The value of a south-facing orientation: A hedonic pricing analysis of the Shanghai housing market☆

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ARTICLE INFO

ABSTRACT

The relationship between the view orientation of an apartment and its property value is examined in the context of Shanghai housing market. Using a hedonic pricing model and a unique dataset, comprised of apartment attributes, ambient environmental indicators and urban spatial structure, shows that a south-facing orientation is associated on average with a 14% premium in property value. Among possible view orientations, due south reflects the highest price. A view of one Shanghai's landmark increases property values by 6%, with this premium being boosted a further 4% by south-facing orientation. Dust pollution lowers prices and shrinks the value of a south-facing view, while PM2.5, which is not visible, has little influence on either. Preference for height in apartment buildings is strongly influenced by the presence of elevators. Internal apartment attributes have the expected signs, but magnitudes can be misleading unless the larger set of apartment attributes is controlled for.

1. Introduction

The view orientation of dwelling units has been important in Chinese society since ancient times, with the best direction being due south in most scenarios (Tam, Tso, & Lam, 1999). The superiority of south-facing views originates from Geomancy (*Feng Shui*), an ancient Chinese wisdom that relates to architectural design and has been widely practiced in land and property development (Eitel, 1993). Many constructions in cities with substantial Chinese populations often take the principles of *Feng Shui* into account in designing buildings (Bruun, 2008), including some urban areas in New Zealand (Bourassa, Peng, & Others, 1999) and Hong Kong (Mak & Ng, 2005). Apart from the superstitious belief of Geomancy, a south-facing orientation may be preferred due to another significant benefit, sunlight.[1] This favorable natural and environmental feature brings a wide range of physiological benefits, like a significantly positive effect on household mental well-being (Leather, Pyrgas, Beale, & Lawrence, 1998) and health condition (Cannell et al., 2006; Guven, 2012). Besides non-pecuniary reasons, sufficient sunlight from a south-facing orientation has direct influences on economic activities. It not just largely increases housework

efficiency when drying the clothes on an apartment's balcony (Wilson & Parisi, 2006),[2] but also facilitates energy saving when keeping the indoor area warm in cooler climates and during winter (Yao, 2014).

Given various benefits from a preferred view orientation in a residence, households are supposed to prefer properties with this favorable attribute in China, holding other factors equal. Thus, this important amenity attached to residences should reflect in China's housing market (Chan, Yim Yiu, Baldwin, & Lee, 2009). Surprisingly, there appear to be no papers in economic literature on the value of housing attributes that provide a comprehensive review with empirical evidence in exploring the influence of a view orientation on housing price. Most relevant researches either qualitatively analyze the benefits of south view orientation (Bourassa et al., 1999; Mak & Ng, 2005) from the perspective of Geomancy or simply take it as one covariate in a hedonic pricing model (Huang, Chen, Xu, & Zhou, 2017). This paper seeks to fill that gap in the context of China's most developed housing market, Shanghai.

There have been massive buildings of apartments in Shanghai and a number of other Chinese cities, with living standards advancing rapidly over the past several decades. As this has occurred, purchasers of

[1] All cities in mainland China lie in the northern hemisphere and most of the sunshine comes from the south. Sunlight is more accessible to dwelling units that look south in Shanghai.

[2] Residents in China do not usually use a dryer but hang clothes on the balcony or outside the windows, which makes the efficiency of drying clothes largely depend on the amount of sunlight available (Wilson & Parisi, 2006).

dwelling units have come to care about a much wider range of housing attributes, although most of them cannot be traded in a formal market, like air quality and convenience in transport. Economic theory suggests that each feature has its own implicit price that can be capitalized (Palmquist, 1984, pp. 394–404). Using hedonic pricing model (Rosen, 1974), the influence of many important urban amenities in the living space has been widely estimated, including green space (Poudyal, Hodges, & Merrett, 2009), public transportation (Li, Wang, Shi, Deng, & Wang, 2015; Wang, Feng, Deng, & Cheng, 2016) and educational facilities (Wen, Zhang, & Zhang, 2014). Air quality has also been given much more attention in China recently and there have been many analyses done by environmental economists about how house value is influenced by ambient air quality (Chen, Ebenstein, Greenstone, & Li, 2013; Mu & Zhang, 2014; Zheng, Kahn, & Liu, 2010). Given a disproportionately large fraction of south-facing apartments in Shanghai,[3] view orientation, as an important housing attribute, could exert a even larger influence on the housing market and necessitates the exploration of its hedonic value.

To the best of my knowledge, this is the first empirical research quantitatively and comprehensively estimating the hedonic value of a preferred view orientation under the framework of Shanghai's housing market. Instead of just controlling for it as a simple covariate, this paper takes view orientation as the main focus to evaluate and provides detailed empirical evidences concerning how a preferred view orientation can be capitalized into property value and interacts with surrounding environmental factors, like scenic view and air quality, that residents care much about. Because data on a large subset of apartment sales in Shanghai is now available and can be matched with spatial information on many other environmental and urban amenities, the hedonic pricing approach is pursued here. The main finding in this paper is that a south-facing orientation would put a premium of about 14% on the property value, which is about 5600 CNY/m^2 (77.6 USD/ft^2).[4]

The remainder of this paper is organized as follows. Section 2 briefly reviews the relevant literature about hedonic pricing model. Section 3 introduces the background and data in this empirical study. Empirical strategies and results are contained in section 4. The last section discusses some policy implications and provides some concluding remarks useful to the inclusion of view orientation in future hedonic pricing models.

