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Flood and Land Property Values

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Abstract

Flood disaster has become a natural concern to the land owners where it raised a critical issue in term of land value depreciation. Previous studies have discussed the issue of potential decline in the value of land which are located on the flood-liable area. However, in Malaysia, current studies on flood impact are considered limited and do not focus on the effects of flood on land property. With the Hedonic Pricing Model (HPM) approach, we investigate the effect of flood on agricultural and industrial land property values in the urban and rural areas in Malaysia. The analysis indicates that the agricultural and industrial land values in the urban and rural areas have significantly decreased due to flood events. This study will benefit the land owners to understand the flood impact on land value and also the factors that contribute to the loss in the land value. It becomes the responsibility of the land owner to put the asset and property to its best use, given the presence of the flood. In addition, this study will help the policy maker to design and allocate land development efficiently in the urban or rural areas for agricultural and industrial project to ensure depreciation value of the land is minimized in the case of flood.

Keywords: flood, hedonic price model, land property, valuation

1. Introduction

Flood is one of the natural disasters that have devastating effect on the economic loss and property damaged. Flood that comes to a piece of land property at random interval will destroy the capital and economic activity on the property will be interrupted. For example, the destruction of property and asset in a country that experienced major flooding takes a long time to recover and resulting in high repair cost. This may result in depreciation in property values. Therefore, the main responsibility of the landowner is to put the property and asset to its best use, given the occurrences of this flood. The consequences of flood on both society and properties differ depending on its attributes such as velocity, depth, frequency and duration (Queensland Floods Science, Engineering and Technology Panel, 2012). According to Bin and Polasky (2004) and Saptutyningsih and Suryanto (2010), the impacts of flood on property have been analysed from various aspects such as residential property value and land property value.

Past studies show that topic on flood disaster and residential property values have been explored by many researchers in the past studies. However, only a few studies have addressed on the effects of flood disaster on land property values. Part of the reason why this topic is less explored by researcher is because not easy to measure the value of land itself. According to Case (1994), most land is sold in combination with capital which makes the task of separating the land from the capital value is difficult. For example in the United States; all property taxes in the United States are levied on the combined value of land and capital. So there is no compelling reason for tax administrators to undertake to separate the two. Greenberg et al. (1974) and Damianos and Shabman (1976) are among the earliest researchers who study the impact of floods on the land price. Other researchers such as Zhai, Fukuzono and Ikeda (2003) and Saptutyningsih and Suryanto (2010) have analysed the relationship between flood event and land value in Asia such as Tokai in Japan and Yogyakarta in Indonesia. All these studies attempted to focus on the indirect impact of flood disaster based on single occurred event. For example Zhai, Fukuzono and Ikeda (2003) analyse the effect of flood on land prices based on case study of Tokai flood had happened in September 2000. They found that flood has effect on the land prices.

Malaysia faces frequent flood event every year where most of the peninsular states experienced flood occurrence

during the periodic monsoon seasons. Even though flood events in Malaysia are not being classified as extreme flood disaster, but the yearly flood occurrence have affected the population and caused damage to the properties. Many studies have been done on flood in Malaysia such as Chan (1996 and 1997). However these studies do not focus on the effect of flood on land property values. In Malaysia, existing studies have focused on the disaster management aspect involving flood risk and flood hazard management including level of understanding and policy regulation practiced (Chan, 1996), causes and solution (Chan, 1997), and health preparedness (Singh & Subramaniam, 2009),

Besides that, literature related to Hedonic Pricing Model and its application to the property research in Malaysia is considered limited and does not incorporate flood. To date, studies on flood and land property in Malaysia using Hedonic Pricing Model remain unexplored. Hence, it becomes an interesting issue to see whether there are differences in the effects of flood on the value of land property in the rural and urban areas in Malaysia. This study contributes on predicting the value of agricultural and industrial land property in the urban and rural areas which influenced the land owner to ensure the good use of land even though it is in the flood prone area or flood free area. Besides that, it also contributes towards new perspective on the property literature regarding the impact of flood in Malaysia whereby the application of Hedonic Pricing Model is integrated into the effect of flood on land value.

Hence, the main objective of this paper is to determine the effect of flood, measured by flood duration, on the land property values in the urban and rural areas. By using Hedonic Pricing Model (HPM) in estimating the flood impact on land value, this study could inform policy makers in efficiently designing and allocating property development for agricultural and industrial project to ensure that property loss is minimize in the case of flood.

