Examining structural changes in Asian offices market

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ABSTRACT

It is complicated to measure the effects of various economic events on office markets within a non-parameter modeling framework. In response to this issue, a non-parametric statistical method-wavelet analysis is introduced in this study. Based on this innovative technique, we not only could detect the abrupt change points with a comparatively small data sample, but also could evaluate the impact from the abrupt change points by reconstructing the wavelet coefficient/de-noising the raw data, which had never been considered in previous studies of office markets. Our empirical results suggest that the wavelet reconstruction method, to some extent, makes it easier for the detection of the existence of structural change points. More interestingly, our findings also indicate that free market economies (i.e. Hong Kong and Singapore) are mainly influenced by the effects of global events, whereas the actual (net) impact on socialist economies (i.e. Beijing and Shanghai), depends on both the openness of the economies, and the magnitude of counter domestic forces put in place.

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Introduction

How do economic events affect real estate markets? It is one of the topics that has long been getting the attentions of researchers and policy makers alike. Loosely speaking, economic events which have significant effects on real estate markets are usually classified into two categories: global events and domestic events. It is believed that real estate markets are subjected to global economic events in market economies (Renaud, 1997). Meanwhile, in socialist economies, governments intervene in property markets in response to the impacts of similar events (Tian and Ma, 2009). In other words, the real estate markets in different economic systems are influenced by different factors. For instance, on 2 July 1997, the day after Hong Kong's handover to China, the Asian financial crisis began. Hong Kong's real estate market had been badly hit, with property price index having fallen by more than 30%. Even to this day, the real estate index has yet to return to its peak level prior to the handover. Meanwhile, the Chinese government responded to the financial crisis by stabilizing the Renminbi (RMB). Therefore, the non-convertibility protected RMB's value from speculative activities on it. Besides, by maintaining the peg of RMB, China's standing within Asia has improved. It has been reported that this policy measure effectively protected China's real estate markets during the crisis. A study of how latent structural changes in real estate markets (i.e. housing prices), with respect to similar events, differ

between free market economies and socialist economies would fill the existing knowledge gap in the literature.

It has been pointed out in a variety of studies that housing price is affected by factors such as interest rate, land supply, and inflation rate (Tian and Ma, 2009; Tsatsaronis and Zhu, 2004). Previous researches have usually concentrated on parameter models such as regression models on housing price and on the correlations between price and various factors. In order to generalize the regression analysis for practical reasons, some assumptions are needed to be set regarding the sample data. This method, however, not only overlooks the issue of multicollinearity of the sample data, but also dismisses the jumps. It is observable from the market that jumps may appear in time-series housing price index data. Moreover, the study on the magnitude of the jumps, or the impact from events, is rarely seen in real estate literature. In this paper, we intend to investigate whether or not a change appears when an economic event takes place in an office property market. More specifically, we will apply the method, introduced by Ip et al. (2004) and Donoho and Johnstone (1994), of wavelet change point detection and wavelet coefficient reconstruction techniques to study the office indices of four renowned Asian cities: Beijing, Shanghai, Hong Kong, and Singapore. One feature that distinguishes this method from the others is that it is applicable to smaller data samples within a non-parameter framework. Besides, we aim to employ the wavelet coefficient reconstruction method to explore office markets in cities under different economic systems and to find out how the latent structural changes differ among these markets. A study of which could provide a useful reference for future investigations of housing markets of other international cities.

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This paper is organized as follows. After a brief introduction, we discuss relevant literature on the approaches for detecting cusps, jumps and change points in 'Literature review' section. 'Model' section presents the wavelet analysis model for jump point detection and de-noise reconstruction. 'Empirical studies' section reports the findings, and hence identifies and discusses some important events in the corresponding points. The last section concludes the paper.

