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Swiftlet Farming Industry—A White Gold in the Malaysian Housing Market?

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ABSTRACT

The swiftlet farming industry is fast-growing and contributes to Malaysia's economic growth. Nonetheless, dirty and noisy surroundings caused by bird droppings and audio systems are unattractive and may adversely impact the housing market. Hence, this study seeks to ascertain the price impacts of the swiftlet farming industry. The first objective defines the hedonic model by reviewing its definition, theoretical framework, methodological process, and house price applications. The second objective explores factors influencing house prices, including the animal farming industry, through a literature review. The third objective evaluates the impact of the swiftlet farming industry on house prices. Ten-year house transaction data and spatial data provided by the Valuation and Property Services Department and Municipal District of Bentong are used to construct the Hedonic model. The result is evaluated based on its logical, statistical and predictive performance. The study found that swiftlet farming in Bentong has a negative impact on house prices, with an inverse price impact that increases with distance from the farming area. Buyers are reluctant to pay for houses near farming due to noise pollution and obstruction. This study supports international and national agendas relating to environment and health sustainability.

Keywords: Externalities, Hedonic price model, house price, LULUs, swiftlet farming

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INTRODUCTION

Swiftlet farming is growing edible birds' nests by constructing specifically constructed structures for swiftlets to roost and lay their eggs in (Connolly, 2016a). These nests are

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prized for health maintenance (Careena et al., 2018; Ma & Liu, 2012; Zulkifli et al, 2019) and skin supplement (Babji & Daud, 2019; Chan et al., 2015; Daud et al., 2019; Zulkifli et al., 2019) since Tang (618–907 AD) (Zulkifli et al., 2019) and Sung (960-1279 AD) dynasties (Blussé, 1991; Lau & Melville, 1994; Lim, 2006). More specifically, edible bird's nest health benefits include the proliferative effects of corneal keratocytes (Zulkifli et al., 2019). Human adipose-derived stem cells (hADSCs) suppress the influenza A virus's hemagglutination of human erythrocytes, enhance skin complexion and bone strength (Haghani et al., 2016) and strengthen lungs and respiratory system for asthmatic people (Kamaruddin et al., 2019). Edible bird's nest is one of the costliest food items eaten by humans, having a market worth between $1,000 and $10,000 per kilogramme due to its high nutritional and therapeutic qualities, as well as the risk and complexity of the nest collecting procedure (Chua & Zulkifli, 2016; Looi & Omar, 2016; Tan et al., 2020). Hence, the terms "Caviar of the East" (Connolly, 2016a; Looi et al., 2016; Thorburn, 2015) and "Tropical White Gold" (Mursidah et al., 2020). Traditionally, nests were harvested in limestone caves by indigenous people in Southeast Asia (Lim & Cranbrook, 2002).

Due to rapid urbanisation, swiftlets are bred inside a converted building, which imitates a cave-like environment and is installed with special equipment to harvest the bird's nest (Merican, 2007; Zulkifli et al., 2019). The swiftlet farming concept started to bloom in Southeast Asia in the 1990s, resulting from a business shift during the Asian Economic Crisis in years 1997–1998 (Ibrahim et al., 2009). Today, the swiftlet farming industry is one of the most profitable industries in Southeast Asia. Over 30,000 swiftlet farmhouses in Malaysia were built and operated (Connolly, 2016b), generating an estimated annual output of 5,654.7 tons worth RM 1.15 billion (Bernama, 2020). It is projected to increase in production at 11.6% per year (Ministry of Agriculture [MOA], 2011) and reach RM 3 billion by the end of year 2020 ("Eksport sarang burung," 2020; "MoA sasar eksport," 2020). Malaysia is currently the world's third largest provider of bird nests, after Indonesia and Thailand, accounting for 9% of the worldwide demand for birds' nests in 2006 (Looi & Omar, 2016). The significance of the swiftlet bird's nest in Malaysia's economic growth resulted in the Economic Transformation Programme, Tenth Malaysia Plan, prioritising the swiftlet bird's nest industry expansion (Looi & Omar, 2016).

