefore, the regression model for mass pricing of facades in the front is as follows:

$$\text{UNIT\_PRICE} = 757{,}253 + 10{,}115 \times \text{SECURITY} + 8{,}008 \times \text{PLOT\_WIDTH} + 7{,}052 \times \text{PLOT\_SHAPE} - 5{,}318 \times \text{DISTANCE\_CITY} + 7{,}589 \times \text{TRAFFIC\_JAM} + 14{,}199 \times \text{LAND\_USE\_TYPE} + 4{,}002 \times \text{BUILDING\_LINE}$$

The significance of the regression coefficient in the regression model for mass pricing with frontage land is construed as follows (other factors remain constant):

$B_{SECURITY}$ = 10,115 indicates that when regional security increases (or decreases) by one degree, the unit price of land will decrease (or increase) by 10,115 thousand Dong/m^2.

B_{PLOT_WIDTH} = 8,008 indicates that when the plot's width increases (or decreases) by one level, the unit price of land will increase (or decrease) by 8,008 thousand Dong/m^2.

B_{PLOT_SHAPE} = 7,052 indicates that when the plot shape increases (or decreases) by one level, the unit price will increase (or decrease) by 7,052 thousand Dong/m^2.

$B_{DISTANCE\_CITY}$ = –5,318 indicates that when the distance (in km) to the centre of Hoi An city increases (or decreases), the unit price of land will increase (or decrease) 5,318 thousand Dong/m^2.

Table 3. Regression model results for mass valuation of frontage land

Variable nam	B	Sig.	VIF
Constant	757,253	0.000	
SECURITY	10,115	0.000	1.421
PLOT_WIDTH	8,008	0.000	1.671
PLOT_SHAPE	7,052	0.000	1.254
DISTANCE_CITY	–5,318	0.000	1.595
TRAFFIC_JAM	7,589	0.000	1.639
LAND_USE_TYPE	14,199	0.000	1.408
BUILDING_LINE	4,002	0.000	1.274
$R_{corrected}$ **= 0.996**			
$F_{statistic}$ **= 1917,587 (Sig = 0.000)**			

Source: Results of data processing analysis, 2019

$B_{TRAFFIC\_JAM}$ = 7,589 indicates that when traffic jams increase (or decrease) by one level, the unit price of land will increase (or decrease) by 7,589 thousand Dong/m^2.

$B_{LAND\_USE\_TYPE}$ = 14,199 indicates that when the land use type increases (or decreases) by one level, the unit price of land will increase (or decrease) by 14,199 thousand Dong/m^2.

$B_{BUILDIND\_LINE}$ = 4,002 indicates that when a right of way increases (or decreases) by one level, the unit price of land will increase (or decrease) by 4,002 thousand Dong/m^2.

Regression model of mass valuation of land in the alley location

Table 4 shows that for the parcel located in the alley, all seven independent variables affect the value of the land plot in the alley. The sign of these independent variables is in line with the expectations of the previous study.

The adjusted coefficient of determination R^2 is 0.992, indicating that the linear regression model fits the data set to 99.2%. The F value is 998,401 with an observable significance level of Sig = 0.000, which shows that the multiple linear regression model under construction is suitable for the whole. VIF magnification coefficients for the independent variables are all below 10, and the Sig value of the regression coefficients is all lower than 0.05. Thus, the regression model of mass valuation of land in the alley meets the requirements and is shown as the following equation.

UNIT_PRICE = 311,724 + 18,886 × SECURITY + 5,018 × ALLEY_LEVEL + 6,975 × PLOT_SHAPE – 3,002 × DISTANCE_CITY + 9,869 × STRUCTURE + 7,173 × TRAFFIC_JAM + 10,772 × ALLEY_LOCATON

The significance of the regression coefficient in the regression model for mass valuation

Table 4. Regression model results for mass valuation of land in the alley location

Variable	B	Sig.	VIF
Constant	311,724	0.000	
SECURITY	18,886	0.000	1.548
ALLEY_LEVEL	5,018	0.000	1.827
PLOT_SHAPE	6,975	0.000	1.204
DISTANCE_CITY	–3,002	0.000	1.705
STRUCTURE	9,869	0.000	1.673
TRAFFIC_JAM	7,173	0.000	1.812
ALLEY_LOCATION	10,722	0.000	1.654

$R_{corrected}$ = 0.992

$F_{statistic}$ = 998,401 (Sig = 0.000)

Source: Results of data processing analysis, 2019

with alley land is construed as follows (other factors remain constant):

$B_{SECURITY}$ = 18,886 indicates that when regional security increases (or decreases) by one degree, the unit price of land will decrease (or increase) by 18,886 thousand Dong/m^2.

