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Who responds more to environmental amenities and dis-amenities?

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ABSTRACT

It is hypothesised that different property sub-markets react to flood risk information, floods and environmental factors differently. To test this hypothesis this research uses spatial quantile regression and quasi-experimental techniques to examine property sub-market behaviour in response to availability of flood risk information and actual flood. This new contribution to the literature is based on the use of the mapping of flood risk areas in 2009 and the 2011 flooding of Brisbane, Australia, as a case study. The results show that the impact of flood risk and actual flood on property markets varies between different sub-markets. They therefore confirm the existence of property sub-markets based on property and environmental characteristics and suggest the need for differentiate mitigation policies.

1. Introduction

Whether all property buyers/sellers (representing different sub-markets) consider environmental amenities and dis-amenities in a similar manner is questionable. To answer this question, this research investigates the variation in impact of the release of flood risk information and actual flood incidence on different property sub-markets. We hypothesise that the property market can be categorised by market value of the property and which assumes rich people tend to buy high-value properties whereas poor people tend to buy low-value properties. The hypothesis is tested, first using quantile regression of hedonic price (HP) analysis and then by a two-stage quantile regression (2SQR) analysis to correct spatial autocorrelation. Finally, the quasi-experimental technique is combined to distinguish the impact of the release of flood risk information and actual flood incidence across different sub-markets.

Property characteristics, namely quality and size of the property are key determinants of property prices. But just as important are the environmental factors such as neighbourhood amenities, open spaces and greenery areas which significantly contribute to market clearance prices (Irwin, 2002; Kong et al., 2007; Hibiki and Managi, 2011). Landry and Hindsley (2011) have observed that properties close to a beach have higher value than similar properties farther away. Furthermore, environmental dis-amenities – floods, bushfire, and environmental pollution – exert a negative impact on property values. For example, Gawande et al. (2013) identified the risks from nuclear waste transportation in Mexico as having a negative impact on property prices.

The evidence from many HP studies show the impact of such factors on property prices vary temporally and spatially (Lamond et al., 2010). This is largely due to the inherent nature of geographical distribution and heterogeneity in property markets which naturally create sub-markets. For example, some properties are close to natural geographical formations (such as waterfronts, natural forests, views) or manmade infrastructure (such as playgrounds, parks, recreational places, religious establishments, the central business district (CBD), shopping centres, schools, roads and transport). Hence by taking into account property sub-markets, results from HP analysis becomes more precise and reliable (Bourassa et al., 1999).

It has been generally accepted that geographical boundaries or administrative boundaries are the best approximations for sub-markets because, within a given geographical area, the property market is more homogeneous. However according to Mak et al. (2010) property sub-markets can be observed even within a single

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condominium. Other than structural, geographical and environmental factors, part of this heterogeneity in the product (property) can be attributed to behavioural and social factors. According to Hoshino (2011), residential preferences are also heterogeneous. For instance, well off people tend to buy properties in an area where resource and environmental factors have value.

Given these facts and complexities, behavioural factors can be a more appropriate means to distinguish sub-markets. For example, property sub-markets can be closely related to the income group of property residents given that high-value properties are largely owned by high-income groups whereas low-value properties are largely owned by low-income groups. Similarly, these groups value environmental amenities and dis-amenities differently. Hence, in the current study the definition of a property sub-market is based on property values and which, it is assumed, also relate to household income and other associated characteristics.

Although a great deal of theoretical and empirical work has been carried out on various aspects of flood impacts on the property market, much less attention has been paid to the behaviour of different property sub-market affected by natural disasters. Therefore, the focus of this paper is to examine, firstly, whether there are similarly marked differences in property sub-markets subject to natural hazards and floods and, secondly, to the release of flood risk information. In particular this research seeks to answer the following research questions which are so far unaddressed in the literature: (1) are low-value properties affected more than high-value properties? (2) which sub-markets (low-value properties or high- value properties) are more price responsive to the availability of flood risk information? (3) which creates more a more negative price impact: availability of risk information or the experience of an actual flood event?

In this study spatial quantile regression and quasi-experimental analysis are applied to two situations – making available flood risk information and an actual flood – as a natural experiment. The study finds that both the availability of risk information and an actual flood impacts on property markets differently between low-value properties and high-value property. This research, therefore, makes an important contribution to the existing literature on the effects on property markets of natural disasters, by exploring the impacts of public risk information provision and actual natural disasters across different property sub-market. The rest of this article is organised as follows. Section 2 briefly reviews the different empirical approaches used to categorise property sub-markets and analyse property market behaviour. The methodology employed in this paper is discussed in Section 3. Empirical results are presented in Section 4 and Section 5 concludes with some brief recommendations.