The expansion of the swiftlet farming industry significantly transformed urban space and has since stirred some debates and controversies, particularly surrounding the health and well-being of humans. The conversion of a building into a birdhouse is inappropriate and deleterious due to the closed environment, accumulation of moisture and bird droppings, which accelerate the decay of the building, affect the built heritage and are an "eyesore" (Connolly, 2016a; 2017). Swiftlet farms attract insects and infestations, emit foul

smells, spread viruses and bacteria and are noisy, which causes restlessness, increased blood pressure and deadly diseases such as avian influenza, lung respiratory and dengue (Connolly, 2016a). Swiftlet farms located near residential areas have faced multiple complaints on the issue of swiftlet droppings and noise pollution (Ammartsena & Ditthapan, 2023; Chan, 2019; Cheng, 2021; Trung, 2023; Wong, 2017; Yassin et al., 2020).

Residential neighbourhoods that experience negative externalities are perceived as unappealing and undesirable for buying, renting, or investing (Suhaimi et al., 2021; Zihannudin et al., 2021), leading to reductions in prices or rents. Since swiftlet farming areas and other concentrated animal feeding operations (CAFOs) are often regarded as locally undesirable land uses (LULUs) (Isakson & Ecker, 2008), their existence is likely to affect proximate property values. In Nebraska, a man won a lawsuit arguing that the presence of animal farming operation had a detrimental effect on the appraised worth of his opulent house. As a result, the assessed value was reduced to 30%, allowing him to pay less property tax (Aiken, 2002). Therefore, it is highly likely that swiftlet farms can have a similar impact.

This study seeks to assess the price impacts of the swiftlet farming industry on nearby residential in the Bentong region. This paper has two advantages. First and foremost, it enhances academic understanding of the effects of swiftlet farms on housing values. Furthermore, it provides guidance to individuals involved in the property market regarding property valuation, investment, and making decisions related to purchasing and selling. Previous research suggests that swiftlet farms are expected to have a detrimental effect on the housing market by causing price reductions.

Animal Farming Impact on House Prices

Property prices are sensitive to the effects of location, structure, and neighbourhood (Suhaimi et al., 2021; Zihannudin et al., 2021). The structural qualities encompass the number of bedrooms and bathrooms, the presence of a fireplace and garage, square footage, lot size, structural age, and whether there is a pool. Neighbourhood qualities encompass socioeconomic factors of residents, the condition of adjoining buildings, whether owned or rented, the ethnic makeup of the community, the presence of schools and tax districts, and the overall quality of the environment. Location qualities encompass factors such as the nearness and availability of diverse amenities. According to Alonso's bid-rent theory, individuals are willing to allocate a portion of their money towards securing a desirable location. A residential property in a sought-after location tends to elicit a greater monetary value. In comparison, a dwelling in an unappealing place tends to elicit a lower monetary value. The hedonic model has been extensively used to quantify the effects of location, structure, and neighbourhood on house prices since the 1960s with works from Lancaster (1966),

Ridker and Henning (1967), Griliches (1971), Rosen (1974), & Nelson (1978).

There is also abundant literature applying the hedonic method to quantify the impact of animal farming on residential prices. Previous empirical studies have demonstrated that houses located near animal farming industries may experience a price reduction of up to 16% compared to houses located farther from animal farming industries (Ables-Allison & Connor, 1997; Herriges et al., 2005; Isakson & Ecker, 2008; Milla et al., 2005; Palmquist et al., 1997). Nearby house prices drop because of the fear of loss of amenities, air and/or water pollution risk and increased possibility of nuisances related to odour and/or insects (Hribar, 2010). On average, a hog farm causes a price discount of between 0.3% to 16% for properties located within ½ mile to 1 mile away from a hog farm (Herriges et al., 2005; Milla et al., 2005; Palmquist et al., 1997). The largest effect came from Iowa, where Herriges et al. (2005) noted that properties located downwind from a hog farm may experience a price discount of up to 16% at ¼ mile.