Literature review

Studies of change points

A great number of approaches have been utilized for testing structural change points (Wu and Chu, 1993; Bernier, 1994; Perron, 2005). Mathematically, Fourier transforms and statistical methods are common methods to detect change points. Rachev and Sengupta (1993) studied the "stability" properties of Laplace and a mixture of Laplace and Weibull in modeling price changes. Lombard (1988) detected cusps by a Fourier analysis. Indeed, the Fourier transform only converts the data into a signal process, whilst neglecting other information such as the location of the frequency. In other words, the method is unable to inform us the location effect within various time periods. To address this particular issue, Muller (1992) introduced a non-parametric method to estimate the location of cusp(s) and its(their) size. This approach is closely related to the boundary kernels framework. Nevertheless, it is still hard to find a criterion to detect a jump point. Compared to the model provided by Muller (1992), Eubank and Speckman (1994) employed a semi-parametric approach to detect the discontinuities in the derivatives of regression functions. They loosened the requirements of smooth higher derivatives for the function. However, similar to Muller's method, Eubank and Speckman's approach also requires a large data sample. Statistically, Andrew and Meen (2003) employed aggregate time-series data to find the relationship between house prices and transactions in the U.K., and discovered a change point during the 1990s. Lavielle and Teyssière, 2006 used the method proposed by Andrew and Meen (2003) to analyze the returns from real estate and financial investments. Lavielle and Teyssiere also considered the bivariate series of returns on FTSE 100 and S&P 500 index, and the results showed that some major changes upon economic events are detected. Another study by Strikholm (2006) focused on the US ex-post real interest rate series. He used a sequential method to determine the number of breaks in piecewise linear structural break models. Hillebrand and Schnabl (2006) concentrated on the effect of Japanese foreign exchange interventions on the volatility of the Yen/Dollar exchange rate. A change point detector was used for the segmentation of the data. Furthermore, Bourassa et al. (2009) developed a model of the repeated sale of residential single-family properties and investigated the impact of housing characteristics on the rate of appreciation. Their findings suggested that the average change in house prices is related to changes in national and local macroeconomic variables or market-wide bubbles. Nonetheless, their method only applies under the hypothesis that housing price adjustments only depend on housing characteristics as well as change in the strength of the housing market. Elíasson and Pétursson, 2009 studied the structural change in the Icelandic Housing market, with the focus mainly on the regression analysis. More recently, Hui et al. (2010a,b) presented a new abrupt change point detection method – a wavelet analysis on Hong Kong's residential real estate market. They pointed out that the detected change points are closely related to events, which are not observable directly. However, Hui et al. (2010b) only used a conservative standard for the selection of the benchmark/threshold in identifying these change points. In addition, the study did not

proffer an efficient way to measure the impact of each change point.

As wavelet analysis has some desired properties, it is suitable to deal with the problems containing the information from real estate markets, which do not require any hypotheses with regard to the market (e.g. market equilibrium). Donoho and Johnstone (1994) brought about selective wavelet reconstruction technique, which generalized the traditional wavelet detection analysis using smaller samples. Wang (1995) suggested a method to detect jumps and sharp cusps in a function, which was observed with noise by checking if the wavelet transformation of the data has significantly large values (in absolute terms) across fine scale levels. The limitation of his method is probably the assumption of uncorrelated white noise about the data series. Ip et al. (2004) proposed a wavelet approach to detect jumps or cusps of a discontinuous function in the presence of a noise. They applied their method to the daily exchange rate of US dollar against Deutsche Mark from 1 August 1989 to 31 July 1991, with convincing results in which all the points detected reflected strong economic and political impacts. Compared with the three other methods, their method was the most reliable one. More recently, Lai and Huang (2007) applied wavelet transform in China's real estate stock market, but due to the lack of data support, the analysis rendered to be qualitative in nature.

Overall, wavelet analysis is a powerful and versatile tool in detecting and measuring abrupt change points by using relatively small sample data sets. In the following section, we intend to employ Ip et al. (2004) and Donoho and Johnstone (1994) in our change point analysis.

Major events from 1998 to 2009

The following global events[1] are believed to have had major impacts on the real estate office market. This is followed by a discussion of specific Asian events.

Global events

(1) The Asian Financial Crisis was a period of financial crisis that gripped much of Asia beginning in July 1997, and raised fears of a worldwide economic meltdown due to financial contagion. As the crisis spread, most of Southeast Asia saw slumping currencies, devalued stock markets and other asset prices, and a precipitous rise in private debt. Hong Kong was hurt by the slump, while the People's Republic of China and Singapore were less affected, although all suffered a loss of demand and confidence throughout the region.

(2) The subprime mortgage crisis is an ongoing real estate and financial crisis triggered by a dramatic rise in mortgage delinquencies and foreclosures in the United States, with major adverse consequences on banks and financial markets around the globe. The crisis, which had its roots in the closing years of the 20th century, became apparent in 2007 and exposed the pervasive weaknesses in financial industry regulations and the global financial system. Approximately 80% of U.S. mortgages issued in recent years to subprime borrowers were adjustable-rate mortgages. When U.S. house prices began to decline in 2006–2007, refinancing became more difficult and as adjustable-rate mortgages began to reset at higher rates, mortgage delinquencies soared. Securities backed with subprime mortgages, widely held by financial firms, lost most of their value. The result was a large decline in the capital of many banks and U.S. government sponsored enterprises, tightening

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[1] The events (global base and city base) are collected from the Bloomberg Database.