The remainder of the paper is organized as follows. The next section is the reviews of related literature on the effect of flood on land property values. Follow up with the section that explained the methodology applied in the study and the empirical results and discussion. Final section concludes and provides some recommendations.

2. Reviews of Relevant Literatures

The impact of flood on property values can be measured by flood depth, flood duration and flood frequency. Minnery and Smith (1996) suggested that flood depth significantly impact property damage. Therefore, it might also affect the property values as well; for example, minor flooding causes little damage on property. However if the water rises above the floor level, it might cause much damage and effect the property price sold in the flooded area. Similarly, Montz (1992a, 1992b) found that properties that were frequently hit by flood have its value reduced and experience a slow recovery in its sold price. Generally, properties which frequently experienced flooding tend to increase the perceived risk associated with the flooding. As a result, the property values significantly decline in value due to flood occurrence.

According to Eves (2004) and Saptutyningsih and Suryanto (2011), the existing literature shows that duration of flood is an important variable in studying the impact of flood on residential and land properties value. In the analysis of flood impact on residential property values, Eves (2004) and Soentato and Proverbs (2004) demonstrated that there is a negative relationship between duration of flood and house value. Usually, the longer the duration of flood, resulting in more decreased in property values. This is because, a greater amount of cost are needed for repairing works on the damage property in every time the flood hits. Similarly, studies regarding effect of flood on land price also used the flood duration characteristic. Saptutyningsih and Suryanto (2011) study the effect of flood on agricultural land property values in Yogyakarta, Indonesia. They found a negative relationship between flood duration and land price. The results show that the increase of time length of flood inundation by eight days will affect the price loses approximately at USD46.43.

Hedonic Pricing Model (HPM) and the repeat-sales method are the two approaches that have been used frequently to measure the value of property. They have been applied extensively in the Australia, Europe and the United States. For example, Palmquist and Danielson (1989) applied the HPM in their agricultural land studies in the United States, meanwhile Lamond, Proverbs and Antwi (2007) applied the repeat-sales method in their property studies in the United Kingdom. Even though both the HPM and repeat-sales method used to estimates property price to measure the value of property on particular attributes but the application of both methods differs.

Bailey, Muth and Nourse (1963) suggested that the repeat sales method is based on the price changes of property that have beensold more than once. The main advantage of the repeat-sales method is that the method requires less information and less costly (Shimizu, Takatsuji, & Nishimura, 2010). Besides that, the method can be used to control the property attributes that accurate measurement of property price could be measured. However,

according to Hensen (2006), it has been argued that the repeat-sales method tends to have a sampling bias issue. The difference in the property price movements between low cost and high cost properties will provide sample biased of overall property price changes. In addition, the different in characteristics between properties that were traded several times compared to a typical one can also contribute to the sample bias (Shimizu, Takatsuji and Nishimura, 2010). According to Dorsey et al. (2010) and Palmquist (1982), another weakness of the repeat-sales method is that the method can only measure a constant quality of property and cannot measure the price changes over different time period. Due to these limitations, researchers such as Harrison, Smersh and Schwartz (2001) prefer to apply HPM to estimate the property values.

According to Triplett (2004), HPM is more comprehensive and practical approach. The method can overcome the limitations in the repeat-sales methods. The primary advantage of the HPM is that all the available sales data can be used. Basically, HPM investigates the relationship between sale prices and property characteristics. Ridker and Henning (1967) were among the earliest researchers applying HPM in determining residential property price by investigating the relationship between environment attributes and property values. Later, Rosen (1974) and Freeman (1979) established the approach by estimating people's values for their conveniences on goods such as location and structural attributes.

Even though a few studies have addressed the flood impact on land property values, there are some of researcher who attempt to focus on applying HPM in analysing the connection between flood and land price. To date, studies have been applied HPM in agricultural land are such Miranowski and Hammes (1984) and Palmquist and Danielson (1989). They found that there will be declining in land price resulted from flood event. Zhai, Fukuzono and Ikeda (2003) and Saptutyningsih and Suryanto (2010) proposed HPM to measure the flood impact on land prices. Land prices are closely related to the infrastructure development, road width, distance to the nearest subway station, and the building-area and floor-area. Zhai, Fukuzono and Ikeda (2003) found that the land price in the flooded areas are lower and have less variance than the flood free area. Similar to this, Saptutyningsih and Suryanto (2010) studied the influence of flood disaster on land price changes in Yogyakarta, using the HPM. They found that the flood significantly reduces the land price.