B_{ALLEY_LEVEL} = 5,018 indicates that when a plot of the land alley increases (or decreases) by one level, the land unit price will increase (or decrease) by 5,018 thousand Dong/m^2.

B_{PLOT_SHAPE} = 6,975 indicates that when the plot size increases (or decreases) by one level, the unit price will increase (or decrease) by 6,975 thousand Dong/m^2.

$B_{DISTANCE\_CITY}$ = –3,002 indicates how many kilometres the distance to the centre of Hoi An city increases (or decreases), the unit price of land will increase (or decrease) 3,002 thousand Dong/m^2.

$B_{STRUCTURE}$ = 9,869 indicates that when a road structure increases (or decreases) by one level, the unit price of land will increase (or decrease) by 9,869 thousand Dong/m^2.

$B_{TRAFFIC\_JAM}$ = 7,173 indicates that when traffic jams (or decreases) by one level, the unit price of land will increase (or decrease) by 7,173 thousand Dong/m^2.

$B_{ALLEY\_LOCATION}$ = 10,772 indicates that when the alley location increases (or decreases) by one level, the unit price of land will increase (or decrease) by 10,772 thousand Dong/m^2.

3.4 Verifying the results of mass land price determination by regression model with compensation land price

To evaluate the results of mass land valuation by the regression model, we randomly selected three frontage plots and three plots in the alleys. After that, we used the unit price of land calculated from the regression model to compare the unit price of the land parcel that has been compensated.

Frontage plots

The results in Table 5 show that the unit price calculated from the regression model of mass valuation for land plots located on the frontage is close to the actual unit price (890 thousand Dong/m^2), which has been compensated in area C, *Nam Hoi An* project. It means that this regression model is relatively precise and can be widely applied to estimating land prices for the plots located on the frontage in the survey area.

Table 5. Results of mass valuation by regression model for the land plots on the facade

	Target	Plot 42	Plot 116	Plot 89
Plot information	Security	Very good	Very good	Very good
	Plot width (m)	6.5	6.3	8
	Plot shape	wide back*	Square-shaped	wide back*
	Distance to the city (km)	15	16	16
	Traffic jam	Rarely	Rarely	Rarely
	Land use type	Residential land	Residential land	Residential land
	Building line (m)	10	10	10
Plot information encoded into the model	Security	5	5	5
	Plot width	6.5	6.3	8
	Plot shape	3	2	3
	Distance to the city	15	16	16
	Traffic jam	3	3	3
	Land use type	2	2	2
	Building line	10	10	10
Land unit price (Thousand Dong/m²)	Calculated according to the regression model	892,291	878,3194	898,985
	Actual		890	

Notes: Wide back* indicates the length of the front is shorter than the back.

Source: Results of data processing analysis, 2019

Plots in the alleys

The land price in the alley calculated from the regression model for the land lots is 302, 309, and 386 are 449,47, 454,34, and 459,50 thousand Dong/m², respectively. This calculated unit price is similar to the actual unit price compensated in the study area (455 thousand Dong/m²).

Thus, it can be seen that the valuation result of the regression model is to ensure the practicality to apply the determination of land prices in alleys and facades in the C Zone of the *Nam Hoi An* project, Thang Binh.