However, this effect disappears after 1½ miles. Palmquist et al. (1997) also noted a decreased effect with increased distance from hog farms. It has also been observed that the size and concentration of animals may also affect residential prices. A farm highly concentrated with animals was observed to have a higher negative impact on nearby residential prices. An additional hog will cause a 3.1% price drop in North Carolina (Milla et al., 2005), an additional 1,000 hogs will reduce Michigan's property prices by 1.71% (Ables-Allison & Connor,1997), and an additional number of animal units will reduce Iowa property prices of up to 13.7% (Isakson & Ecker, 2008). Nonetheless, the negative price effect reduces with increased distance from animal farming operations (Isakson & Ecker, 2008). It diminishes for larger animal farms as they are newer, modern and well-managed (Herriges et al., 2005).

Certain studies even indicated a price premium for properties near new, highly concentrated and big-sized animal farming operations. In Minnesota, a new feedlot increases prices for homes within 3 miles of the feedlot (Taff et al., 1996). Meanwhile, in Indiana, the Indiana Business Research Centre (2008) found that multiple animal farming operations increase prices for properties located within ½ and 3 miles of distance from animal farming operations. Adding a 1000-animal unit livestock facility will increase the prices of nearby houses (500 m). Apart from the size and concentration of animal farming operations, the type of animals may also give variations in price impact. Ready and Abdalla (2005) compared price effects across swine and beef and dairy and poultry operations and discovered a larger discount effect for the latter type of animal operation.

An unusual result was discovered by Park et al. (2004), whereby a premium was found for houses located near beef and dairy operations and vice versa for houses located near hog or sheep operations. However, discounts were observed when the size of

the beef and dairy operations was increased, and premiums were observed when the size of the swine operations was increased. Interestingly, poultry operation was found to affect property prices either positively or negatively depending on the distance. Properties located closer to poultry farms (less than 2 miles of distance) enjoy price premiums, while properties located beyond 2 miles of distance from poultry farms suffer price discounts. In another study, the Indiana Business Research Centre (2008) found a premium for swine and beef operations and a discount for dairy operations. The literature has also shown that older and less expensive housing markets were most likely to be negatively affected by nearby animal farming operations (Indiana Business Research Centre, 2008; Park et al., 2004; Taff et al., 1996).

The existing body of literature demonstrated different price impact possibilities from animal farming. A price stigma attached to nearby properties was attributed to unpleasant odours, groundwater contamination and noise from animal farms. Meanwhile, a price premium attached to nearby properties may signify a rural lifestyle that exists with animal farming nearby (Park et al., 2004), increased housing demand from farm labour-driven population growth (Kuethe & Keeney, 2012; Taff et al., 1996) and advanced odour abatement technology in modern animal farming operations (Kuethe & Keeney, 2012). Nonetheless, this unique finding may also have been attributed to insufficient variables or transactions in the Hedonic pricing model, which may have masked the negative impacts of animal farms (Taff et al., 1996).

Moreover, the negative impact of animal farming operations was very localised in nature, as most studies only indicate that the impact is significant for houses up to one mile from animal farming operations. Previous literature has focused on hogs, swine, and live stocks in the United States of America. Despite the significant number of swiftlet farms in Southeast Asia, particularly Malaysia, and the negative externalities related to swiftlet farming, no one has attempted to quantify the effect of swiftlet farms on home prices. The current Malaysian literature on the impacts of swiftlet farming houses is limited to Md. Yassin et al. (2020). Despite showing the negative perception of local communities towards swiftlet farming houses, the study did not quantify the impact of swiftlet farming houses on the houses of nearby residents. It raises the question of whether swiftlet farms have an impact on house prices. If so, what is the magnitude of the impact?

The impact of proximity to swiftlet farming on house prices is an issue that merits consideration. The degree to which swiftlet farms generate negative externalities needs to be addressed, as prices of nearby homes can be potentially diminished, exaggerated or overstated. Inadequate information on the house price impacts caused by swiftlet farming industries may cause inaccurate market interpretation and estimation, as well as property management and decision-making for an area by property buyers, investors, valuers, estate agents,

property managers, and developers. The negative environmental impacts of the swiftlet farming industry, coupled with the scarcity of the literature on the housing market, highlight the need to quantify swiftlet farming's impacts on house prices. With price estimates in place, the property market players can respond quickly to changes in the market and make more informed decisions.