3. Methodology

As discussed in the previous section, many researchers successfully implemented the HPM to investigate the effect of flood on land price changes. Based on the previous arguments, the HPM can be used to measure the effect of flood on land properties value. Therefore, this study's methodology builds on the existing literature dealing with the flood attributes by including a flood variable into the HPM. The HPM enables the possible influence of each attributes on the property price to be tested and analysed. There are many factors and attributes that influence the land property price. In this study, these factors and attributes are classified into flood (FLOOD), location (LOC), structural (STR) and neighbourhood (NGH) as shown in the Table 1. The functional form of the model explaining property price (P) using HPM is shown in Equation (1);

$$P = f\ (FLOOD, \mathrm{LOC}, STR, NGH) \tag{1}$$

Selection of elements to be the factor for flood variable, location attributes, structural attributes and neighbourhood attributes are based on the review on the past relevant literature. It is important to look into the appropriateness of these elements to be applied and tested in Malaysia. This study proposed the semi-log functional form which is log-linear functional form because according to Basu and Thibodeau (1998), the semi-log functional form can be used to correct the heteroscedasticity problem between land price and the residuals. Hence, the final log-linear equation for this study is as in Equation (2);

$$ln\ P_i = \beta_0 + \Sigma\beta_j\ DUR_{ij} + \Sigma\beta_u\ LOC_{iu} + \Sigma\beta_l\ STR_{il} + \beta_k\ NGH_{ik} + \mu_i \tag{2}$$

where P is a vector price for land property. The parameters to be estimated are $\beta_1, \beta_2, \beta_3, \beta_4$ and ε is the random error term. For the log-transformed explanatory variables, the estimated coefficients measure the price elasticities with respect to a given variable.

DUR is the matrice of flood duration. As discussed in the previous section, the measurement unit used for DUR is hours. Meanwhile, LOC is the matrice of location attributes. For the location attributes, elements of distance to bus station and distance to city centre are used. The measurement unit for both elements is kilometers (km). This study examines whether the distance between agricultural and industrial land to the LOC attributes does affect the value of land. Based on Zhai, Fukuzono and Ikeda (2003) and Saptutyningsih and Suryanto (2011), the distance to the public transport such as subway station and bus station can be used as the factor elements for location attributes. This study used distance to the nearest bus station instead of subway station because in Malaysia, rapid mass transit facilities such as subway station are not available; meanwhile public transportation

such as bus is widely available throughout the country. The result can be either in positive or negative, for example Baldwin (2001) found that real estate which is situated near the transportation access lead to the higher value. Property price decreases with increasing distance from a bus station. Previous studies such as McCann (2001) and Fujita and Thisse (2002) found that distance to city centre has negative relationship with the property market values. The price of land is highest in the area city centre and decrease with every unit of distance from city.

STR is the matrice of structural attributes. Previous studies such as Maddison (2000) and Zhai, Fukuzono and Ikeda (2003) have shown that structural attributes are important determinants of the size of land and presence of infrastructure facilities. This study apply elements including size of land, presence of infrastructure facilities and telecommunication area as the elements in the structural attributes in determining the land property values in Malaysia. The measurement units for size of land is hactare. Meanwhile, the dummy variables for the presence of infrastructure facilities and telecommunication area, dummy equals one if the attributes presence and otherwise zero. Based on the review on previous literature, there is no study that examines the relationship between telecommunication area and land value. Thus, this study helps to fill this gap in the literature and contributes to the new knowledge on land property values. Maddison (2000) found a positive and significant relationship between property values and the land size. Increased in the size of land tends to have higher value. Meanwhile, the existing study on impact of infrastructure facilities and land value are scarce. In general, infrastructure is a basic facility that can be describes as road system or electricity that helps to run the development in the land area. Infrastructure is important for the economic development in any land such as residential, industrial and agricultural land. A study by Zhai, Fukuzono and Ikeda (2003) found that infrastructure development and road system had positive relationship with the land value.

NGH is the matrice of neighbourhood attributes. Neighbourhood attributes represent the neighbourhood characteristic such as airports, hospitals, schools, recreational parks and rivers. This study used the distance of property area to the nearest airport and river as the factor elements and the measurement units are kilometers (km). This study evaluates whether the presence of airport and river near to the agricultural and industrial land areas might affect the land property values. Gautrin (1975) found that the land property values located near to the airport area tends to increase more rapidly compare to other area. Espey and Lopez (2000), however, found otherwise. The researchers reported that the land property closer to the airport have lower value than those farther away from it. However, there has been limited research on the impact of distance to the nearest river on agricultural land value. To date, there is lack of studies regarding the effect of distance to the nearest river or drainage on the land value. However, Saptutyningsih and Suryanto (2010) used the distance to river and drainage as important elements to include in the neighbourhood characteristic. Generally, the presence of river or drainage near the agricultural land becomes a major concern to the land owner. This is because, river and drainage play very important part in water cycle especially for farming and crops grown in agricultural land and orchid.

