

**THE EFFECTS OF FLOODING ON HOUSE PRICES: TWO
CASE STUDIES IN MALAYSIA**

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ABSTRACT

Flooding of residential property is a real and growing phenomenon in the Malaysia and is causing short and long-term detriment of various kinds to its victims. The issue of potential decrease in value of those properties which are located on the floodplain, though much discussed in the media, has received scant attention in the Malaysian research literature. An extensive literature survey of Anglo-Saxon and US origin has revealed a need for methodological innovation in the field of temporal impact of flooding and the inadequacy of the current paradigms for inclusion of insurance into flood modelling.

The main thrust of this research is to determine whether flooding has any effect on housing prices in Malaysia. The ancillary objectives of this study are limited to a search for evidence that expected annual flood damages borne by flood plain activities are or are not capitalized into the fair market value of floodplain properties in Malaysia.

Addressing this question is more involved than just comparing the actual price of a floodplain property to a hypothetical, otherwise identical, non-floodplain property. This study defines this difference as the discount for floodplain location. The discount for floodplain location, however, does not necessarily equate to discount for primary flood damages. The location discount represents the net effect of all attributes, positive and negative alike, associated with floodplain location which affects property value. Examples of positive attributes are access to recreational boating and river views. Negative attributes include clean-up costs and loss of income during a flood.

Hedonic price models are used to empirically measure a discount due to primary flood damages, separate from the discount for floodplain location. Hedonic price models describe the contribution of a property attribute to the overall price. The models are empirically assessed with multi-variety regression models where sale price is the dependent variable and the property attributes are the independent variables.

This study reviewed existing academic literature on hedonic price models of the floodplain real estate market. In addition, two hedonic price model cases were studied to answer some of the questions raised in the literature review. The case studies used price data on Damansara and Dungun.

The output from this study makes a contribution to the understanding of the impact of flooding on house prices, allowing for better valuation advice. Empirical findings are that the understandable concerns of residential property owners at risk of flooding regarding long term loss of property value are largely unfounded. Price discounts are observed for some recently flooded areas but they are temporary.

The output from the study also makes a methodological contribution in extending concepts relating to the relationship between flooding, insurance and house prices. This development is anticipated to facilitate refinement and updating of the empirical findings with reduced effort in the light of future events.

ABSTRAK

Banjir di kediaman hartabenda adalah suatu fenomena sebenar dan berkembang di Malaysia dan ianya menyebabkan pelbagai kesan kerugian jangka pendek dan panjang. Isu potensi penurunan nilai hartabenda yang terletak di kawasan dataran banjir, meskipun telah banyak dibahas di media, sedikit sebanyak menarik perhatian kajian penyelidikan di Malaysia. Sebuah kaji selidik menyeluruh (komprehensif) dari literature-literatur Anglo-Saxon dan Amerika Syarikat telah mendedahkan keperluan kepada inovasi metodologi di dalam bidang kesan berangkaian banjir (sequential impact of flooding) dan kekurangan paradigma semasa untuk dimasukkan ke dalam model insurans banjir.

Motivasi utama kajian ialah untuk mengetahui samada banjir telah mempengaruhi harga perumahan di Malaysia. Objektif tambahan kajian ini adalah terhad untuk mencari bukti bahawa jangkaan kerosakan banjir tahunan ditanggung oleh kegiatan di dataran banjir atau tidak dimodalkan kepada nilai-nilai wajar pasaran hartabenda di dataran banjir di Malaysia. Menangani persoalan ini perlu lebih penglibatan bukan sekadar membandingkan harga sebenar hartabenda di dataran banjir kepada hipotetis, sebaliknya mengenalpasti, hartabenda bukan di dataran banjir. Kajian ini mendefinisikan perbezaan ini sebagai diskaun untuk lokasi dataran banjir. Diskaun untuk lokasi dataran banjir, bagaimanapun, tidak harus sama dengan diskaun untuk kerosakan banjir utama. Diskaun lokasi merupakan kesan bersih dari semua atribut, positif dan negatif sama, berkaitan dengan lokasi banjir yang mempengaruhi nilai harta. Contoh atribut positif ialah akses kepada rekreasi berperahu dan melihat pemandangan sungai. Atribut negatif termasuk kos pembersihan dan kehilangan pendapatan semasa banjir.