This study examines prior research on CAFOs, builds a Hedonic model to quantify the impact of living near swiftlet farms, and applies the model to home purchases in the Bentong area. The dirty and noisy surroundings of swiftlet farms in Bentong may impact nearby house prices. Thus, it is hypothesised that swiftlet farms negatively impact the housing property market, with nearer houses receiving greater price discounts. The findings of this paper contribute to the growing debate on the impacts of animal farming on the housing market.

MATERIALS AND METHODS

Research Location

The study was conducted in Bentong, a district with a population of 128,000 and spread over about 1,832 km² (Majlis Perbandaran Bentong, 2018) in Pahang (Figure 1). Apart from its lumber, eco-tourism, homestay and agro-tourism activities (Kenny & Kanavathi,

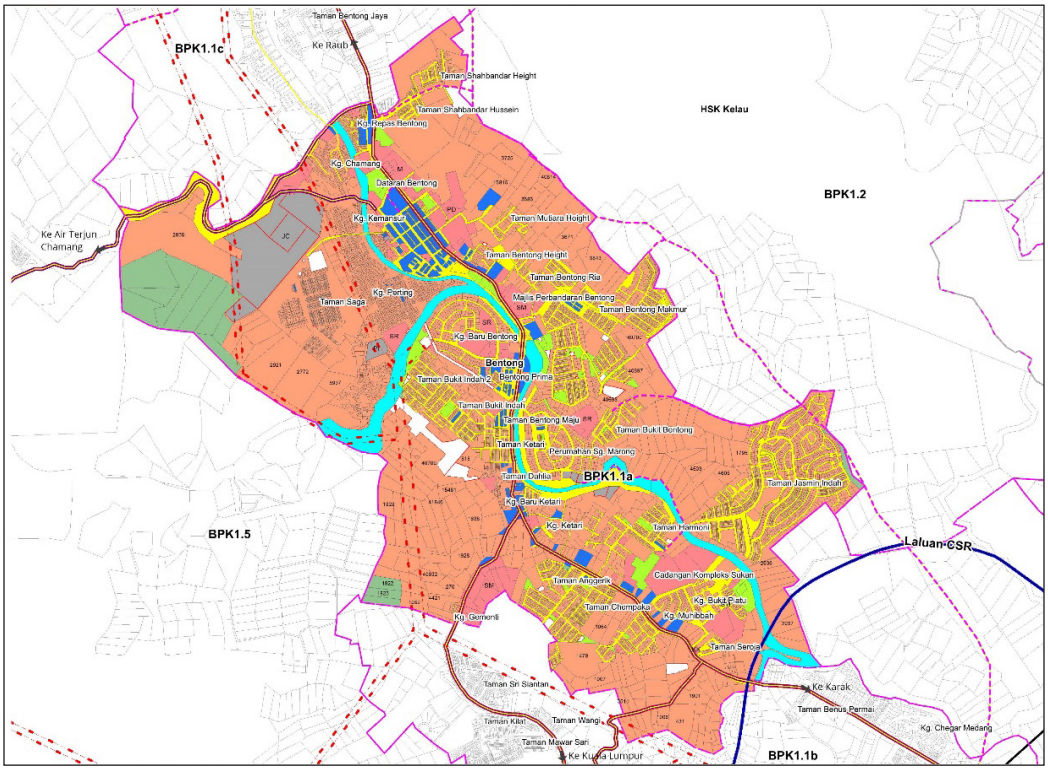

Figure 1: The study area
Source: Bentong Municipal Council (2018)

2016), there is a growing number of swiftlet farming activities in Bentong due to the good environment for breeding swiftlets. Swiftlets' primary foraging environments are wetlands, woodland, and open paddy plains (Petkliang et al., 2017). Thus, the mountains, rivers, and swamps surrounding Bentong provide a complete and long-term food chain for the swiftlets. A residential area 6km away from the heart of Bentong Town with 41 shop lots operated as swiftlet farming since 2009 has been selected as the study area. These converted shop lots were claimed to disturb the residents' daily lives since their operation ("Unlawful swiftlet farming," 2011).