Based on the discussion, the suggested hypotheses and expected signs of the flood duration, location, structural and neighbourhood variables are shown in Table 1.

Table 1. Expected sign of the coefficients

Variables	Element	Description	Expected Sign
Flood	DUR	Duration of flood (hours)	Negative
Location	BUS	Distance to the nearest bus station (km)	Positive/Negative
	CITY	Distance to the nearest city centre (km)	Positive/Negative
Structure	LAND	Size of land (hectare)	Positive
	DINFRA	Presence of infrastructure facilities (Dummy – 1: Yes, 0: otherwise)	Positive
	DTELE	Presence of telecommunication area (Dummy – 1: Yes, 0: otherwise)	Positive
Neighbourhood	AIRPORT	Distance to nearest airport (km)	Positive/Negative
	RIVER	Distance to nearest river (km)	Positive/Negative

3.1 Data and Sources

The target population in this study were agricultural and industrial land in rural and urban areas that affected by flood from 2008 to 2013. This study used stratified sampling method to highlight a specific sub group in the population, where the entire target population was divided into different subpopulation. In order to obtain a stratified sample of flood victims, this study would first organize the population by states and districts. The area of study covered the whole area of Peninsular Malaysia. The scope area was narrowed down to the certain districts that were hit by floods. The sample frame employs in this study were two districts in each state that were hit by flood. The information and data on land property will be acquired from secondary sources; where list of information regarding land can be directly taken from the govenment and private agencies such as National Property Information Centre, Valuation and Property Services Department, Municipal Council, Malaysian Department of Social Walfare, Malaysian Department of Statistics and Malaysian Department of Irrigation and Drainage's Annual Flood Report from 2008 until 2013.

4. Results and Discussions

A total of 410 observation land price including agriculture and industrial land which experienced flood events were obtained from Land and District Office and National Property Information Centre. The proposed model was used to evaluate the flood effect on land price. The descriptive statistics of the quantitative variables are shown in Table 2.

Table 2. Descriptive statistic on land property values

Variable	Minimum	Maximum	Mean	St. Deviation
Flood;				
- DUR	0.00	72.00	15.0439	20.27664
Location;				
- BUS	0.20	23.80	10.7722	11.41702
- CITY	0.23	16.60	10.5786	9.39878
Structural;				
- LAND	0.0152	11.00	1.303761	1.3817055
Neighbourhood;				
- AIRPORT	1.90	203.00	50.1827	37.94915
- RIVER	0.80	17.20	2.9482	4.44464

Table 2 shows that the flood duration (DUR) that hit the study areas from 2008 to 2013 range between 0 to the highest 72 days. The mean and standard deviation of the flood duration are 15.04 and 20.27 days respectively. For the location attributes, the distance to the nearest bus station (BUS) stated in this study range from the minimum 0.20 to the highest 23.80 kilometers. Besides that, the distance to the nearest city centre (CITY) surveyed in this study range from the minimum 0.23 to the maximum 16.60 kilometers.

The structural attributes which are selected for this study consist of size of agricultural and industrial land, infrastructure facilities and telecommunication area. Based on the result above, the size of agricultural and industrial land (LAND) surveyed in this study range from the minimum 0.0152 to the maximum 11.0 hectare. The mean and standard deviation for the size of land are 1.30 and 1.38 hectares respectively. The results of neighbourhood attributes show that the distance to the nearest airport (AIRPORT) recorded in this study range from the minimum 1.90 to the highest 203 kilometers. Meanwhile, the minimum distance to the nearest river (RIVER) reported in this study is 0.80 and the maximum distance is 17.20 kilometers.

