



Trend properties, cointegration, and diffusion of presale house prices in Taiwan: Can Taipei's house prices ripple out?



Ming-Te Lee ^a, Ming-Long Lee ^{b,*}, Shin-Hung Lin ^c

^a Ming Chuan University, Taiwan

^b National Dong Hwa University, Taiwan

^c National Yunlin University of Science and Technology, Taiwan

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ABSTRACT

This study, which is the first to apply Vogelsang's (1998) $t - PS_1^1$ test, shows that trends in presale house prices in Taiwan's largest urban areas are stochastic. Contrary to previous studies, this study's cointegration analysis clearly demonstrates that Taipei is not isolated from long-run price trends. Furthermore, as indicated by weak exogeneity tests, both Taipei and Kaohsiung are long-run leaders in house prices. Moreover, Granger causality test results reveal a strong lead-lag interdependence of house price changes among Taiwan's largest urban areas. These findings have important implications for housing policy-makers, mortgage lending institutions, and property investors.

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Introduction

Housing is many families' largest asset. Thus, house price dispersion among regions can cause a significant distortion in the wealth distribution (Shi, Young, & Hargreaves, 2009). Through the housing wealth effect, fluctuations in relative house prices have the potential to further influence relative regional economic activity (Holmes, 2007). Furthermore, those fluctuations could potentially influence labor mobility at the regional level due to housing affordability and relocation costs (Holmes, 2007). For these reasons, it is important for government policymakers to understand how regional house prices behave in relation to each other over time.

The co-movements of regional house prices are also of interest to housing investors. A recent survey by Knight Frank LLP reports that investment is a key factor for housing acquisition in the U.K. (Knight Frank, 2007). Recent issues of the Institute for Physical Planning and Information's Housing Demand Survey report the same finding in the Taiwanese housing market (Chang & Lin, 2011). Specifically, in Taiwan, approximately 5% of housing sales were made to investors in 2002, a number that steadily increased to 16% in 2011 (Chang & Lin, 2011). Many studies in the real estate literature demonstrate that housing is an effective investment vehicle

(Lee, 2008). Moreover, in 2006, the Chicago Mercantile Exchange introduced the first housing futures market in the U.S., trading housing futures contracts and options (Jud & Winkler, 2009).

As a result of these significant developments, the phenomenon of house price diffusion across regions, known as the ripple effect, has long been an area of intense interest to researchers (Canarella, Miller, & Pollard, 2012; Clapp & Tirtiroglu, 1994; Luo, Liu, & Picken, 2007). In particular, the U.S. housing crash of 2007 has generated significant interest in exploring the ripple effect in Taiwan. Two studies examine Taiwan's market for secondhand housing, i.e., housing that is not newly built. Chien (2010) focuses on the long-run ripple effect of the regional/national house price ratio. Chen, Chien, and Lee (2011) examine the ripple effect in Taipei, New Taipei, Taichung, and Kaohsiung. To examine Taiwan's presale housing markets, Lee and Chien (2011) explore the long-run equilibrium among Taipei, New Taipei, Taoyuan–Hsinchu, Taichung, and Tainan–Kaohsiung. Significantly, all of these studies document that Taipei, Taiwan's capital city, has long been isolated from Taiwan's other major urbanized areas in terms of house-price trends. These studies attribute this isolation to Taipei's status as a global city.

However, this finding contrasts with the view of popular industrial and newspaper reports. These reports reveal increases in house prices in New Taipei, Taoyuan, Hsinchu, and even Taichung and Kaohsiung due to house price movements in Taipei (Cao, 2010; Liu, 2009; Ma, 2011; Taiwan Realty, 2010; Yu, 2010). In particular, located in northern Taiwan, Taipei is Taiwan's capital city and the country's most important economic center. As Taiwan is a relatively

* Corresponding author.

E-mail addresses: mingteli@mail.mcu.edu.tw (M.-T. Lee), ming.long.lee@mail.ndhu.edu.tw (M.-L. Lee), shlin@yuntech.edu.tw (S.-H. Lin).

small and homogeneous country, house price movements in Taipei are likely to represent macroeconomic shocks that subsequently also affect other urbanized areas in Taiwan. Moreover, Taipei's house price movements are generally the focus of media reports on Taiwan's housing market. If individuals in other urban areas regard Taipei as a benchmark to evaluate what the “right” price change is, Taipei's house price changes should diffuse to these areas.

In the face of contradictory information, this study aims to explore the issues of house price cointegration and diffusion in Taiwan's presale housing market. Similarly to forward or futures markets, presale housing markets are more likely to attract informed investors. Accordingly, a ripple effect caused by house prices in Taipei is likely to be more apparent in presale markets than in secondhand markets. Importantly, previous empirical studies on Taiwan devote little attention to the trend properties of house prices and neglect the consequence of misspecifying the deterministic components of a vector error correction (VEC) model. In contrast, the current study employs the [Vogelsang \(1998\)](#) $t - PS_T^1$ test to formally justify the inclusion or exclusion of the linear deterministic time trend in an empirical model of Taiwan's house prices.