Data Collection

A unified database of house observations transacted between 2009 and 2018 was set up. This database contained transaction price and property price-influencing attributes such as location and structural and neighbourhood characteristics sourced from the Valuation and Property Services Department of Pahang. Meanwhile, the Bentong Municipal Council supplied the spatial characteristics of houses and industrial areas. The distance variable was generated from an overlay of swiftlet farmhouse buffers and the location of houses in ArcGIS 9. Following the collection of data, any duplicate entries and outliers were removed to ensure the data used for analysis was of high quality (Nazri et al., 2022; Rahman et al., 2019; Sa'at et al., 2021). The permissible data range is as follows: the number of bedrooms must be between three and five, the transaction price must fall within the range of RM 90,000 and RM 490,000, the main floor size should be between 20 m^2 and 198 m^2, the house type must be terracing the location should be within a 4000-meter radius of the swiftlet farming house. Following the data cleansing process, researchers could choose 337 properties out of 342 transactions. Table 1 summarises the dataset used in this study.

In the study area, an average house has a land area of 16 2m^2 and 113 m^2 of main floor area priced at approximately RM214,566. A large portion of the middle lot (90%) was present in the dataset and corresponds to the Bentong residential property submarket. For comparison purposes, this study selected TM, Y11, FH and >2000 m to represent the middle lot terrace house transacted in 2011 and located more than 2000 metres from the swiftlet farming house area as reference variables. This selection aligns with Field's (2013) recommendation, whereby the reference variables are chosen based on the most frequent or largest instance in each category.

In accordance with previous works, the hedonic regression method was performed as it permits quantification of the impact of location, structure and neighbourhood characteristics (Adi Maimun et al., 2015; Adi Maimun, 2016), including swiftlet farming. The following equation is Rosen's (1974) hedonic price function.

$$P_i = \alpha\chi_i + \Sigma\beta_k S_{ki} + \Sigma\beta_q L_{qi} + \varepsilon_i\chi_i \quad (1)$$

Where i=1,..., N is the subscript denoting each property; Pi is the property price

Table 1
Descriptive statistics

Variables (N= 337)	Description	Minimum	Maximum	Mean	Standard Deviation
Price	Transaction price (RM/unit)	90000.000	483000.000	214566.250	79807.587
L_Price	Log transaction price	11.408	13.088	12.216	0.340
LA	Land area (m^2)	111.000	421.000	161.740	49.967
MFA	Main floor area (m^2)	71.540	197.700	112.508	38.980
BED	Number of bedrooms	3	5	3.520	0.646
TM	Intermediate lot	0	1	0.900	0.306
TE	End lot	0	1	0.050	0.213
TC	Corner lot	0	1	0.060	0.231
FH	Freehold	0	1	0.820	0.388
Y09	Year 2009 transaction	0	1	0.110	0.313
Y10	Year 2010 transaction	0	1	0.050	0.225
Y11	Year 2011 transaction	0	1	0.320	0.467
Y12	Year 2012 transaction	0	1	0.190	0.395
Y13	Year 2013 transaction	0	1	0.030	0.178
Y14	Year 2014 transaction	0	1	0.090	0.281
Y15	Year 2015 transaction	0	1	0.100	0.298
Y16	Year 2016 transaction	0	1	0.040	0.186
Y17	Year 2017 transaction	0	1	0.040	0.200
Y18	Year 2018 transaction	0	1	0.030	0.170
1000 m	House located within a 1000 metre distance from swiftlet farming	0	1	0.050	0.219
2000 m	House located within a 2000 metre distance from swiftlet farming	0	1	0.040	0.207
>2000 m	House located more than a 2000 metre distance from swiftlet farming	0	1	0.910	0.294