The main objectives in this study is to investigate the effect of flood on land property values in Malaysia. Therefore, this study examine whether there are any difference in the flood event occurred in resulting between urban and rural areas. In order to minimize the problem of multicollinearity and heteroskedasticity, the choice of variables to include in the equation must be carefully selected. Besides that, semi-log functional form (dependent) was used in this model which can correct for heteroscedasticity and multicollinearity problems (Basu and Thibodeau, 1998). The result of the hedonic regression on land property values is presented in Table 3;

Table 3. Estimates of hedonic regression on land property values

Variables	Urban Area		Rural Area	
	Coefficient	St. Error	Coefficient	St. Error
(Constant)	13.425***	0.470	13.642***	0.493
Flood;				
- DUR	-0.042***	0.006	-0.047***	0.007
Location;				
- BUS	0.070	0.044	0.051	0.055
- Bus^2	-0.002*	0.001	-0.002	0.001
- CITY	-0.204***	0.064	0.044	0.061
- $City^2$	0.007***	0.002	-0.002	0.02
Structural;				
- LAND	0.417***	0.113	0.162***	0.061
- DINFRA	0.384*	0.212	0.044	0.265
(have infrastructure facilities = 1)				
- DTELE	-0.333	0.404	0.159	0.266
(have telecommunication area = 1)				
Neighbourhood;				
- AIRPORT	-0.020**	0.009	-0.046***	0.008
- $Airport^2$	0.0001**	0.001	0.0002***	0.000
- RIVER	0.357***	0.136	0.278**	0.118
- $River^2$	-0.025**	0.012	-0.020***	0.007
R-Squared	0.451		0.599	
Adjusted R-Squared	0.408		0.567	
F-Value	10.354		18.830	
p-value	(0.000)		(0.000)	

Note. *, **, *** denote the significant at 10%, 5% and 1% respectively

We apply flood duration as the indicator of flood variable in measuring the effect of flood on land property values in the urban and rural areas. Table 3 shows that the R-Squared in both urban and rural areas are 0.451 and 0.599 respectively of the variation in the dependent variable can be explained and accounted for by the independent variables in this regression analysis. However, the adjusted R-Squared results indicate that only 0.408 and 0.567 respectively of the variation in the dependent variables can be explained by the regressors in influencing the independent variable. The p-value for the F-statistic in all models is less than 0.05 indicate that the independent variable as a whole is statistically significant. Therefore, the overall models of specification is said to be statistically significant and the equation can be accepted for forecasting the value of land property.

Table 3 shows there is no multicollinearity issues as the Variance Inflation Factor (VIF) of all coefficients are below 10, the rule of thumb as suggested by Field (2013). The results show that the variable of flood duration (DUR) in urban and rural areas are negative and statistically significant. It explains that if the flood duration is increased by an hour, the land value in urban and rural areas decreased by 0.042 and 0.047 per cent. It shows that the land property in the urban and rural areas which face a high risk of prolonged periods of flooding tend to have a lower price in the market. This is because the prolonged periods of flooding continuously caused damage and destruction to the crops in the agricultural land or factory building in the industrial land. For example, the massive floods in rural area in Segamat and Tanah Merah has caused a serious destruction on agricultural sector especially to the vegetable crops, fruits and trees (Department of Irrigation and Drainage Malaysia, 2007 and 2014). The prolonged period of flood duration resulted decreased in crops productivity in the rural area.

Therefore, landowners and farmers who are involved with the cultivation of crops will lost the revenue in the long term period between six months to a year. Consequently, the loss and damages of crops and farming resulting a low demand for this land and affect the value of agricultural land. This result is consistent with the findings by Saptutyningsih and Suryanto (2010).

Besides that, the prolonged period of flooding also affected the premises and factories that operate in the industrial land in the urban or rural area. The long term flood did paralyzed the industrial activities involved and caused a serious damage to the assets which is located in the industrial land such as factory building and premises. For example, major floods in urban area, Dungun in 2014 resulted the destruction of the business premises, industrial plants and equipments which resulting high repair cost (Majlis Keselamatan Negara, 2015). Therefore, this situation will affect the buyer's decision to buy an industrial land in the flood prone area since the conditions of prolonged flooding will involved huge reconstructing cost as well as reducing the property market price.

A negative and statistically significant sign of coefficient CITY in urban area indicates that a kilometer increase in the distance to the nearest city centre will reduce the land value by 0.204 per cent. The land value will fall until the distance to the nearest city reaches a certain level of limit, then the value will increase at 0.007 per cent. It means that a land located near to city in the urban area tend to have significant higher market value. This is because, according to Woham et. al (2010), the pace of development in the city centre especially in the urban area has a positive impact on the land activities in the surrounding area. For example, in urban area Kuantan, the agricultural and industrial sectors are carried nearby city and the result of production activities will be exported directly to the city. This is because, city plays an important access as a center for the collection of finished products (Rostam, 2000). Therefore, the location of city centre in the urban area is significantly affecting the value of agricultural and industrial land. This result is consistent with the finding by Zhai, Fukuzono and Ikeda (2003).

