



# The impact of the 2008 financial crisis on housing prices in China and Taiwan: A quantile regression analysis



Hsin-Hong Kang<sup>a</sup>, Shu-Bing Liu<sup>b,\*</sup>

<sup>a</sup> National Cheng Kung University, Department of Business Administration and Institute of International Business, No. 1, University Road, Tainan City 701, Taiwan, ROC

<sup>b</sup> Department of Finance, Shih Chien University Kaohsiung Campus, No. 200 University Rd, Neimen Shiang, Kaohsiung 84500, Taiwan

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## ABSTRACT

This paper adopts quantile regression to investigate the impact of the 2008 financial crisis on housing prices at difference price levels in China and Taiwan, and employs data from the period July 2005–December 2010. According to the empirical results, the ordinary least squares estimates are similar to those achieved from quantile regression. However, the conditional mean-focused regressions do not capture the results that are obtained by using quantile regressions. The empirical results indicate that in Taiwan the housing prices were more affected by the financial crisis when the prices of real estate were high, but in China the housing prices were less affected by the crisis when the prices were high.

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## 1. Introduction

The subprime financial crisis that began slowly in the first and second quarters of 2007, and continued to escalate throughout 2008, was due to years of real-estate binging by over-indebted households, enabled by careless Wall Street lending. Many major financial institutions teetered on the edge of collapse, and some failed. Meanwhile, the economy sank into a deep and prolonged recession, and the resulting financial crisis affected many industries. However, how did this financial crisis impact the real-estate industry? The objective of this paper is thus to study the effects of the 2008 global financial crisis on housing prices in China and Taiwan.

If the economy goes into a recession and unemployment rises, the demand for buying housing will fall significantly. Housing prices are affected by a combination of supply and demand factors. When the demand for buying housings falls, house prices will be affected. Fortura and Kushner (1986) find that demand factors are important explanatory variables in determining housing prices. The 2008 financial crisis led to a global recession, and in this work we are interested in studying the impact of this event on housing prices in Taiwan and China, and further investigating whether and how the crisis affected the real estate market at different price levels.

In addition, properties at different price levels are bought by people with different consumption levels. Whether and how the crisis affected consumers with different consumption levels? More specifically, which group was more affected by this crisis, consumers at the top of the pyramid (TOP) or those at the bottom of the pyramid (BOP)? Jill

(2011) points out that half of the poorest families did not see any declines in their wealth during the crisis in America. More specifically, the Federal Reserve surveyed 4000 households between 2007 and 2009, and found that while the total wealth of 63% of all Americans declined in that period, 77% of the richest families experienced a fall, while only 50% of those on the bottom of the pyramid suffered a decrease (Jill, 2011). There are two views about TOP consumers during financial crises. One is that they are the main victims of financial crises, as they may invest large amounts of their assets in financial instruments that fall in value during such events. The other view is that “the big get bigger, and the rich get richer”. The sociologist Robert K. Merton called this phenomenon the Matthew effect, named after a passage in the gospel of Matthew. Based on this, BOP consumers are more affected by financial crises than TOP consumers. When the price of real estate is high, only TOP consumers can afford to make a purchase. If the demand for housing decreases at a smaller rate when the prices are high than when they are low, then this implies that the second view is true, and thus TOP consumers are less affected by financial crises, and vice versa.

These observations lead us to formulate the following hypotheses:

- H1.** The 2008 financial crisis had a negative impact on housing prices.
- H2.** The effects that the 2008 financial crisis had on housing prices varied at different price levels.

This paper uses quantile regression to investigate the separate responses of housing prices to the financial crisis at different quantiles of the housing price distribution. Quantile regression is appropriate for use in this context, as it enables us to examine the whole distribution of the housing price variables rather than only focus on a single measure

\* Corresponding author. Tel.: +886 6 2757575.

E-mail addresses: [hkang@mail.ncku.edu.tw](mailto:hkang@mail.ncku.edu.tw) (H.-H. Kang), [g9624711@yuntech.edu.tw](mailto:g9624711@yuntech.edu.tw) (S.-B. Liu).

of the central tendency of the distribution. Specific to the concerns of this study, the quantile regression method also allows us to picture the relation between the 2008 financial crisis and prices separately for higher and lower prices of real estate, and this is the main contribution of this study.

House prices have been rising rapidly in China since the housing reforms that were carried out in 1998. In 1998 the average housing price was 1976 yuan per square meter, and this had risen to 4695 yuan by 2009, an increase of 137.6%. Moreover, the housing price-to-income ratio in China is much higher than the average level of developed nations. According to Li et al. (2013), the housing price-to-income ratio in China was 7.76 in 2010. However, according to *Demographia International* (2010), which computed the median housing price-to-income ratios for 227 regions, the comparable figures were 2.9 for the US, 5.1 for the UK and 6.8 for Australia. Given the housing price-to-income ratios quoted above, it is easy to conclude that China's prices are much less affordable, which remains a problem for most Chinese, who have relatively low incomes (Hanink et al., 2012). Previous studies of housing prices have discussed the distribution of affordability, in particular for low income families (Hulchanski, 1995; Kutty, 2005).