Source: Authors' work

i; k=1,..., K is the number of structural attributes; q=1,..., Q is the number of locational attributes; α ,β, and ε are the corresponding parameters; χi is a column vector that consists entirely of ones. Assuming a linear relationship between dependent and independent variables, no multicollinearity between independent variables and normally distributed, not autocorrelated and homoscedastic error terms. There is no clear direction from theory on selecting the proper functional form for regression (Malpezzi, 2003). However, this study utilises two of the four functional forms available, linear and semi-log functional forms, to represent both the linearity and non-linearity of the pricing. Linear methods quantify the direct monetary

impact of changes in house prices for each unit change in an independent variable. In contrast, semi-log models assess the percentage impact on prices for each unit change in an independent variable (Adi Maimun, 2016).

For this study, transaction prices (dependent variable) were regressed by land area, main floor area, number of bedrooms, type of tenure, position of building, year of transaction, and distance to swiftlet farming area (independent variables) to quantify the price impact of swiftlet farming area (2).

$$\text{Price}=\text{Constant}+(\beta x\text{LA})+(\beta x\text{MFA})+(\beta x\text{BED})+(\beta x\text{TM})+(\beta x\text{TE})+(\beta x\text{TC})+(\beta x\text{FH})+(\beta x\text{YR09})+(\beta x\text{YR10})+(\beta x\text{YR11})+(\beta x\text{YR12})+(\beta x\text{YR13})+(\beta x\text{YR14})+(\beta x\text{YR15})+(\beta x\text{YR16})+(\beta x\text{YR17})+(\beta x\text{YR18})+(\beta x1000\text{m})+(\beta x2000\text{m})+(\beta x>2000\text{m})+\varepsilon \quad (2)$$

In addition to the linear regression model (2), a semi-log regression model (3) was adopted to quantify the percentage of the impact of swiftlet farming areas on house prices.

$$\text{L\_Price}=\text{Constant}+(\beta x\text{LA})+(\beta x\text{MFA})+(\beta x\text{BED})+(\beta x\text{TM})+(\beta x\text{TE})+(\beta x\text{TC})+(\beta x\text{FH})+(\beta x\text{YR09})+(\beta x\text{YR10})+(\beta x\text{YR11})+(\beta x\text{YR12})+(\beta x\text{YR13})+(\beta x\text{YR14})+(\beta x\text{YR15})+(\beta x\text{YR16})+(\beta x\text{YR17})+(\beta x\text{YR18})+(\beta x1000\text{m})+(\beta x2000\text{m})+(\beta x>2000\text{m})+\varepsilon \quad (3)$$

The model's performance was evaluated through several statistical tests, which included R Squared (R^2), Adjusted R Squared (R^2), F value, and Sum of Estimated Errors (SEE) value. A good model will exhibit a value of R^2 and R^2 closer to the number 1, a large F value and a low SEE value (Adi Maimun, 2011; 2016). In addition, the Variation Inflation Factor (VIF) value was generated to ensure no evidence of multicollinearity in the model. A model with a VIF value less than 5 and a tolerance value greater than 0.2 indicates no multicollinearity (O'Brien, 2007).

RESULTS AND DISCUSSION

Table 2 tabulates the regression results for the linear and semi-log models. Both models demonstrate coefficient values matching the theory and acceptable R^2, F and SEE values. There was no indication of multicollinearity.

An analysis of the impact of swiftlet farming on house prices showed prices decrease with nearer distance to swiftlet farming and vice versa. This finding is consistent with Alonso's (1964) bid rent theory, which claimed that a house in a sought-after location would demand a higher price. In contrast, a house in an unfavourable neighbourhood would fetch a lower price. Thus, the declining prices reflect the buyer's unwillingness to pay more for houses near swiftlet farming. This backs with earlier studies on the detrimental impact of livestock husbandry on local home prices, such as Ables-Allison and Connor (1997), Herriges et al. (2005), Isakson and Ecker (2008), Milla et al. (2005) and Palmquist et al. (1997) and. Houses within 1000 m and 2000 m of swiftlet farming experience a discount of RM25,405 and RM22,963, respectively (19% to 21% of