Coefficients of LAND in the urban and rural area show a positive and statistically significant, indicate that a hectare increases in size of land will increase the land value by 0.417 and 0.162 per cent respectively. This positive relationship shows that an increase in the land size makes the land area become extra-large and spacious. For example, we looked at the industrial sector in both urban and rural areas; where an increase in the industrial site land provides an opportunity to the industry company to plan the construction of new factory, and upgrading of infrastructure and facilities in the new land for better development of industry. In addition, an increase in the land size that is appropriate for industry growth, contributes the development for the investment projects. As a result, the demand for the increase land size creates more value to the land. Thus, it makes the increasing size of industrial land produced a high market value of property either in the urban or rural area. This finding lends support to the ones reported by Maddison (2000).

Meanwhile, a positive and statistically significant coefficient of DINFRA indicates that the value of land with presence of infrastructure facilities such as road and electricity in the urban area increased by 0.384 per cent more than a land without any infrastructure facilities. It shows that the land with a presence of road and electricity has high market value in the urban area. This is because, the infrastructure facilities such as road system in the urban area is crucial to increase the capacity and to provide access to an area. According to Han et. al (2011), good infrastructures such as road system has a positive relationship where increases in the road network will flourished the economic growth in surrounding urbn area. Besides that, Woharn et. al (2010) also agreed that a land with complete infrastructure facilities such as located near the highways play an important role in attracting investors to invest in the particular land nearby. This would increase the market value of the land. For example, the North-South Expressway located near the urban area Nilai Industrial Area helps the transportation aspects such as exporting the finished goods and importing the raw materials or components for the industrial activities. Thus, it shows that the infrastructure facilities not only has a positive impact to the land but also to its value as well. These results are consistent with the findings by Maddison (2000) and Zhai, Fukuzono and Ikeda (2003).

The negative and statistically significant result for the coefficient of AIRPORT in urban and rural areas show that if the distance to the nearest aiport increased by a kilometer, the land value decreased by 0.020 and 0.046 per cent respectively. However, the land value will significantly increase by 0.0001 and 0.0002 per cent respectively in the urban dan rural areas when distance to the nearest airport reaches a certain level of limit. It means that the land which is located near the airport area has a high value. This is because, the perspective of the strategic location of industrial and agricultural land in both urban and rural aresa located near the airport gives a positive impact on industrial management and production. Apart from the rapid economic development in the surrounding urban and rural areas, the location of the industrial land nearby airport helped to facilitate the

industrial exports products directly using air transportation. This makes the industrial and agricultural land in the urban and rural areas near to the airport has affect the value of property.

The coefficients of distance to the nearest RIVER in the urban and rural area are positive and statistically significant. That means if the distance to the nearest river increases by a kilometer, the land value also increased by 0.357 and 0.278 per cent respectively in the urban dan rural areas. In spite of that, the value of land will significantly decreased by 0.025 and 0.020 per cent respectively if the distance to the nearest river is reaches a certain level of limit. It shows that the land properties located near the river has a lower market value in the urban or rural areas. This is because river is also said to be one of the causes of flooding. According to Department of Irrigation and Drainage Malaysia, disposal of solid wastes into rivers is one of the causes of human induce flood. Besides that, most of the river erosion will cause the collapse of the banks such as Sungai Kelantan (Wee and Ariffin, 2011). As a result, any agricultural or industrial land located near the river is at great risk for flooding. Mar Iman and Hamidi (2005) found that the value of land located within a distance of less than 200 meters from the river bank is RM305 per square meter smaller than a land in the 500 meters further away from the river bank. This indicates that a land situated nearby the river will affect the property values as well. Therefore, the distance to the nearest river does affect the land property values in both urban and rural areas.

5. Conclusions and Recommendations

This study is examining the relationship between flood and land value in urban and rural areas. The results in the study are consistent with the previous ones where the flood duration had adversely affected the value of land. The result suggests that agricultural and industrial land prices in the urban dan rural flood prone areas suffered reduction in property market values as well as it causes serious property damage to the asset such as crops and factory building on the land. It indicates the responsibility of the agricultural and insdustrial land owners to put the asset and property to its best use, given the presence of the flood. Thus, the solutions on structural and non-structural such as flood mitigation project and measure provide an immediate action to avoid the flood problems. Consequenctly, this project would also help the policy maker to efficiently design and allocate the land development for agricultural and industrial sectors in urban dan rural areas to ensure depreciation value of the land is minimized in the case of flood.