2. Literature review

HP analysis is widely used in valuing environmental amenities and dis-amenities. For example, Kong et al. (2007) and Nicholls and Crompton (2005) have shown the manner in which physical access or views of green space has a positive and significant impact on determining house prices. Similarly, Gopalakrishnan et al. (2011) observed that being close to a water view had a similar impact on house prices. Among the extensive literature on environmental dis-amenities, a number of studies have investigated the behavior of the property market in relation to natural disasters[1] including flooding and the presence of flood plains (Rajapaksa et al., 2016; Bin and Landry, 2013; Petrolia et al., 2013; Rambaldi et al., 2013; Samarasinghe and Sharp, 2010; Lamond et al., 2010; Zhai and Fukuzono, 2003; Fridgen and Shultz, 1999).

Some studies have shown that flood risk discounts property values (see, for example, Rambaldi et al., 2013; Lamond et al., 2010) whereas, others have indicated a negative impact following an actual flood incidence (see, for example, Bin and Landry, 2013). In a study of New Zealand property sales data, Samarasinghe and Sharp (2010) showed a significant negative impact on property prices from being located in flood prone areas. A study of the recent effects of hurricanes in North Carolina by Bin and Landry (2013) employing a difference-in-differences (DID) framework found the presence of a risk premium ranging between 6% and 20% for properties in the flood prone zone. However, a related study in the UK found that the impact of floods varies temporally and spatially (Lamond et al., 2010). A qualitative analysis of price behaviour of the Brisbane property market showed that floods create negative effects on the average listing price (Eves and Wilkinson, 2014). However, other than a recent study by Zhang (2016), none of these studies have investigated the variation in negative impact across different sub-markets. Using quantile regression analysis Zhang (2016) found that the flood risk impacts on housing market differently. However, this study is different as we combined spatial quantile regression and quasi-experimental analysis to compare two events across different sub-markets.

Reviewing 125 research articles, Sirmans et al. (2005) show the inconsistency of parameter estimation, even among commonly used property related variables in HP analysis. This is possible due to the highly heterogeneous nature of the property market and the existence of property sub-markets. Buyers do not tend to bid for properties in a number of differentiated sub-markets but rather for similar sub-markets given that different property sub-markets behave differently. Thus the property demand and supply structure differs across different market segment (Freeman, 1993). According to Farmer and Lipscomb (2010), households compete with each other within their own sub-market. Furthermore, within a sub-market, properties are more homogeneous and hence estimations are more precise (Bourassa et al., 1999). As suggested by Michaels and Smith (1990), separate HP functions for different market segments will produce more precise estimations of the relationship between property characteristics and property price than a single HP function. In addition, Miron (1995) showed that hedonic rental prices vary from city to city in Canada.

Property sub-markets and their characteristics have been extensively researched in real estate and marketing literature. Bourassa et al. (1999) in adopting the K-means clustering procedure and principle component analysis to identify property sub-markets in Sydney and Melbourne found that the HP estimation for sub-markets is more appropriate than for the whole market. As Wilhelmsson (2004) suggests, the HP predictive power can be improved while reducing spatial dependency by identifying property sub-markets. A number approaches have been used to distinguish different housing sub-markets. Most have used geographical boundaries, administrative boundaries, school boundaries and census boundaries. Dale-Johnson (1982) used factor analysis whereas Wilhelmsson (2004) employed a cluster analysis in clustering Swedish property markets. In contrast to statistical approaches, Dorsey et al. (2010) used zip codes to define property sub-markets. As noted, if sub-markets are ignored in the HP analysis the estimation coefficients become biased.

Another approach to sub-market classification is to use income information. Gayer (2000) provides empirical evidences for the existence of behavioural differentiation of property sub-markets

[1] Examples of other dis-amenities include impact of air pollution (see, for example, Zabel and Kiel, 2000; Kim et al., 2003), telecommunication tower (see, for example, Filippova and Rehm, 2011), nuclear waste (see, for example, Gawande et al., 2013), noise (see, for example, Duarte and Tamez, 2009), other characters (Thompson et al., 2012).