Table 6. Results of mass valuation by regression model for the land plots in the alley

	Target	Plot 302	Plot 309	Plot 386
Plot information	Security	Good	Good	Good
	Alley level	Level 2	Level 2	Level 2
	Plot shape	wide back *	wide back *	Square-shaped
	Distance to the city (km)	15	17	16
	Structure	Cement	Soil	Cement
	Traffic jam	Occasionally	Occasionally	Occasionally
	Alley level location	Position 2	Position 2	Position 2
Plot information encoded into the model	Security	4	4	4
	Alley level	2	2	2
	Plot shape	3	3	2
	Distance to the city (km)	15	17	16
	Structure	3	2	3
	Traffic jam	2	2	2
	Alley level location	3	3	3
Land unit price *(Thousand Dong/m²)*	Calculated according to the regression model	449.47	454.34	459.50
	Actual		455	

Notes: Wide back* indicates the length of the front is shorter than the back.

Source: Data processing analysis results, 2019

4 Conclusions

The research results show that the unit price of land at the front in the C zone of the *Nam Hoi An* project, Thang Binh, is affected by security, the plot width, the plot shape, the distance to Hoi An city, traffic congestion, land use types, and roads. Meanwhile, the unit price of land in the alley is influenced by security, alley level, plot shape, distance to Hoi An city, road structure, traffic congestion, and alley's location. The most influencing factor of the frontage land unit price is the land use type, and that of the alley land unit price is the alley type. The regression models fit well with the compensation land price in the locality. The regression models could be used effectively for mass land valuation appraisal in the C zone of the *Nam Hoi An* project and other areas with the same survey area conditions.

References

1. Cochran, W. G (1977), *Sampling Techniques*, Wiley Eastern Limited, Third Edition, New Delhi.
2. H. V. Cuong (2017), *Real Estate Market Curriculum*, National Economics University Press.
3. N. Q. Hoa (2015), Application of mass valuation methods in state management of land, *Journal of Development and Integration*, 22(32).
4. N. Q. Hoa and N. H. Duong (2016), Building a model of mass land valuation for Go Vap district, Ho Chi Minh City, *Journal of Economic Development*, 26(3), 82–103.
5. N. T. Huan (2009), *Curriculum on Land and Other Real Estate Valuation*, Agricultural Publishing House.
6. IAAO (2017), *Standard on Mass Appraisal of Real Property*, IAAO: Kansas City, MO, USA.
7. IVSC (2017), *International Valuation Standards*, IVSC: London, UK.
8. Jahanshiri. E, Buyong. T, Shariff. A.R.M (2011), A Review of Property Mass Valuation Models, *Pertanika J. Sci. Technol*, 19, 23–30.
9. John D Benjamin and C. F. Sirmans (2004), Mass Appraisal: An Introducion to Multiple Regression Analysis for Real Estate Valuation, *Journal of real estate practise and education*.
10. T. H. Lien, H. V. Hung (2013), *Building land value areas for land valuation and land management*, Agricultural Publishing House.
11. Lin. C. C, Mohan S. B (2011), Effectiveness comparison of the residential property mass appraisal methodologies in the USA, *Int. J. Hous. Mark*, Anal, 4, 224–243.
12. Ramanathan Ramu (2002), *Introductory econometric with application*, Fort Worth: Harcourt College Publishers.
13. RICS (2017), *RICS Valuation – Global Standard*, RICS: London, UK.
14. Tajani. F, Morano. P (2018), Automated valuation models for real estate portfolios A method for the value updates of the property assets, *J. Prop. Invest. Finance* , 36, 324–347.
15. Thang Binh People's Committee (2019), *Socio-economic development report of Thang Binhcommittee*, Quang Nam.
16. Thang Binh district land fund development center (2020), *Summary report for activities in 2019*, Quang Nam.
17. The Appraisal Foundation (2018), *Uniform Standards of Professtional Appraisal Practise*, The Appraisal Foundation: Washinton. DC, USA.

18. Vietnamese Government (2014), *Decree No. 44/2014 on land price regulation*, Hanoi.

19. Vietnamese Congress (2013), *Land Law*, Ha Noi.

20. Daikin Wang and Victor Jing Li (2019), Mass Appraisal Models of Real Estate in the 21st Century: A Systematic Literature Review, *Sustainability*, 11, 7006.

21. Yeh. I. C, Hsu. T. K (2018), Building real estate valuation models with comparative pproach through case-based reasoning, *Appl. Soft Comput*, 65, 260–271.