Previous literatures have demonstrated that the Hedonic Pricing Model (HPM) is very useful method studying the relationship between property attributes and its prices. The HPM tends to indicate that land property values is correlated with the location, structural, and neighborhood attributes. The results show that most of the coefficients in the locational, structural and neighbourhood attributes are significant and have a priori sign. Therefore, these attributes could be priced in a similar way in Malaysia, as with other countries. HPM demonstarate an accurate portrayal and information on attributes of land property which might affecting the land value. Finally, the analysis indicates the negative relationship between flood and the value of land in the urban and rural areas.

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References

Bailey, M., Muth, R., & Nourse, H. (1963). A regression method for real estate price index construction. *Journal of the American Statistical Association, 58*, 933-942.

Baldwin, R. E. (2001). Core-periphery model with forward-looking expectations. *Regional Science and Urban Economics, 31*(1), 21-49. http://dx.doi.org/10.1016/S0166-0462(00)00068-5

Basu, A., & Thibodeau, T. G. (1998). Analysis of spatial autocorrelation in house prices. *Journal of Real Estate Finance and Economics, 17*(1), 61-85.

Bin, O., & Polasky, S. (2004). Effects of flood hazards on property values: Evidence before and after Hurricane Floyd. *Land Economics, 80*(4), 490-500. http://dx.doi.org/10.2307/3655805

Case, K. E. (1994). *Land prices and house prices in the United States*. National Bureau of Economic Research. 29-48. Retrieved February 2, 2013, from http://www.nber.org/chapters/c8820

Chan, N. W. (1996). Flood disaster management in Malaysia: an evaluation of the effectiveness of government resettlement schemes. *Disaster Prevention and Management, 4*(4), 22-29.

Chan, N. W. (1997). Increasing flood risk in Malaysia: causes and solutions. *Disaster Prevention and Management, 6*(2), 72-86.

Damianos, D., & Shabman, L. A. (1976). *Land prices in flood hazard areas: applying method in land value analysis*. Virginia Water Resources Research Centre. Bulletin 95.

Dorsey, R. E., Haixin, H., Walter, J. M., & Hui-chen, W. (2010). Hedonic versus repeat-sales housing price indexes for measuring the recent boom-bust cycle. *Journal of Housing Economics, 19*(2), 87-105. http://dx.doi.org/10.1016/j.jhe.2010.04.001

Espey, M., & Lopez, H. (2000). The impact of airport noise and proximity on residential property values. *Growth and Change, 31,* 408-419. http://dx.doi.org/10.1111/0017-4815.00135

Eves, C. (2004). The impact of flooding on residential property buyer behaviour: an England and Australian comparison of flood affected property. *Structural Survey, 22*(2), 84-94. http://dx.doi.org/10.1108/02630800410538613

Field, A. (2013). *Discovering statistics using IBM SPSS statistics*. London: Sage Publication Ltd.

Freeman, A. M. (1979). Hedonic prices, property values, and measuring environmental benefits: a survey of the issues. *Scandinavian Journal of Economics, 81,* 154-173.

Fujita, M., & Thisse, J. F. (2002). *Economics of Agglomoration: Cities, Industrial location, and Regional Growth.* Cambridge: Cambridge University Press.

Gautrin, J. F. (1975). An evolution of impact of aircraft noise on a property values with a simple model of urban land rent. *Land Economics, 51*, 80-86.

Greenberg, E., Levin, C. L., & Schlottmann, A. (1974). *Analysis of theories and methods for estimating benefits of protecting urban flood plains, St. Louis: Washington University, Institute for Urban and Regional Studies.*

Hansen, N. (2006). An analysis of mutative σ-self-adaptation on linear fitness functions. *Evolutionary Computation, 14*(3), 255-275. http://dx.doi.org/10.1162/evco.2006.14.3.255

Harrison, D. M., Smersh, G. T., & Schwartz, A. L. (2001). Environmental determinants of housing prices: the impact of flood zone status. *Journal of Real Estate Research, 21*(1), 1-20.

Lamond, J., Proverbs, D., & Antwi, A. (2007). The impact of flood insurance on residential property prices: Towards a new theoretical framework for the United Kingdom market. *Journal of Financial Management of Property and Construction, 12*(3), 129-138. http://dx.doi.org/10.1108/13664380780001099

Maddison, D. (2000). A hedonic analysis of agricultural land prices in England and Wales. *European Review of Agricultural Economics, 27*(4), 519-532. http://dx.doi.org/10.1093/erae/27.4.519

McCann, P. (2001). *Urban and Regional Economics*. Oxford: Oxford University Press.