In the case of Taiwan, housing prices have increased dramatically since 1987, and this has led to greater wealth discrepancies between the rich and poor, making society more unstable. Indeed, the phenomenon of 'Snails without Shells', or people who do not own their own homes, is now receiving wider public attention due to the most recent housing boom that developed after 2005. Housing prices have nearly doubled since then, while the average income has grown less by than 3%.

During the past few decades, many countries have experienced rapid increases and high volatility in house prices. On the other hand, as in Taiwan, growth in income has been relatively gradual and appears to be unable to catch up with increased house prices. The United Kingdom (Bramley, 1994), Ireland (Memery, 2001), Japan (Yamada, 1999), and Taiwan (Chang et al., 2001) have all experienced problems of affordability in the last few decades.

Both Chinese and Taiwanese people have the traditional idea that 'land is wealth', and hence real estate is especially important to them. In addition, the geographical locations of China and Taiwan are similar, as are their cultures, although there are some notable differences. For example, China has traditionally been characterized as a high power distance<sup>1</sup> culture environment (Wang and Fulop, 2007), whereas Taiwan is a medium power distance one (Wu, 2006). With regard to their economies, Taiwan is a small, open and well-developed economy, while China is much bigger, has much more state involvement, and has experienced several decades of very rapid growth. We are thus interested in comparing the relationship between the 2008 financial crisis and housing prices in China and Taiwan, as both locations are very similar with regard to geography and ideas about real estate, but with different degrees of power distance and economic scales.

## 2. Related literature

The real estate sector has received much attention from research scholars, as it is a key part of any economy. There is thus a large literature on the impact that financial crises have on real estate. Wu and Chang (2002) conducted a study on whether the Asian financial crisis which began in 1997 had an impact on the real estate sector in Taiwan during post- and pre-crisis periods. The empirical results revealed that the financial crisis did not have a significant impact on the real estate market. However, the researchers stated that

macroeconomic variables like GDP, money supply and consumer price index, were leading indicators of the real estate market. A similar opinion was voiced by Reinhart and Reinhart (2010) in their study of the impact of the global fall, and Kim (1999) in his study of the Korean real estate market.

In contrast, Leung et al. (2002) found that the price of residential housing in Hong Kong fell by 50% and that for both office and industrial properties by even more than this after the Asian financial crisis. Ooi and Liow (2004) conducted a study on the performance of real estate stocks listed in seven developing markets in East Asia between 1992 and 2002. They found that size, book to market value, capital structure, interest rates and market conditions played a significant role in influencing the returns of such stocks (see also Bond et al., 2003; Devaney, 2001; Ling and Naranjo, 1998). In addition, Nicholas and Scherbina (2013), Shiller (2006), and Hyott (1933) found that there is a direct relationship between general business cycles and real estate performance. Al-Malkawi and Pillai (2013) analyzed the performance of real estate and construction companies in the United Arab Emirates (UAE) during the pre- (2006–2007) and post- (2008–2009) global financial crisis periods. They reported that the business cycle had a negative impact on the performance of real estate companies in the UAE, with significant falls in the liquidity, profitability, leverage and activity ratios after the financial crisis.

In spite of the many studies that examine the effects of financial crises on real estate, to the best of our knowledge there are few empirical works focusing on the impact of the 2008 global crisis on higher and lower real estate prices. This study aims to fill this gap by using a quantile regression method to investigate whether and how this 2008 financial crisis affected different levels of housing prices.

## 3. Data, variables and methodology

### 3.1. Data and variables

For the empirical analysis, the sample includes 66 observations from China and 66 observations from Taiwan over the period July 2005–December 2010. The objective of this study is to describe the impact of the 2008 financial crisis on housing prices, and thus it includes crisis dummy variables as the main explanatory ones. The events of the global stock market crash in August 2008 (crisis08\_dummy) and Lehman Brothers' bankruptcy in September 2008 (crisis09\_dummy) are used to mark the pre- and post-financial crisis periods. The 2008 financial crisis caused a global recession, and thus it is expected that the demand for housing would fall significantly, causing a fall in housing prices. Accordingly, this study expects a negative relationship between the crisis\_dummy variable and housing prices.

According to McCue and Kling (1994), the macroeconomy explains almost 60% of the variation in the real estate returns. Several studies explore the relationship between macroeconomic factors and housing prices. Fortura and Kushner (1986) investigate the sources of intercity housing price differentials in Canada, and the results suggest that demand factors are important explanatory variables. More specifically, they find that a 1% increase in the income of households raises housing prices by 1.11%, and that higher rates of anticipated inflation lead to higher housing prices due to the increase in household demand for real assets, such as housing, during inflationary periods. Darrat and Glascock (1993) examine the efficiency hypothesis in the context of the real estate market using monthly data and vector autoregressive (VAR) modeling. They test the causal relationship between real estate returns and a number of relevant financial and economic variables. The empirical results suggest that the real estate market is efficient in terms of the available information about industrial production, the risk premia, the term structure of interest rates, and the monetary base. McCue and Kling (1994) explore the relationship between the macroeconomy and real estate returns. Their results show that prices, nominal interest rates, output and investment all directly influence

<sup>1</sup> Hofstede (1980) defines power distance as the degree of equality, or inequality, between the people in a society. A high power distance ranking indicates that inequalities of power and wealth have been allowed to grow, while a low power distance ranking indicates that the society de-emphasizes differences between citizen's wealth and power.

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