2. Literature review

Unlike regular commodities that can be freely traded, many public goods and certain attribute in a commodity cannot be purchased separately and thus priced directly due to the lack of formal markets for them (Tiebout, 1956). Two main techniques of obtaining an estimated value of these special objects have been proposed. The first is to use a discrete choice experimental approach with stated preferences, a survey method like travel cost and contingent valuation (Louviere, Hensher, & Swait, 2000; Mitchell & Carson, 1989). The second one is hedonic pricing model, the approach taken by this paper based on revealed preferences (Malpezzi, 2002, pp. 67–89; Sirmans, Macpherson, & Zietz, 2005). This method can be traced to consumer theory by Lancaster (1966) and implicit market model by Rosen (1974). Following the theoretical foundation established by Harrison and Rubinfeld (1978), hedonic pricing model has been popularly used in estimating the values

of a wide range of public goods, like medical care (Howard, Bach, Berndt, & Conti, 2015) and public transportation (Wang et al., 2016). Another widespread application of hedonic pricing model lies in the assessed contribution of environmental attributes (Freeman III, Herriges, & Kling, 2014; Ridker & Henning, 1967) and urban amenities (Taylor, 2017) through nearby property values.

Along with rapid Chinese urbanization and data availability, there have been many studies conducted with hedonic pricing model in China. Most estimate the value of numerous urban amenities through their influence on local housing prices, such as public transport system (Wang et al., 2016), urban green space (Jim & Chen, 2009; Kong, Yin, & Nakagoshi, 2007) and educational facilities (Wen et al., 2014). Given the larger concern over health-related living condition, many researchers also provide estimated valuations of environmental attributes in China. For instance, the hedonic values of improvement on water quality in river (Chen, 2017) and ambient air quality (Chen et al., 2013; Mu & Zhang, 2014; Wang & Mauzerall, 2006; Zheng et al., 2010) have been explored in urban housing markets. Using hedonic pricing model, several studies focus on housing price prediction in China's major cities, like Bejing (He et al., 2010), Shanghai (Huang et al., 2017), Wuhan (Hu, Yang, Li, Zhang, & Xu, 2016), Shenzhen (Wu, Ye, Du, & Luo, 2017) and Hangzhou (Wen & Tao, 2015).

Apart from public goods and urban amenities, hedonic pricing model has been widely applied in assessing housing attributes. One property is usually sold as a package of inherent attributes (Freeman, 1979) and home buyers take account of all related attributes of each residence in house purchase (Rosen, 1974). In a typical setup of hedonic pricing model, housing price is regressed on all housing attributes having an influence on property value (Rosen, 1974). Existing researches have already estimated the hedonic value of many housing attributes, including scenic view (Jim & Chen, 2009), interior decoration (Zhang & Liu, 2014) and life span (Liu, Xu, Zhang, & Zhang, 2014) for apartments sold in China's housing markets. As an important apartment-related attribute that can be potentially capitalized into property value, view orientation should also be given much attention. Some previous studies have confirmed its significance to a micro-built environment and buildings (Bourassa et al., 1999; Mak, 1998, pp. 83–89) and shown that a south-facing orientation is preferred in building design in China under the framework of Geomancy (Lip, 1995; Mak & Ng, 2005). However, little empirical evidence has been collected to support the conclusion.[5] Accessibility of a rich dataset with many observed housing attributes, including view orientation, makes it feasible to conduct the non-market valuation of this important attribute using a hedonic pricing model. This paper aims to provide a comprehensive evaluation of all view orientations and quantitatively examine whether the preference over them reflects in apartments in Shanghai housing market. In addition, interaction of view orientations with other housing attributes and surrounding environmental features are also sufficiently investigated.

3. Empirical background and data

3.1. The housing market in shanghai

Due to rapid population growth and economic development, the housing market has skyrocketed in the past decade in Shanghai (Chen & Jin, 2014). Both annual housing investment and total floor area of the residential property have been increasing drastically over the past two decades in Shanghai.[6] As with other major metropolis areas in the

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[3] Nearly 75% apartments in sample data have a south-facing orientation. View orientations in many U.S. and European cities with similar level of development are typically equally distributed and some are dominated by a nearby scenic view, like those penthouses facing the central park in New York.

[4] This estimated premium of a south-facing orientation is very close to that given by Huang et al. (2017), p. 15% of property value in Shanghai's housing market. The exchange rate of USD/CNY employed is 6.1277, the average number during the study period.

[5] Some recent paper empirically confirms the preference over a south-facing orientation by only taking it as a control variable, but lacks comprehensive evaluation on its premium (Huang et al., 2017).

[6] Refer to National Bureau of Statistics of China, http://data.stats.gov.cn/english/.