Minnery, J. R., & Smith, D. I. (1996). Climate change, flooding and urban infrastructure: In W. J. Bosma, G. I. Pearman, & M. R. Manning (Eds.), *Greenhouse, Coping with Climate Change, CISRO, Australia* (pp. 235-247).

Miranowski, J. A., & Hammes, B. D. (1984). Implicit prices of soil characteristics for farmlands in Iowa. *American Journal of Agricultural Economics, 66*, 745-749.

Montz, B. E. (1992a). The effect of flooding on residential property values in three New Zealand communities. *Disasters, 16*(4), 283-298.

Montz, B. E. (1992b). *The impact of flood hazard area disclosure on property values in three New Zealand communities.* Natural Hazard Research Working paper 76. Natural Hazards Research and Applications Information Centre, University of Colorado, Colorado.

Othman, J., Othman, R., & Mohd Nor, N. (2006). Welfare impacts of air quality changes in Malaysia: The hedonic pricing approach. *Jurnal Ekonomi Malaysia, 40*, 47-58.

Palmquist, R. B. (1982). Measuring environmental effects on property values without hedonic regressions. *Journal of Urban Economics, 11*, 333-347.

Palmquist, R. B., & Danielson, L. E. (1989). A hedonic study of the effects of erosion control and drainage on farmland values. *American Journal of Agricultural Economics, 71*, 55-62.

Queensland Flood Science, Engineering and Technology Panel. (2012). *Understanding the flood.* Retrieved

January 13, 2013, from http://www.chiefscientist.qld.gov.au/publications

Ridker, R. G., & Henning, J. A. (1967). The determinants of residential property values with special reference to air pollution. *The Review of Economics and Statistics, 49*, 246-257.

Rosen, S. (1974). Hedonic prices and implicit markets: product differentiation in pure competition. *Journal of Political Economy, 82*(1), 34-55.

Rostam, K. (2000). Bandar Pertengahan Sebagai Pusat Pembangunan Industri Pembuatan di Malaysia: Kuantan, Pahang Darul Makmur. *Jurnal Sains Kemasyarakatan dan Kemanusiaan, 56*, 3-26.

Saptutyningsih, E., & Suryanto. (2011). Hedonic price approach of flood effect on agricultural land. *Economic Journal of Emerging Markets*, 87-96.

Shimizu, C., H., Takatsuji, H. O., & Nishimura, K. G. (2010). Structural and temporal changes in the housing market and hedonic housing price indices: the case of the previously owned condominium market in the Tokyo metropolitan area. *International Journal of Housing Markets and Analysis, 3.*

Singh, H., & Subramaniam, S. (2009). Health emergency and disaster preparedness in Malaysia. *Southeast Asian Journal of Tropical Medicine Public Health, 40*(1), 11-15.

Soentato, R., & Proverbs, D. G. (2004). Impact of flood characteristics on damage caused to UK domestic properties: the perception of surveyors. *Structural Survey, 22*(2), 95-104. http://dx.doi.org/10.1108/02630800410538622

Tomkins, J., Topham, N., Twomey, J., & Ward, R. (1998). Noise versus access: the impact of an airport in an urban property market. *Urban Studies, 35*(2), 243-258.

Triplett, J. E. (2004). *Handbook on quality adjustment of price indexes for information and communication technology products.* OECD Directorate for Science, Technology and Industry, Paris.

Wee, S. T., & Ariffin, R. (2011). *Kajian Terhadap Struktur Bagi Mengawal Hakisan dan Banjir di Tepi Sungai Kelantan.* Retrieved September 1, 2015, from http://eprints.uthm.edu.my/2017/1/Seow_Ta_Wee_2

Woharn, T. W., Hussain, M. Y., & Manaf, A. A. (2010). Faktor penentu pemilihan lokasi industri pembuatan: Kajian kes Kawasan Perindustrian Nilai. *Malaysian Journal of Society and Space, 6*(2), 20-36.

Yusof, N. (2011). Foreign Direct Investment and Development of Electric and Electronic Products Industry in Penang State from year 1970–2007. *Jurnal Kemanusiaan, 18*(2), 43-74.

Zhai, G., Fukuzono, T., & Ikeda, S. (2003). Effect of flood on megalopolitan land prices: a case study of the 2000 Tokai flood in Japan. *Journal of Natural Disaster Science Volume, 25*(1), 23-36.