Specifically, employing the [Vogelsang \(1998\)](#) $t - PS_T^1$ test, unit-root tests, and a VEC model, this study seeks to answer the following question: In presale markets, is Taipei isolated from Taiwan's other major urban areas with respect to house price movements? The answer should interest Taiwanese government policymakers, property investors, and financial institutions. According to an Executive Yuan online poll, expensive housing in major cities, particularly in Taipei, is Taiwanese citizens' primary complaint ([Wang, 2009](#)). If Taipei's house prices can ripple out, then policies that are implemented in Taipei may either decrease or boost quickly rising house prices in other areas. Additionally, when planning regional development, those areas' governments must account for the influences of the ripple effect on local economic activity. If Taipei's house prices can ripple out, then investors who missed its housing boom may still have an opportunity to enter the market and invest in other areas that will experience future price surges ([Real Estate Investar, 2012](#)). However, if the ripple effect exists, it will be more difficult for financial institutions to diversify their mortgage-lending risks ([Quigley & Van Order, 1991](#)), and housing investors will find it more difficult to compile geographically diverse portfolios in Taiwan ([Oikarinen, 2006](#)).

The study is also of interest to international property investors—particularly ethnic Chinese—because Taiwan is the dominant freehold-property market in the ethnic Chinese world. Taiwan has opened its property market to international investors. Since 1997, foreigners have been able to purchase property in Taiwan with official permission from the Department of Land Administration, and since 2001, based on the reciprocity principle, international investors have freely purchased properties in Taiwan ([Lai & Fischer, 2007](#); [Lee, 2009](#)).¹ That year, according to Department of Land Administration statistics, foreigners purchased approximately 60,000 m² of land and 44,000 m² of buildings. The numbers have increased dramatically since then. On average, foreigners have acquired an additional 582,000 m² of land and 152,000 m² of buildings every year from 2002 to 2010. Local developers and asset-management companies have also noticed and reported international investors' increasing interest international in Taiwan's housing markets ([Pacific Assets Management Co. Ltd., 2011](#); [Shining Group, 2011](#)).

This study contributes to the ripple effect literature as follows. First, no previous study has applied the [Vogelsang \(1998\)](#) $t - PS_T^1$ test to check for deterministic trends in house prices. Ripple effect studies often employ unit-root tests, cointegration tests, and vector error correction models, which are well known to be sensitive to the inclusion or exclusion of deterministic time trends ([Ahking, 2002](#)). As a result, decisions based on deterministic trends could lead to different patterns and conclusions about regional house price diffusion. [Luo et al. \(2007\)](#) show that house price diffusion patterns in state capital cities in Australia clearly depend on the inclusion or exclusion of deterministic time trends in cointegration models. However, no existing studies have performed a form test to justify their inclusion or exclusion of deterministic time trends. By applying the $t - PS_T^1$ test, this study can offer more convincing evidence related to deterministic trends.

Second, the ripple effect implies that over the long term, regional house prices tend to return to a long-run fixed relationship ([Meen, 1999, 2001](#)). However, there is no consensus in the literature about house price cointegration among global cities (i.e., alpha cities) and other cities over the long term. On the one hand, Dublin, Johannesburg, and Melbourne and Sydney are linked to other regions in Ireland, South Africa, and Australia, respectively ([Balcilar, Beyene, Gupta, & Seleteng, 2013](#); [Luo et al., 2007](#); [Stevenson, 2004](#)). On the other hand, Madrid and Taipei display unique house-price behavior that is isolated from other regions ([Chen et al., 2011](#); [Chien, 2010](#); [Larraz-Iribas & Alfaro-Navarro, 2008](#); [Lee & Chien, 2011](#)). Moreover, studies reveal contradictory evidence with respect to house price trends in London ([Cook, 2003](#); [Holmes & Grimes, 2008](#); [Macdonald & Taylor, 1993](#)). By offering new empirical evidence, this study enhances the understanding of house price behavior in global cities.

The remainder of the paper is organized as follows. The next section describes Taiwan's major urban areas, along with the source and description of our data. The next section, which addresses trend properties and unit root tests, presents the $t - PS_T^1$ test, its results, and the results of unit root tests. The VEC model section constructs the model and discusses the cointegrating vector and lead-lag relationships. The final section provides our conclusions.

Taiwan's major urban areas

This study investigates whether house prices diffuse among the following major urban areas, shown in [Fig. 1](#): Taipei, New Taipei, Taoyuan–Hsinchu, Taichung, Tainan, and Kaohsiung.

Located in northern Taiwan, Taipei is Taiwan's capital city and its political, economic, and cultural center. In 1967, Taipei was declared the country's first direct-controlled municipality. Since the 1990s, due to its highly diversified economy, Taipei has been transformed into the node of a high-technology knowledge center with the status of a regional global city ([Wang, 2003](#)). In 2008, the Globalization and World Cities Research Network classified Taipei as an alpha global city. Taipei is surrounded by its suburb, New Taipei, which is the most populous city in Taiwan and has been a direct-controlled municipality since December 2010. The Taoyuan–Hsinchu area, which borders New Taipei, is home to many industrial parks and technology company headquarters. The area's counties, which are composed of Taipei's satellite cities, of which Taoyuan became a quasi-direct-controlled municipality in January 2011, are home to Taiwan's largest immigrant populations.

Although Taichung was only declared a direct-controlled municipality in December 2010, it is the most important city in central Taiwan. The city has a diverse economy that incorporates traditional businesses, small family-run shops and factories, large industrial areas, and a thriving commercial sector. The city is nicknamed the “Mechanical Kingdom” for its successful development of precision

¹ The reciprocity principle allows investors from more than 40 countries to invest in Taiwanese real estate. These countries include the U.S., Canada, France, Switzerland, the Netherlands, Malaysia, and Singapore, among others.

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