Table 2
Regression results

Variables	Linear Model		Semi-log Model	
	B (t)	Tol (VIF)	B (t)	Tol (VIF)
Constant	44884.799* (-2.393)		10.998** (134.235)	
LA	512.331** (9.284)	.464 (2.157)	0.002** (9.166)	.464 (2.157)
MFA	975.831** (14.815)	.535 (1.870)	0.004** (14.443)	.535 (1.870)
BED	11195.950* (2.346)	.371 (2.696)	0.081** (3.863)	.371 (2.696)
TM	Reference		Reference	
TE	7564.892 (0.821)	.914 (1.094)	0.072 (1.796)	.914 (1.094)
TC	-14702.116 (-1.276)	.498 (2.009)	-0.062 (-1.234)	.498 (2.009)
LH	-5180.682 (-0.895)	.699 (1.431)	-0.003 (0.127)	.699 (1.431)
1000 m	**-25405.054*** **(-2.193)**	.547 (1.829)	**-0.187**** **(-3.703)**	.547 (1.829)
2000 m	**-22963.456** **(-1.812)**	.514 (1.944)	**-0.209**** **(-3.780)**	.514 (1.944)
>2000 m	Reference		Reference	
Time controlled	Yes		Yes	
R^2	0.823		0.814	
R^2	0.814		0.804	
F	87.530		82.285	
SEE	34413.888		0.1503073	

Note. **denotes p-value significant at 0.01
Source: Authors' work

the price difference) compared to houses located beyond 2000 m of swiftlet farming. It implies that noise pollution and aesthetics concerns by residents of Bentong are indeed reflected in a price discount for houses located near swiftlet farming. Noise pollution caused by the sound of swiftlet tweeters installed on swiftlet farming house premises used to attract swiftlet is the most severe impact of swiftlet farming houses, as Duckett (2010) mentioned.

In regard to aesthetics, the conversion and erection of buildings for swiftlet farming have not only changed the appearance of buildings but also disrupted the scenery of the area. Nonetheless, the impact lessens as houses move farther from swiftlet farming houses. This corroborates Herriges et al.'s (2005) results, who observed no evidence of price discounts for properties located beyond 1½ miles or 2000 m from a hog farm.

CONCLUSION

This study examined the effect of swiftlet farming on Bentong house prices. A hedonic analysis of 337 transactions observed evidence of swiftlet farming's impact on house prices. This finding supported the findings in other countries, namely the United States. Consistent with the location theory, this study found an inverse price impact that enhanced with closer distance from the swiftlet farming area. It implied that there was an optimum distance to swiftlet farming houses that buyers preferred. Buyers were unwilling to pay for houses located near swiftlet farming houses due to the noise pollution and obstruction of view coming from swiftlet farming houses. Nonetheless, the negative price impact diminished for houses located beyond 2000 metres.

This study employed buffers to measure the distance of houses from swiftlet farming. To ensure a more accurate measurement of the price impact, it is suggested that future studies employ individual distance measurement and add other significant variables pertinent to house prices, such as distance to the city centre and facilities and consider a few more swiftlet farming areas which differ in size, concentration and management practices. A comparison across different species of animal farming may also generate interesting findings. A study on the price impact of building after converting into swiftlet farming houses may also be worth venturing in. This study has enhanced further understanding of the swiftlet farming impact on house prices in the body of literature. Swiftlet farming houses may be white gold to some housing markets but not in Malaysia, specifically within the Bentong area, due to the negative externalities of the swiftlet farming houses. This calls for improved policy enforcement in managing and monitoring swiftlet farms to reduce the negative externalities to the nearby residential area.

The findings may also guide valuers in valuing the impact of swiftlet farming on nearby house prices, specifically to give discounts to houses located near swiftlet farms. Town planners can also establish the optimum buffer size (at least 2000 m) around swiftlet farms in Bentong to ensure a minimal impact on surrounding house prices and residents' health in general.

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