Model Harga Hedonic digunakan untuk mengukur secara empirikal diskaun kerana kerosakan banjir utama, berasingan dari diskaun untuk lokasi dataran banjir. Model Harga Hedonic memperihalkan sumbangan atribut hartabenda kepada harga keseluruhan. Model secara empirikal dinilai dengan model multi-variate regression dimana harga jualan adalah pembolehubah dependen dan atribut hartabenda adalah pembolehubah bebas. Penyelidikan ini mengupas kajian akademik sediaada bagi Model Marga Hedonik dari pasar real estat dataran banjir. Selain itu, dua kes harga hedonik model dipelajari untuk menjawab beberapa soalan yang muncul dalam tinjauan literatur. Kajian kes digunakan data harga di Damansara dan Dungun. Hasil dari kajian ini memberikan sumbangan untuk memahami kesan banjir ke atas harga rumah, membenarkan nasihat penilaian yang lebih baik. Penemuan empirikal adalah pertimbangan yang dapat difahami bagi pemilik hartabenda kediaman berhubung risiko banjir jangka panjang tentang hilangnya nilai hotel sebahagian besar tidak berasas. Harga diskaun diamati untuk beberapa daerah baru-baru ini banjir tetapi mereka bersifat sementara. Hasil dari kajian ini juga membuat sumbangan metodologi dalam memperluaskan konsep-konsep yang berkaitan dengan hubungan antara banjir, insurans dan harga rumah. Perkembangan ini diharapkan dapat memudahkan pembaikan dan pengemaskinian penemuan empirik dengan usaha mengurangkan dalam terang peristiwa masa depan.

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LIST OF SYMBOLS &

ABBREVIATIONS

ARIMA	Autoregressive integrated moving average
ACORN	ARC (Australian Research Council) Communications Research Network
Bernama	Bernama News Agency
Cagamas	Perbadanan Cagaran Malaysia or the National Mortgage Corporation
GARCH	Generalized AutoRegressive Conditional Heteroskedasticity
JPPH	Jabatan Penilaian dan Perkhidmatan Harta
JPSM	Jabatan Pengairandan Saliran Malaysia
NAPIC	National Property Information Centre
NFIP	National Flood Improvement Programme
MRA	Multiple Regression Analysis

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CONFERENCE PROCEEDINGS

Beksin,A.M. (2009).Markov Switching Regime of Malaysian Property Cycle. Proceedings from National Social Science Postgraduate Seminar 2009.Penang, Malaysia

Beksin, A.M. (2010).The Effects of Perceived Risk on Property Prices: An Analysis on Bukit Antarabangsa,Malaysia. Proceedings from International Property Conference 2010, Perth,Australia

Beksin, A.M.(2010). Forecasting Models of Flood-Affected Residential Property Prices. Proceedings from ASC2010 Australian Statistical Conference 2010, Fremantle, Australia.

PUBLICATIONS

Ali Mohammed Alashwal, Hamzah Abdul Rahman and Abdul Mutalib Beksin. (2010).THE ASPECTS OF PROJECT LEARNING WITHIN A FRAGMENTED CONSTRUCTION PROJECT: EXPLORING THE ENABLERS. African Journal Of Business Management. Accepted and awaiting print.

Abdul Mutalib Beksin(2010). PERCEIVED RISK AND ITS EFFECTS ON PROPERTY PRICES.” African Journal Of Business Management. Accepted and awaiting print

Abdul Aziz Abdullah, Hamzah Abdul Rahman, ZakariaHarun,Ali Mohammed Alashwal& Abdul Mutalib Beksin.(2010) LITERATURE MAPPING: A BIRD’S EYE VIEW ON CLASSIFICATION OF FACTORS INFLUENCING PROJECT SUCCESS.African Journal Of Business Management.Published December 2010

Abdul Aziz Abdullah, Hamzah Abdul Rahman, Zakaria Harun,Ali Mohammed Alashwal & Abdul Mutalib Beksin.(2010). NON TRADITIONAL FACTORS INFLUENCING PROJECT SUCCESS (PLANNING APPROVAL) OF A DEVELOPMENT PROJECT. Scientific Research & Essays. Accepted and awaiting print.